A SCHOOL AS A SYSTEM AND ITS IMPLICATIONS FOR TECHNOLOGY IMPLEMENTATION: WITH REFERENCE TO KENDON PROFESSIONAL DEVELOPMENT SCHOOL, LANSING, MICHIGAN.

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ABSTRACT

A SCHOOL AS A SYSTEM AND ITS IMPLICATIONS FOR TECHNOLOGY IMPLEMENTATION: WITH REFERENCE TO KENDON ELEMENTARY PROFESSIONAL DEVELOPMENT SCHOOL, MICHIGAN.

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The objectives of this study were (a) to establish historical profile of Kendon technology, classify Kendon technology leaders and their followers within the school system according to their respective roles and influences, (b) to describe the incentive and constraint factors, and (c) to understand the participants' beliefs and expectations about Kendon technology programs. The central concern was to seek evidence of leadership factors that have influenced Kendon technology implementation. In addition, time series "Top-down and Bottom-up" interaction effects were of particular interest. A case-study approach was used for the study, covering (I) Kendon Organizational Culture; (II) The Role and Influences of key Technology Actors; (III) Teachers' Beliefs, Expectations, and Adoption of Technology; and (IV) Perceived Instructional Changes over time and Technology Modeling. Self-administered survey and personal interviews were used as primary data collection and complemented by reviews of proceedings of group meetings, Kendon technology records, and observational data on Kendon computer teaching laboratory. The following conclusions were drawn from the study findings.

The first adoption of technological innovations was based on the personal decision, voluntarism, and enthusiasm, i.e., the first

adoption was a modest "bottom-up" start which was well publicized within the school.

The early technology adoption process at Kendon was "idea sharing" strategy among peers. Team teaching and small group writing projects practiced by the early adopters started to shift the "individual" to "group" instructional processes in some classrooms.

The pace of teachers' adoption of technological innovations was very slow due to limited equipment, teacher's lack of expertise in technology, and student-centered approach to the implementation process. The competing demands on time and limited time allocations for staff development made the implementation plan more difficult for teachers. The sustainability of the innovations during this first phase was a major problem.

Emphasis placed on staff development and technical support strategies, peer mentoring strategies, teamwork, the shift from student-centered to teacher-centered approach, and the 40 computers and network management in-service training offered by the School District during 1993/94 school year were greeted with more teacher participation in technology programs and activities. This mass participation and the "bottom-up" approach adopted in the school were clear evidence of sustainability of technology applications in the curriculum.

Over the past five years, the school principal, a few teachers, and Michigan State University collaborators have been the key technology leaders at Kendon. The leadership role had been characterized by enthusiasm, hard work, open-mindedness, commitment, professional and self consciousness, confidence, and actions accompanied by examples and encouragement.

DEDICATION

To the memory of my late:

father, Kofi Nimako;

brothers, Osei Nimako and Paul Nimako;

and sisters, Serwaa and Maggie.

To my wife, Agathe,

and our daughters, Agnes, Lydia, and Nina,

for their love and support.

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CHAPTER 1

A NEW PARADIGM FOR TECHNOLOGICAL CHANGE

The first decade of information technology entering schools has been marked by the absence of thorough integration of such technologies into classroom life. Numerous reports of computer usage document a general failure to apply technology to daily problem solving and inquiry of mathematics, social studies, science, or English classes (U.S. Department of Education, 1991). The full potential of these educational tools will not be realized unless the technology, system, and pedagogy advance together. There is no single *"best use"* of technology in schools and colleges to improve teaching and learning, but as each new medium is put into educational use, it provides the opportunity for educators to examine interactions among relevant influences operating within a school system.

For effective implementation of technology in our schools, administrators, teachers, parents, and community members may need to move toward the kinds of structures and learning teams envisioned by Senge (1990), who sees members of the school system on a quest for change and improvement. Each and every teacher has the responsibility to help create an organization capable of individual and collective inquiry and continuous renewal, or it will not happen (Fullan, 1993). Bringing parents and community members into more active contact with the new technologies may likely help them to gain a personal appreciation for the power of these

technologies. As no one person can possibly understand the complexities of change in dynamically complex systems, it follows that we cannot simply leave the responsibility to others.

From a personal perspective, seven years of teaching experiences at the Audio Visual Department of "Institut National Superieur De L'Enseignement Technique (INSET)", Cote D'Ivoire, gave me similar insights about the pedagogical and attitudinal problems involved with technology implementation in school and college curricula. In my capacity as a classroom teacher and an audio visual technical assistant to the entire faculty, I observed that many of my colleagues used the College Instructional Media Center as an entertainment center to cover for their unplanned instructional activities. The inappropriate uses and the kind of perceptions that these teachers had of instructional technologies undermined the potentials of these powerful tools and, thus, rendered the cost-benefits of these educational technologies meaningless, i.e., waste of time, efforts, and money.

Another typical technology implementation issue in Cote d'Ivoire was UNESCO-Cote d'Ivoire Joint Instructional Television Programs for Elementary Schools in the country. Between 1972/73 and 1976/77 school years, instructional television programs were broadcast from Bouake Television Station to all remote elementary schools in the country. These programs were the primary mode of classroom instruction, supported by the classroom teacher. Thus, technology was placed before the traditional system of classroom instruction. The program was discontinued after the fifth year as a result of school parents and teachers' disapproval of the effectiveness of the programs. As an expatriate teacher in Cote d'Ivoire from 1980 to 1987, I had an opportunity to engage in personal informal discussions with some school parents and elementary school teachers in Abidjan, Yamoussokro, and Bouake. I hope you will learn with dismay or interest that, every individual I talked to disclosed strong pessimistic views about instructional technologies.

The lessons learned from my personal and professional experiences in African schools are that: (1) there is a need to provide the necessary guidelines and strategies that would assist local teachers to select and apply appropriate technology in their respective classrooms, (2) it is a common practice among many educational decision-makers in Africa to acquire expensive high technology (Big Media, according to Schrumm) without the participatory role of the end-users (i.e., school faculty), and (3) without effective planning and implementation strategies that involve teachers, these instructional tools tend to become "White Elephants" in our schools.

In East Lansing, Michigan I have had the opportunity to work with educational technology experts at Michigan State University and to work for an elementary school taking a very different approach to technology implementation. This school is attempting to make technology implementation a byproduct of the planning efforts of teachers, administrators, and other actors within the school system, and my experiences with this school confirm my belief that, for any effective school technology implementation, it is critical to understand the internal leadership roles that exist within the school system. In addition, these experiences confirm that perceptions and local control of the technology program by the various actors within the school system need to be examined seriously to understand their effects on the implementation processes at each stage of development.

Consequently, given my perspective and concerns, I found Kendon school in Lansing, Michigan, an ideal research setting. Leadership roles and dynamics pertaining to technology implementation could be examined in depth. I could study the perceptions, beliefs, and expectations of all individuals and groups who are directly and/or indirectly involved in planning, development, implementation, and evaluation of technology in our schools. I was in a position to collect detailed information from and about all key actors within Kendon school system and to collect detailed

information about the process of technology implementation at the school. In other words, I was able to study, in-depth, the dynamics of interacting factors in Kendon school as a possible new paradigm of effective technological change-- a paradigm for technology implementation processes and procedures that certainly deserves examination and evaluation.

Central Concerns of the Study

The study was designed to: map the course of technological changes within the school system in order to study the impacts of technology implementation on instruction and other factors affecting the dynamics of the system; examine the evolution of the roles of individuals and groups identified as leaders and followers with respect to technology within Kendon school system; and study changing perceptions (e.g., issues and problems) in order to understand the major factors or attributes that characterize Kendon technology leadership role.

Each of the questions addresses a different aspect of the interacting forces at work within a school system engaged in technology implementation and the changing dynamics of each are followed over several years. The purpose is to examine, in a developmental sequence, how each factor relates to the others.

Specific Research Questions

Three major questions were addressed in this study and related subquestions were developed to gather in-depth information which provided answers to the main issues raised in this study.

1. *What changes occurred in the uses of technology and how did these interact with other influences and outcomes?*

This question tried to gather evidence from school records and personal observations to establish an historical profile of

technology development at Kendon. The subquestions related to this broad question were:

a. What kinds and number of hardware and software did the school receive each year?
b. What kinds of instructional events and projects were involved with technology in the curriculum within and across grade levels?
c. Who directly participated in those activities and what were their respective duties and/or contributions?
d. What impacts did these acquisition and events have on the dynamics of the system and on the perceptions and attitudes of administrators and teachers?

2. *What changes occurred in roles, policies, and procedures in the school system over time and how did these influence the implementation of technology?*

This question sought to examine the various ways in which the external participants such as the School District and internal (local) schoolhouse participants such as teachers and administrators within Kendon school system have influenced the school technology implementation program over the past five years. The following related questions were asked for in-depth answers to this main question:

a. Who are the principal actors during the conceptualization, development, and implementation of the technology programs? What vision do they hold for Kendon technology implementation?
b. Does the organizational culture (e.g., instructional policy, incentives, staff development, and technical support) specific to Kendon school relate to teachers' adoption of or resistance to technology in the classroom and in the laboratory?

3. *In what ways did expectations, beliefs, and instructional practices of various actors within the school system change and how did these promote or hinder Kendon teachers' adoption of technology in the curriculum?*

This question attempted to examine the philosophical, attitudinal, and pedagogical issues that the individuals and groups within the school system hold for technology implementation in the curriculum and their implications for Kendon school curriculum innovation goals. The related subquestions were:

a. Do attitudinal factors such as computer self-competency, computer utility beliefs (philosophical attachment), and general attitudes towards computers affect the adoption of computers for instruction?
b. To what extent and in what ways are teachers using computers in the classrooms and in the computer teaching laboratory?

Limitations and Potentials of the Study

The major issues and problems raised in this study have the potential of being generalized across many schools which use technology in the curriculum, despite the fact that the research concerns a single school. Some educational issues are more context and time specific due to internal dynamics of the people involved in a particular school system as well as to changes of instructional policies and personnel. This study, therefore, was limited to a single school setting and the key actors within the school system. It covered a period of five school years (1989/90-1993/94). The issues and problems were concerned with the actors' respective roles as leaders or followers, their beliefs and expectations with respect to technology. The instructional changes discussed pertained to the ones that happened as a result of technology applications in the curriculum over the past five years. In other words, the study

provided rich sources of data about the school and, it should be possible to generalize the knowledge sought through in-depth investigation beyond Kendon to schools across the United States.

Despite the privileges that Kendon Elementary enjoys as a professional development school, being technical, financial, or personnel (a situation which is typical to many United States educational environments) the issues and problems investigated could be a potential concerns for every school system. Furthermore, my personal technology experiences in Michigan State University and Kendon Elementary in the United States, University of Sorbonne (Paris III), and INSET of Yamoussokro, Cote d'Ivoire, Africa, lead me to suggest to my readers that many aspects of Kendon instructional technology practices learned from this study could be applied in many schools in the world using or attempting to introduce technology in the curriculum.

Combining Quantitative and Qualitative Methodologies

The kind of information and data sought to answer the questions developed for this case study required both quantitative and qualitative methodologies to investigate the issues raised. Reviews of Kendon school technology records, proceedings of group meetings such as Staff and School Improvement Team meetings, and my personal observation data on Kendon Computer Teaching Laboratory for a period of six months (i.e., from January to June, 1994) were one data source. Self-administered surveys followed by individual interviews were another source of data. The methods selected allowed me to obtain in-depth information on technology over the past five school years from certain individuals and groups within the school system.

The combination of both quantitative and qualitative methodologies in a case study like this one, not only captures the general picture of the school system and its related issues and problems, but also provides some specific complementary

information that facilitates the full understanding of the complex system.

CHAPTER 2

LITERATURE REVIEW

Introduction

In the early sixties social scientists were concerned primarily with the "process of change". According to Havelock (1973), this change rests on the assumptions that social progress can be planned and engineered so that it is more reliable and more beneficial to more people. "This new concept of 'planned innovation' stresses the importance of realistic diagnosis of needs, adequate resource retrieval, collaborative planning and solution building, and systematic design and evaluation of alternative solutions (Havelock and Havelock, 1973, p.2)".

Strategy was recognized as the key aspect of this new concept of innovation. In building such strategies, Lippit, Watson and Westley in "The Dynamics of Planned Change" (1958), made available the first coherent conception of the social change agent; Bennis, Benne, and Chin (1969) worked on "Planned Change"; Rogers and Shoemaker (1971) gave empirical research on the "Diffusion of Innovations; and Havelock and collaborators (1969) provided a comprehensive summary of most available literature on change process. These works provided a useful starting point for building the content of training programs for change agents. For instance, the conference on change agent training which assembled 50 nationally (USA) recognized leaders of research and training on educational

change at Clinton, Michigan, in Spring 1970 derived propositional statements from the existing literature and endorsed as "important" or "essential" by all the conference participants. The major perspectives or statements and observations on the change process identified by Havelock et al. (1969) are presented below.

Change as a Problem Solving Process

According to Havelock (1969), advocates of problem solving as a mean of change process involves at least five points: first, that the user-need is the paramount consideration; second, that diagnosis of need always has to be an integral part of the total process; third, that the outside change agent should be nondirective, rarely, if ever, violating the integrity of the user by placing himself in a direct or expert status; fourth, that the internal resources should always be fully utilized; and fifth, that self-initiated and self-applied innovation will have the strongest user commitment and the best chances for long term survival. A few of the major advocates of this orientation are Lippitt, Watson, and Wesley (1958), Goodwin Watson (1967), and Herbert Thelen (1967). These social psychologists were concerned with group dynamics-human relations tradition. From this perspective, this case study examined the "Need Assessment" strategies adopted by Kendon school system prior to technology implementation in the school curriculum.

Change as a Research-Development-and-Diffusion Process

According to Havelock (1969), the conceptual categorization advocated by Brickell (1961) and Clark and Guba (1965), under this orientation, is guided by at least five assumptions. First, it assumes that there should be a rational sequence in the evolution and application of an innovation. This sequence should include research, development, and packaging before mass dissemination takes place. Second, there has to be a planning. Third, there has to be a division and coordination of labor. Fourth, it assumes a more-or-less passive but rational consumer who will accept and adopt the innovation if it

is offered to him or her in the right place, at the right time, and in the right form. Fifth, the proponents of this viewpoint accept the fact of a high initial development cost prior to any dissemination activity. In its broad terms, this orientation is a grand strategy for planned innovation. According to Havelock and Havelock (1973), the prototypes of this model are presumed to exist in industry and agriculture. Considering the importance of effective planning for any successful innovation programs in educational setting, this case study explored the "Planning" strategies adopted by the school system for the technology implementation taking into account social, cultural, and economic factors specific to Kendon Elementary Professional Development School. It also attempted to identify all those who were involved and the kind of roles played during the planning and development stages.

Change as a Process of Social Interaction

According to Havelock (1969), a body of empirical research tends to support five generalizations about the process of innovation diffusion: first, that the individual user or adopter belongs to a network of social relations which largely influences his adoption behavior; second, that his place in the network (centrality, peripherality, isolation) is a good predictor of his or her rate of acceptance of new ideas; third, that informal personal contact is a vital part of the influence and adoption process; fourth, that group membership and reference group identifications are major predictors of individual adoption; and fifth, that the rate of diffusion through a social system follows a predictable S-curve pattern (very slow beginning, followed by a period of very rapid diffusion, followed in turn by a long late-adopter or "lagged" period).

Rogers (1962) warns that the opinion leader can be "worn out" as an effective promoter of change if he or she becomes too closely identified with outside change agents and becomes too isolated from his followers. He suggests that opinion leaders also need to be able to filter out innovations which might upset their relationships to

followers. Rogers (1971) strongly emphasizes that innovation adoption in schools is a collective decision process.

If computers are being used in all classrooms and a laboratory setting at Kendon, then this case study had every reason to examine the strategies adopted by the school system which had influenced innovation diffusion, taking into consideration "who, when, what, and where" aspects specific to Kendon technology. Particularly, this case study examined the issues of Kendon technology leaders and followers, the roles and specific characteristics of technology leaders and followers, the early and late adopters, and the pace at which the technology adoption process has taken place.

Change as a Linkage Process

The concept of "Linkage" proposed by Havelock and collaborators (1969) is seen as a possible unifying and integrating ideas based on the three orientations previously discussed. This model emphasizes that the user must enter into a reciprocal relationship with the resource system (Cosmopoliteness). Rogers defines "cosmopoliteness" as "the degree to which an individual's orientation is external to a particular social system." (1962, p. 17) It results from experience in more than one system either through living, traveling, visiting, or communicating. Thus, the resource systems and resource persons must (1) simulate the user's need, (2) simulate the search activity that the user has gone through, and (3) simulate the solution-application procedure. Havelock (1969) suggests that this reciprocating relationships need to be developed towards the creation of a stable and long-lasting social influence network. He describes this kind of collaboration as a chain of knowledge utilization, connecting the most remote sources of expert knowledge in the university with the most remote consumers of knowledge. He stresses that linkage between systems is the essential process in any effort aimed at planned social change. Havelock and Havelock (1973) indicate that students of educational change appear to agree that problem-solving human relations

approaches and rigorous system analytic approaches have to be brought together at the local level before a truly satisfactory educational change model can evolve.

Kendon Elementary being a Professional Development School, this case study examined among other things the kind of social interactions that go on within the school system (i.e., among Kendon faculty, parents, community business partners, and university collaborators) and the kind of impacts that these interactions have on the technology implementation program.

Additional Propositions about Change Process
(Rewards and Reward Structures for Changing)

In addition to the above strategies discussed, reward systems play a vital role in our educational innovation efforts. Havelock (1969) identified six major issues pertaining to reward systems. First, he noted that effective knowledge utilization is a self-fulfilling prophesy. Kurland (cited in Havelock and Havelock, 1973, p. 33) notes the importance of building individual and group confidence in the capacity to produce change. Second, a willingness to take risks is an important requirement for successful innovation. "As well as developing new animals known as change agents, we must instill in present training programs for most educational personnel a greater reliance upon "new" information, as well as a more positive attitude toward the "risk" of fighting tradition", says Towne (cited in Havelock & Havelock, 1973, p.33). However, Taylor (cited in the same review) cautions that a typical system has no reason to take risks on innovation ideas until they are supported by solid evidence of utility. Havelock noted that shared accountability and a specification and limitation of consequences may be ways in which risk-taking can be safeguarded. "Accountability may not work for system improvement if people do not have the right to make mistakes. Change requires a certain degree of error embracement" (Havelock and Havelock, 1973, pp. 33 & 34). Third, a willingness to make an effort to adapt innovations to one's own situation is an

important prerequisite to effective utilization (a dimension of openness). Fourth, social interaction tradition suggests that there is a general factor of capacity or competence that accounts for much of the variance in diffusion studies. Havelock noted that those who already possess the most in the way of resources and capabilities are the most likely to get even more. His summary concept ties together, according to him, the highly intercorrelated variables of "wealth, power, status, education, intelligence, and sophistication" which are invariably good predictors of successful innovation and utilization. Another ingredient of capacity, identified by Havelock, self-confidence, is also important predictor of successful utilization. Other ingredients identified are: the amount of available time; energy; education; sophistication; and size of operation. Fifth, he noted that anticipated reward is a major incentive for diffusers and users of innovation. The review indicates that management of the reward system is seen as the crucial element in change. "I think the basic element in change in education is tied into the reinforcing agents that are available for modifying the behavior of all operational personnel, both teachers and school administrators, for example", says Ofiesh (cited in Havelock & Havelock, 1973, p. 35). Sixth, the review indicates that new ideas and innovations which clearly contradict preexisting values will not get far in a user system, whereas those which appeal to cherished values will. According to Chesler (cited in Havelock & Havelock, 1973, p. 37), change is a political process fraught with conflicts of interest and values.

Considering the importance of preservice and inservice training to effective applications of these modern instructional tools, considering self and professional interests of teachers in general as a probable means of program adoption in instruction, this case study sought to understand the expectations and beliefs of Kendon teachers. It equally explored the kinds of motivational strategies specific to Kendon Elementary PDS that have influenced the technology implementation programs. Following the lessons

learned from some renowned social scientists in the sixties, it was absolutely necessary to hear what other educational scientists say about the process of change in schools as experienced from seventies to the present era.

Some educational scientists of the seventies indicate that prior to 1970, the focus of school change was primarily on adoption of materials. Educators assumed that program implementation followed an "industrial model"; that changing a curriculum involved simply adopting a new program, installing it with minimum staff development and assuming widespread use (Fullan, 1987). Fullan has described the period from 1970-1980 as one of "documenting failure". He pointed out that during this period we learned about what not to do: do not ignore training; do not ignore local leaders and opinion setters; do not implement large, vague innovations; adoption by organizations does not tell us about how individuals act in classrooms; and reported use does not mean actual use. The industrial view does not fit the school setting.

Research shows that change in schools requires leadership, staff development, modification of the organizational structure, and the involvement of people from all aspects of educational system (Fullan, 1982). The process of change needs also to be integrated into any reform initiative. When interventions are not integrated into the change process, the innovation implementation efforts are often unsuccessful (McLaughlin, 1990).

Organizational innovative programs could not be assessed without fully understanding the complexity of the change process in general. The following literature review was intended, therefore, to explore (1) in large part, the underlying pattern and general dynamics of systemic change in our organizations, education in particular (2) the impacts of staff development on the effective applications of modern instructional tools, and (3) the impacts of modern technologies on instruction.

The Dynamics of Systemic Change

The Complexity of the Change Process

Senge (1990) makes the distinction between 'detailed complexity' and 'dynamic complexity'. The former involves identifying all the variables that could influence a problem. According to Senge, detailed complexity is not reality. "Dynamic complexity is the real territory of change: when 'cause and effect' are not close in time and space and obvious, interventions do not produce expected outcomes (ibid., p.365) because other 'unplanned' factors dynamically interfere". Senge argues that productive change is the constant 'search for understanding, knowing there is no ultimate answer' (ibid., p. 282). The real leverage for change, says Senge, involves:

. Seeing interrelations rather than linear cause - effect chains, and

. Seeing processes of change rather than snapshots. (ibid., p. 73).

Educators are., therefore, required to create a habit of experiencing and thinking about educational change processes as an overlapping series of dynamically complex phenomena. According to Senge (1990), eight basic lessons have been identified from the new paradigm of dynamic change.

Lesson 1: *You Can't Mandate What Matters* (the more complex the change, the less you can force it). To accomplish certain educational goals, you cannot mandate what matters, because what really matters for complex goals of change are skills, creative thinking, and committed action (McLaughlin, 1990). He argues that mandates are not sufficient and the more you try to specify them the more narrow the goals and means become. Teachers are not technicians. Even in the relatively simple case - detailed complexity - almost all educational changes of value require new (i) skills; (ii) behavior; and (iii) beliefs or understanding (Fullan, 1991). Let us think of computers across the curriculum, teachers' thinking and

problem solving skills, integration of special education in regular classrooms, etc. All of these changes, to be productive, require skills, capacity, commitment, motivation, beliefs and insights, and discretionary judgment on the spot. According to Pascale (1990), the only alternative that works is creating conditions that enable and press people to consider personal and shared visions, and skill development through practice over time. In light of these assumption, the study attempted to identify the nature of vision that Kendon school system holds for technology.

Lesson 2: *Change is a Journey, Not a Blueprint* (Change is non-linear, loaded with uncertainty, and sometimes perverse.) If change involved implementing single, well-developed, proven innovations one at a time, perhaps it could be blueprinted. But school districts, according to Senge (1990) are in the business of implementing a bewildering array of multiple innovations and policies simultaneously. If one tries to match the complexity of the situation with complex implementation plans, the process becomes unwieldy, cumbersome and usually wrong. Take a particular school situation in England. McMahon and Wallace (1992) engaged in school development planning. Experienced in the planning process, working together, and committed to the plan they produced, they nonetheless encountered a series of unanticipated problems: staff training sessions had to be postponed because of delays in the production of national guidelines; a training project had to be deferred because the teacher appointed to run it had left after six weeks; the government introduced a series of new changes that had to be accommodated; etc. Thus, they qualified this as a journey into the partially known or unknown is an apt metaphor. 'Route and destination' says Stacey (1992), 'must be discovered through the journey itself if you wish to travel to new lands' (p.1). In the face of unpredictable change, 'the key to success lies in the creative activity of making new maps'. (p. 1) Under conditions of uncertainty, learning, anxiety, difficulties, and fear of the unknown, according to Stacy, are *intrinsic* to all change process,

especially at the early stages. Csikszentmihalyi, (1990) states that people who learn to control their inner experiences, while contending with the positive and negative forces of change will be able to determine the quality of their lives. In support of this Senge (1990) argues that productive educational change, like a productive life itself, really is a journey that does not end until we do .

Lesson 3: *Problems Are Our Friends* (Problems are inevitable, but the good news is that you cannot learn or be successful without them.) Success in school change efforts, according to Senge (1990), is much more likely when problems are treated as natural, expected phenomena, and are looked for. He argues that successful change management requires problem-finding techniques, like 'worry lists', and regular review of problem-solving decisions, at subsequent meetings, to see what happened. Since circumstances and context are constantly changing, an embedded spirit of constant inquiry is essential. Says Pascale (1990, p.14), 'inquiry is the engine of vitality and self-renewal'. Louis and Miles (1990) found that the least successful schools they studied engaged in 'shallow coping' - doing nothing, procrastinating, doing it the usual way, easing off, increasing pressure - while the successful schools went deeper to probe the underlying reasons and to make more substantial interventions like comprehensive restaffing, continuous training, redesigning programs, and the like. They concluded that smoothness in the early stages of a change effort is a sure sign that superficial or trivial change is being substituted for substantial change attempts.

Lesson 4: *Vision and Strategic Planning Come Later* (premature visions and planning can blind). Senge (1990) explains that visions are necessary for the success of many new instructional programs but few concepts are more often misunderstood and misapplied in the early stages of the change process. He argues that visions come later for two reasons: first,

that under conditions of dynamic complexity one needs a good deal of reflective experience before one can form a plausible vision; second, that shared vision, which is essential for success, must evolve through the dynamic interaction of organizational members and leaders. Visions come later because the process of merging personal and shared visions takes time. Senge (1990) provides an illuminating discussion of the tension between personal and collective ideals. He states that shared vision is vital for learning organization because it provides the focus and energy for learning. He argues further that while adaptive learning is possible without vision, generative learning occurs only when people are striving to accomplish something that matters deeply to them. In fact, according to him, the whole idea of generative learning - 'expanding your ability to create' - will seem abstract and meaningless until people become excited about some vision they truly want to accomplish.

In corporate leadership today, we find that most 'visions' are one person's (or one group's) vision imposed on an organization. Such visions, at best, command compliance - not commitment. Senge wrote

> . . . shared vision is a vision that many people are truly committed to, because it reflects their own personal vision. (p. 206) and, organizations that intend on building shared visions continually encourage members to develop their personal visions. If people do not have their own vision, all they can do is 'sign up' for someone else's. The result is compliance, never commitment. People with a strong sense of personal direction can join together to create a powerful synergy toward what I/we truly want (Senge, 1990) (p. 211).

By contrast, the old paradigm is still being promulgated, such as Beckhard and Pritchard's (1992) recommendations for vision-driven change. There are four key aspects, they say

> . . . creating and setting the vision; communicating the vision; building commitment to the vision; and organizing

> people and what they do so that they are aligned to the vision. The programmatic approach often assumes that attempts to change how people think through mission statements or training programs will lead to useful changes in how people actually behave at work (p. 25).

In contrast, in their study of twenty-six plants over a five-year period, Beer, Eisenstat and Spector (1990), findings suggest that people learn new patterns through their interaction with others on the job. (p.150) In short, the critical question is not whether visions are important, but *how* they can be shaped and reshaped given the complexity of change.

According to Stacey (1992), visions can die or fail to develop in the first place if too many people are involved at the beginning, when leaders fail to advocate their views, when superficial talk rather than grounded inquiry and action is the method used. Another paradox is 'ownership'. Trying to get everyone on board in advance of action cannot work because it does not connect to the reality of dynamic complexity. Ownership cannot be achieved *in advance* of learning something new. Ownership is stronger in the middle of a successful change process than at the beginning, and stronger still at the end than at the middle or beginning. Ownership is a process as well as a state. Ownership is crucial unless one knows how it is achieved.

Strategic planning is also called into question. Spending too much time and energy on advance planning is a mistake. Participation, elaborate needs assessment, formal strategic plans are uncalled for at the outset of complex change process. Louis and Miles (1990) call this the evolutionary perspective. They argue

> . . . The evolutionary perspective rests on the assumption that the environment both inside and outside organizations is often chaotic. No specific plan can last for very long, because it will either become outmoded due to changing external pressures, or because disagreement over priorities arises

> within the organization. Strategy should be viewed as a flexible tool, rather than a semi-permanent expansion of the mission. (p. 193) .

Senge (1990) proposes that 'Ready, Fire, Aim' is the more fruitful sequence if we want to take a linear snapshot of an organization undergoing major reform. According to him, if 'Ready' is important, there has to be some notion of direction, but it is killing to bog down the process with vision, mission, and strategic planning, before you know enough about dynamic reality. He explains that 'Fire' is action and inquiry where skills, clarity, and learning are fostered. He claims that 'Aim' is crystallizing new beliefs, formulating mission and vision statements and focusing strategic planning. He concludes that vision and strategic planning come later.

Some case studies have been done in this regard. For instance, in working on reform in teacher education in Toronto, Pascale et al (1990) experienced this sequence (ready-fire-aim) over five years. According to them, they rejected launching immediately into large scale strategic planning. Instead they began with few readiness principles: work on the teacher education continuum, link teacher development and school development, commit to some field-based programs, work in partnership with schools, infuse their efforts with continuous inquiry. The firing part took the form of establishing a number of field-based pilot projects with different teams of faculty and cohorts of student teachers, and entering into action-oriented agreements like the Learning Consortium. Near the end of year 3 they were ready to focus on their aim, by establishing a Strategic Planning Committee. Another case in point is Thorah Elementary School, north east of Toronto in their Learning Consortium. Starting on a small scale (the Principal and two teachers out of a staff of twenty-three), the school developed from individualistic to a highly collaborative culture over three-year period: not staring with a vision, but by working toward a shared vision generated through their actions (Fullan, 1992). Pascale (1990)

also captures the ready-fire-aim sequence when he analyzes how the Ford Motor company developed a widely shared mission and values statement in the 1980s. A major factor in the wide acceptance of this statement [Ford's vision and values] is that its principles were enacted for several years before they were formally announced.

Lesson 5: *Individualism and Collectivism Must Have Equal Power*. (There are no one-sided solutions to isolation and groupthink). Productive educational change is also a process of overcoming isolation while not succumbing to groupthink. Senge (1990) points out that teaching has long been called 'a lonely profession' and that the professional isolation of teachers limits access to new ideas and better solutions, drives stress inward to fester and accumulate, fails to recognize and praise success, and permits incompetence to exist and persist to the detriment of students, colleagues, and the teachers themselves. Lortie, (1975) states that isolation allows conservatism and resistance to innovation in teaching. Rosenholtz, (1989) and Fullan & Hargreaves, (1991) have indicated that educational problems are all the more complex, and that collaborative, 'learning enriched' schools do better than those lingering with the isolationist traditions of teaching . They questioned "So what to do?" They think participatory site-based management is the answer. Fullan and Hargreaves, (1991) argue

> . . . Mentoring and peer coaching are a must. Well, yes and no. Pushed to extremes collaboration becomes 'groupthink'. In moving toward greater collaboration we should not lose sight of the 'good side' of individualism. The capacity to think and work independently is essential to educational reform. Keeping in touch with our inner voice, personal reflection, and the capacity to be alone are essential under conditions of constant change forces.

Solitude also has its place as a strategy for coping with change, says Strorr, (1988). The law of cybernetics - the law of requisite variety - states

> . . . for any system to adapt to its external environment, its internal controls must incorporate variety. If one reduces variety inside, a system is unable to cope with variety outside. The innovative organization must incorporate variety into its internal processes. (p. 14) Thus, what a group comes to share in the variety of culture and philosophy emerges from individual personal beliefs through a learning process that builds up over years. And if the learning process is to continue, if a school is to be continually innovative, the emphasis should be on questioning the culture, not sharing it. Having a healthy respect for individuals and personal visions is a source of renewal in inquiry-oriented organizations. Honouring opposites simultaneously - individualism and collegiality - is the critical message (Stacey, 1992) (p. 145).

Lesson 6: *Neither Centralization nor Decentralization Works*

(Both top-down and bottom-up strategies are necessary.) Centralization errs on one side of overcontrol, decentralization errs towards chaos. Pascale (1990) puts in this way, in examining the Ford case: "Change flourishes in a 'sandwich'. When there is consensus above, and pressure below, things happen." Control at the top as many reform-minded leaders have found, is an illusion. The key question as Senge (1990) says is 'how to achieve control without controlling'. He continues: While traditional organizations require management systems that control people's behavior, learning organizations invest in improving the quality of thinking, the capacity for reflection and team learning, and ability to develop shared visions and shared understandings of complex issues. It is these capabilities that will allow learning organizations to be both more locally controlled and more well coordinated than their hierarchical predecessors'. Similarly, it is a mistake for local units

to ignore the centre. The centre and local units need each other. What is required is a different two-way relationship of pressure, support and continuous negotiation. It amounts to simultaneous top-down bottom-up influence.

Lesson 7: *Connection with the Wider Environment Is Critical* (The best organizations learn externally as well as internally). Many organizations work hard on internal development but fail to keep a proactive learning stance toward the environment. Smith (1984) makes this profound observation: "For a social entity such as an organization to reflect on itself, it must have a system representing both itself and the context in which it is embedded, that is where nonequilibrium comes in. A social system that promotes paradox and fosters disequilibrium (i.e., encourages variation and embraces contrary points of view), has a greater chance of knowing itself". This in turn generates a reasonable likelihood of being aware of the context in which it operates (Pascale, 1990) p. 289." Dynamic complexity means that there is constant action in the environment. For teachers and schools to be effective two things have to happen. First, individual moral purpose must be linked to a larger social good. Second, organizations must be actively plugged into their environment responding to and contributing to the issues of the day. Fundamentally, the learning organizations should know that expectations and tensions in the environment contain the seeds of future development. There are far more ideas 'out there' than 'in here'.

Lesson 8: *Every Person Is Change Agent* (Change is too important to leave to the experts.) There are two basic reasons why every person working in an enterprise committed to making continuous improvements must be change agents with moral purpose. First, since no one person can possibly understand the complexities of change in dynamically complex systems, it follows that we cannot leave the responsibility to others. Second, and more

fundamental, the conditions for the new paradigm of change cannot be established by formal leaders working by themselves. Each and every teacher has the responsibility to help create an organization capable of individual and collective inquiry and continuous renewal, or it will not happen (Fullan, 1993).

In summary, there is a pattern underlying these eight lessons of dynamic change: simultaneously pushing for change while allowing self-learning to unfold; being prepared for a journey of uncertainty; seeing problems as sources of creative solution; having a vision, but not being blinded by it; valuing the individual and the group; incorporating centralizing and decentralizing forces; being internally cohesive, but externally oriented; and valuing personal change agency as the route to system change.

This analysis means that success in any educational efforts depends on the extent to which each force can willingly contend with if not embrace the other as necessary for productive educational change. The change process is exceedingly complex as one realizes that it is the combination of individuals and societal agencies that make a difference (Fullan and Miles, 1992). Teachers are major players in creating learning societies. Development is 'the continuing improvement in the capacity to grow and build ever more connections in more varied environments' (Land and Jarman, 1992 p. 30). Internal connections (within oneself, within one's organization) and external connections (to others and to the environment) must co-exist in dynamic interplay.

Stages of the Change Process

According to Anderson (1993), administrators across the United States are recognizing that the education system needs fundamental changes to keep pace with an increasingly complex global society. In educational system, six developmental stages and six key elements of change have been identified (Anderson, 1993). These six stages of change characterize the shift from a traditional educational system to one that emphasize interconnectedness,

active learning, shared decision making, and higher levels of achievement for all students. The six stages are:

1. *Maintenance of the old system.* Educators focus on maintaining the system as originally designed. It is time to recognize the importance of incorporating into the present educational structure the new knowledge about teaching, learning, and organizational structures.
2. *Awareness of change.* Many educational reformers become aware that the current system is not working, but they are unclear about what is needed instead.
3. *Exploration.* Educators and policy makers study and visit places that are trying new approaches. They try new ways of teaching and managing.
4. *Transition.* A critical number of opinion leaders and groups commit themselves to the new system and take more risks to make changes in crucial places.
5. *Emergence of New Infrastructure.* Educators need to keep with the desired new system because these new ways are generally accepted.
6. *Predominance of the New System.* Key leaders begin to envision better systems.

Key Elements to Change

As schools, districts, and states move through the six developmental stages, six elements of the education system seem to be particularly important (Fullan, 1993). First, *Vision*: the vision that people have of an education system must change in order for the system to change. Second, *Public and Political Support:* the inclusion of diverse populations appears to be critical in building support. Such support involves a deepening understanding of the "what" and "why" of the changes needed. Third, *Networking:* need for networks that would study, pilot, and support the new vision. Instead of bureaucratic structure, these networks need to rely on the frequent use of computers, newsletters, conferences, and personal

communications. Fourth, *Teaching and Learning Changes:* if changes do not occur in teaching and learning, all the other changes have little value. Fifth, *Administrative Roles and Responsibilities:* to achieve change in the classroom, administrative roles and responsibilities need to shift at the school, district, and state levels from a hierarchical structure of control to one of support and shared decision making. Sixth, *Policy Alignment:* state and local policy need to be aligned around the beliefs and practices of new system, particularly in areas related to curriculum frameworks, instructional methods and materials, student assessment practices, resource allocation, and the inclusion of all types of students.

According to Holzman M. (1993), if teaching and learning are to improve for all students, we need systemic change, i.e., fundamental change. This implies that improvements needed in education are so extensive that they cannot be done within the limits of the present system; thus people should seek to change the nature of that system. Educational observers now see that bureaucratic and technical structures make it difficult to focus on the paradigmatic learning situation, the relationship between an individual teacher and an individual student.

Leadership Role

In an attempt to give describe a keen leader in our institutions or organizations, many perspectives have been present. Wenig and Matthews (1983) argues that key to the success of any new endeavor, whether in business, education, or government, is the total commitment and involvement of those in leadership positions. They define leadership as a common element of successful people, institutions, organizations, businesses, and industries. It is important to understand that leadership involves more than a single person. Tannenbaum, Weschler, and Massarik (1961) include in their definition of leadership "the virtue of generality to all individuals" (p.24). They also suggest that the concept of leadership is not limited to those specifically appointed functionaries nor to

individuals whose prevalence rests with voluntary consent of others. Rather, leadership that positively persuades others is a process applicable to all interpersonal relationships regardless of individual situations and/ or events. Why do some individuals persuade people to act while others fail to make things happen? Schuller (1978) indicated that probably 95 percent of the people who fail do so because they have never learned to take charge of their lives and to show creative leadership.

Leaders are sensitive to fundamental needs, wants, and values of collaborators. Burn (1978) suggested that leaders emerge from complex socialization patterns involving varying degrees of motivations, values, and goals. In essence, leadership, according to Burn (1979) is inseparable from followership. Using Burn's model, leadership takes the form of the transforming or transactional style. A person possessing normal physiological and psychological qualities has the potential of exhibiting leadership in all facets of life (Krauss, 1974).

Traditionally, the leadership image has been dominated by the few in power positions. Many have forgotten that most examples of personal influence are actually examples of leadership and are practiced quietly and subtly in everyday relationships. Leadership trait identification can be valid if it is for a specific situation as opposed to identifying global leadership traits. The exception to this would be those identified by Stogdill (1974) such as strong drive, vigor, persistence, venturesomeness, and originality.

Rationale of Leadership Situation

Contemporary leadership thoughts focus on the specific situation, that is, the interaction among leaders, collaborators, and the situation. The degree of success, the effectiveness of leaders, relates directly to how they function appropriately within the entire situation (Wenig and Matthews, 1983).

Principal and a Few Teachers as Program Leaders

School innovation programs such as Kendon technology, could not be assessed without fully understanding the complexity of the change process in general in our school systems. As many schools rely on the efforts of individual external enthusiasts such as university collaborators for program implementation, majority of these programs are often spotty and unsuccessful. This is often due to lack of coordination within the school system. We, therefore, need more school-based heroics with imagination and spirit to inspire the rest of the staff for the effective implementation of those programs in the school system.

Regarding technology implementation, leadership role may be the keystone for the success of the implementation plan. School principals and teachers play a critically important role in developing successful technology programs. "Ideas such as vision and developing shared leadership are quite beyond most of those who occupy administrative positions in our schools" according to Tye (1992). For any effective leadership efforts on technology in our school systems, administrators must move toward the kinds of structures and learning teams envisioned by Senge (1990), who sees members of the school system on a quest for change and improvement. Substantial numbers of parents do not understand how new technologies might be central to the education of a child for citizenship in the next century. School leaders, therefore, must redefine their job assignments to include marketing campaigns that will broaden community involvement and support for technology programs. Bringing parents and community members into more active contact with the new technologies may likely help them to gain a personal appreciation for the power of these technologies.

Hull and Parnell (1991) reported that when upper-level administrators simply endorse a concept and then hand over its implementation to a second- or third-line administrative level, implementation is slower and sometimes less effective. According to them, this does not preclude the reality that, once leadership has

been clearly established, many responsibilities can be delegated to others within the structure. They stress that, for any school technology program, the key administrator is the principal. "If this person, as the educational leader for that school, is not supportive to the technology program, all efforts will fail. The principal must inspire or motivate the teachers and other support personnel."

Berman and McLaughlin (1975) argue that teachers' concerns with regard to accountability often raise eyebrows and defensiveness in many schools. "In order to avoid such a reaction the school principal and his or her staff need to accept the concept of 'mutual adaptation' that may lead to shared leadership role and ownership of technology program" says McKenzie (1993). In addition to teachers' active participation in the leadership role, he proposes that school administrator needs to break down the traditional isolation of schools from external resources by inviting a rich flow of ideas and possibilities, especially from the communities and universities, into the school system.

One study (Wenid and Matthews, 1983) supports the view that teacher, parent, business, and university support systems play an important role for any effective implementation of school technology program. The study argues that if technology is to work, it must be supported by all personnel within the school system. The study indicates that, this support is likely to happen only when all individuals have an adequate understanding of the technology concept and feel a sense of commitment, that is, when they develop a sense of ownership. According to Wenid and Matthews, (1983), a question that should be asked early in the development of a technology program is "will parents support it"? They noted that because parents usually exercise a powerful influence on their children's learning, it is important that they understand clearly what kind of technology is being introduced, its instructional implications, and the kind of support required from the parents. Again, one of the very critical issues to be addressed early in the implementation of a technology program is university and local

business support. Appropriate involvement of local businesses and universities provides the school system with human and financial resources and helps with marketing the school technology program. These segments of the population should be partners through the entire process, serving on technology committees and contributing support in diverse ways such as training.

Interactive Technologies in Education

Microcomputers

Many reviews of literature have been done in the area of instructional computing, but they have not been very useful in helping school administrators decide how best to allocate resources for computer uses. A review was made by Robler et al (1988) aimed at providing the most useful statistical information for decision making. Several specific questions were addressed in a series of meta-analysis:

1. *How effective are various computer applications in each content area?* The findings indicated that reading, mathematics, and cognitive skills (for problem solving) all equally demonstrated educationally significant effects. Science simulations seemed to be even more effective than any applications in other content areas. In mathematics all kinds of applications were equally effective, while tutorials seemed more effective than other kinds of tools in reading.
2. *How effective are computer applications in English as a Second Language (ESL)?* The descriptive results from two studies indicated that computer applications were ineffective in this area. The reasons for negative effects on ESL were not clear and this further suggested that educators need to consider carefully the potential problems in this kind of instruction.
3. *How effective is word processing in improving writing skills?* Results indicated that while the use of word processing did not seem to increase quality of writing, it did make students want to write more and make them feel more positively about their writing.

4. *How effective are LOGO and Computer Assisted Instruction (CAI) in teaching problem solving?* The studies of LOGO uses provided consistent evidence of educational effectiveness. However, unstructured CAI was very effective in teaching general thinking and problem solving skills.
None of the studies in the meta-analysis compared either these applications to a strong non-computer instructional program, therefore there is a need for further research.

A study of five New York city high schools by Bracey (1988) shows that students as well as teachers find computer applications in the classrooms more conducive to learning. The students who participated in the study were then taking courses in English, science, social studies, business and mathematics that made uses of computers. They reported that teachers in computer-aided classes gave them more personal attention than did teachers in regular classrooms. This was true of all disciplines except social studies, where there no differences. Seventy percent said they understood material better from computers and 75 percent said they remembered the material better. The students expressed more anxiety about giving wrong answers in conventional classrooms and only five percent felt negative about computer classrooms. Sixty four percent said that regular classrooms were interrupted more often. Teachers perceived themselves as less authoritarian in computer classrooms and more facilitative to student-directed learning. They said they spent more time with individuals in the computer classrooms. The teachers indicated that computer instructional environment was different from that of regular classroom. For example, in the computer environment students had a greater sense of accomplishment, better attitude toward the subject-matter, classes are more student-centered and student-directed. Significant improvements in student functioning were evident to the teachers. These improvements, according to the teachers, might due to the socially supportive yet individually responsible nature of microcomputer classrooms.

Another case study is concerned with writing skills. The low writing scores achieved by ninth-graders at Woods High School, Houston, sparked the school authorities to introduce computer-assisted laboratories in Fall 1987. Laboratory users' attitude survey and other observations were used to validate the students' writing skills at the end of the year. It was noted that weaker students wrote more than teachers expected. An average honor students seemed to manipulate text more extensively and more frequently. Sixty-five percent of the students indicated that they did as much or more revision as on hand written papers. Those who indicated "less revision" made comments as "I saw my mistakes on the screen and corrected them, so I had less revision to do". Seventy five percent stated writing in the laboratory "a very good experience which we enjoyed". The most spectacular evidence was the increase of 22 percent on the state writing test scores.

The writing in the laboratory received local, state, and national recognitions. But the computer is only a tool, only teachers truly teach writing. Teachers who share a common vision, a commitment and needed skills strategies teach writing better (Young, 1989). The two-year increase in achievement scores and gains for the students at two elementary schools, Woodlands and Silverdale in Washington, results from the excellent classroom teaching techniques practiced along with the application of correct methods of monitoring, diagnosing, and prescribing lessons available through the CAI laboratories. Eighty three percent of the parents felt CAI was valuable for the education of their children. Ninety six percent of the parents agreed that it helped their students gain in mathematics, reading, and language arts skills. Teachers found that students who worked with the CAI in the laboratory approached long problem solving assignments, associated with higher-level thinking skills, with less apprehension. There were no discipline problems in the laboratory. The maximum effectiveness of the CAI in the laboratory depends on the efficient manipulation of the program by the teacher (Hertzke, 1987).

The Office of Technology Assessment (OTA, 1988) research on educational uses of computers in a wide range of applications found that the varied capabilities of the technologies are key to their power. Educators use interactive technologies for many purposes; there is no single "best use" of technology in schools to improve learning. The following OTA findings are:

1. Using CAI for drill and practice to master basic skills, the study showed that elementary children who used CAI for mathematics gained the equivalent of one to eight months instruction over peers who received only traditional instruction.
2. Both mainstream and special students who used word processor as a supplement to writing made significant gains in writing ability
3. Students who used microcomputer based laboratories MBLs) made deeper understanding of complex scientific concepts than did students who did not use MBLs.
4. Computer simulations in science, mathematics, and social studies proved to be effective tools. Students could test abstract concepts and experiment with scientific processes that are not feasible or too dangerous for actual classroom work.
5. Studies indicated that students who used databases outperformed other students in tests of information processing skills. In addition, databases helped students to understand underlying concepts and relationships better, work cooperatively, and became more enthusiastic about gathering and analyzing data.
6. Computer-based technology enhanced individualized learning. It made it possible for teachers to develop instruction that adjusts to each student's prior knowledge, rate of learning, and the nature and style of the student's response. For instance, the technology helped to strengthen reading comprehension through analysis of the students' understanding of the texts. Intelligent tutoring systems in areas such as geometry provided the students with an expert and sensitive tutor; and "hypertext" systems allowed students to manipulate text, graphics, and different levels of information.

Networking

The computer is certainly not the ideal delivery for all classes in schools. However, in cases where it serves as both the medium and the subject, on-line instruction has proven ideal. With the linking of widely scattered students to information and instructors in a very timely manner, individualized learning takes on new meanings. This type of distributed learning should be treated as a need for lifelong learning and also as a means to widen a knowledge base (Seguin, 1988). Wide area educational networking is taking place in some elementary schools in the United States. For instance, Holte's (1989) five classes of sixth graders grow corn, track geese, measure acid rain, monitor weather patterns, and compare their findings with those of students across the United States. In all of these on-line experiments, students mimic the efforts of real scientists to establish national and international networks, to share data, and to see trends. Also, like adult scientists, they are investigating new areas and discovering things for themselves. Technology can engage kids in their own learning and thereby give them power over that learning. Using telecommunication is cost effective for what it can do for a class (Solomon, 1989). The power of computers explodes when they are connected by networks. For an example, an instructional network at East Linvoln Senior High in Denver, NC, helped Principal Steve Cherry boost of his students' reading levels. The school's 754 students in 10th, 11th, and 12th grades, 20 percent of them were reading at a seventh grade level or lower. To provide a solution, Cherry analyzed a variety of network software and selected a relevant package for the school's reading program. Testing at the end of the 1988-1989 school year revealed that 76 percent of the pilot group raised their reading levels. Teachers found that the network made their teaching more rewarding and exciting. The network also helped increase communication among educators. Teachers and administrators could communicate about training sessions, staff meetings, courseware evaluations, students' progress and parent/teacher conferences.

Multimedia

The ability to transfer information is what education is all about and multimedia systems allow that by using the sensory functions of the body. "The best things that come from multimedia tools (e.g., visuals graphics, audio, and texts)", according to Roberts (1991) "are the motivation to really learn and the students' increased self-esteem when they see and show off the results". Interactive multimedia allows students to propel themselves forward by their own curiosity and build, connection by connection, their very personal understanding of the world (T.H.E, special Issue, IBM multimedia, Sept., 1991). Putting tools in the hands of students in turn encourages or forces them to think about relationships.

Despite all those teaching and learning benefits from multimedia, there is still a need for in-depth research on these new educational tools since many questions still persist regarding the full potentials of multimedia. According to D'Ignazio (1991), multimedia has to go through the cycle of experimentation, discovery, and reinvention. He argues that multimedia is still young to have been tested and conclusively proven effective in research laboratories. In response to the question as to whether multimedia is an effective tool, Young (1991) believes that multimedia is at least as effective today as other methods of teaching and learning, but there is no proof.

As each new medium is put into educational use researchers might consider a number of different questions. For example, we might ask about the impacts of a medium's introduction on the setting. For instance, the organizational climate, interactions between the teachers and students and the changes the setting undergoes (Sheingold et al., 1983). Evaluations of media-based programs might usefully compare alternative forms of delivering and shaping instruction on the basis of cost efficiency and appeal to students without necessarily making inferences about learning or performance (effectiveness) advantages. According to Gagne and

Rein(1982), media selection schemes should be based on appeal and efficiency but not only on presumed learning benefits.

The Impacts of Staff Inservice Training on Technology Applications in Education

Trying to infuse technology into the traditional methods course remains a difficult task due to faculty reluctance and inexperience with computers (Biter et al, 1987). If computer technology is to have an impact on teaching and learning, teachers must be comfortable with computers, seeing them as tools that enhance rather than interfere with their daily teaching. To make this happen, teachers need special training (Gleen et al, 1987). Collins (1987) has indicated that since teachers typically teach as they were taught, upgrading the technological skills of education faculty is an essential first step for preparing technologically literate entry-level teachers.

As educational technologies are not self-implementing, investments in technology cannot be fully effective unless teachers receive training and support. Office of Technology Assessment (1988) has found five interrelated conditions that should be met in order to realize the full potentials of instructional technologies: Training in the skills needed to work with technology; Education that provides vision and understanding of state-of-the-art development and applications; Support for experimentation and innovation; and Time for learning and practice.

Some barriers to greater use of the technology, according to OTA findings, are mainly associated with lack of equipment, inadequate or inappropriate training, and for some teachers' anxiety about new technology. OTA finds that teachers' use of computers depends on their instructional goals, teaching approach, training, software and hardware available to them, and the instructional setting.

Inservice training plays an important role in technology training. With technologies changing and applications varying so widely, preservice education alone cannot ensure the effective use

of technology by teachers. Advanced training in applying new technologies can occur through inservice and continuing education. Inservice training can also build on experiential learning, based on the teachers' specific classroom experience and needs. Thus, training for teachers should be seen as ongoing requirement for professional growth (Carnevale, 1986). According to Williams and Williams (1984), several factors contribute to teachers' anxiety about computers:

1. Fear of uncertainty. It requires a change in attitude for a teacher to admit the potentials of the tools that he or she lacks expertise; not being an expert may lessen the teachers' authority over the technology; and fear of embarrassing themselves in front of their students.
2. Concerns regarding changes in teacher-student relationships. Students are often more enthusiastic about working with computers than teachers. Students are likely to learn more things from computer databases than teachers. Therefore, computers are likely to alter roles and relationships, especially when students know more about the computer than the teacher, and when students are given the responsibility for helping run a computer lab or classroom for teaching other teachers.
3. Concerns over accountability. CAI makes it easier to monitor students' scores, therefore, teacher success can be checked against these scores.

Stecher et al (1987) studies examining inservice computer education programs identified several instructional practices that contribute to effectiveness. Among others are:

1. A cycle of mini presentations, demonstrations, and practice sessions appear to be the most effective approach
2. Detailed curriculum guides and lesson plans are important.
3. Clear and relevant objectives. Teachers need to have a clear understanding of what they would learn and of their responsibilities.

4. Lesson related materials and hands-outs appear to free teachers from extensive note taking or reliance on computer manuals.
5. Inservice lessons that link to instruction. Teachers like specific help on preparing materials and experiences for their own students. Teachers appreciate and learn from good modeling on the part of the trainers.
6. Peer interaction during hands-on sessions is particularly effective.
7. Strategies for teaching heterogeneous classes. Trainers who have ways to deal with teachers of differing levels of prior knowledge and anxiety are more effective.
8. The impact of training is much stronger when followed up. Typically, teachers would come back together and report on their use of the computer application in the classroom and share experiences.

Studies on educational media by Laryea (1984) showed that when teachers are exposed to media during their preservice training, they tend to use them more and with greater expertise during their inservice days.

Summary

Research shows that change in schools requires leadership, staff development, modification of the organizational structure, and the involvement of people from all aspects of educational system (Fullan, 1982). Literature indicates that computers are now integral part of our educational system due to their maximum support to educators, students, parents, and educational policy makers. Good software packages have demonstrated significant teaching and learning gains over traditional methods in many subject-matter areas, especially mathematics, science, and social studies. Much of the literature support the point of view that instructional tools such as computers and CD-ROMs function best if they are connected in a

form of local area networks (LANs) and/or wide area networks (WANs), that is to say, electronic networks.

Teacher training and motivation issues have always been critical to all educational innovations. The full potentials of instructional tools could not be realized unless teachers receive the necessary technology training, support for demonstrations, experimentations, and innovations. With technology constantly changing and applications varying so widely, inservice training plays a leading role in technology implementation in our schools.

CHAPTER 3

QUALITATIVE AND QUANTITATIVE METHODS USED IN THIS STUDY

Overview

This chapter describes the design and procedures of this case study. It includes the discussion of methods used to investigate the three major questions addressed in this study:

1. What changes occurred in the use of technology and how did these interact with other influences and outcomes?
2. What changes occurred in roles, policies, and procedures in the school system over time and how did these influence the implementation of technology?
3. In what ways did expectations, beliefs, and instructional practices of various actors within the school system change and how did these promote or hinder Kendon teachers' adoption of technology in the curriculum?

The information sought required both quantitative and qualitative methodologies, and it was imperative that the methods obtain in-depth information on the school system and technology changes over the past five school years. One approach to data collection was through the reviews of Kendon school technology records, meeting proceedings, participant observations, and formative evaluation. A second approach used self-administered surveys plus individual and group interviews.

Rationale for a Case Study

Best and Kahn (1989) describe a case study as:

> "...a way of organizing social data for the purpose of viewing social reality. It examines a social unit as a whole institution, or a community. The purpose is to understand the life cycle, or an important part of the life cycle of the unit. The case study probes deeply and analyzes interaction between the factors that explain present status or that influence change or growth. (p. 76)."

Best and Kahn state that, in a case study, the element of typicalness rather than uniqueness is the focus of attention, for emphasis on uniqueness would prevent scientific abstraction and generalization of findings. As Bromly (cited in Best and Kahn, 1989) noted, "A 'case' is not only about a 'person' but also about 'that kind of person.' A case is an exemplar of, perhaps even a prototype for, a category of individuals" (p. 92). Best and Kahn also noted:

> Case studies are not confined to the study of individuals and their behavioral characteristics. Case studies have been made of all types of communities, from hamlet to great metropolis, and all types of individuals.... and institutions. These studies have been conducted for the purpose of understanding the culture and the development of variable relationships. (p. 93)

According to Van Dalen and Mayer (cited in Ansah, 1980), one of the objectives of the case study is to find "the nature of prevailing conditions, practices and attitudes... seeking accurate descriptions of activities, objects, processes and persons" (p. 82). Personal interviews with subjects are one of a wide variety of methods that may be used to gather data in a case study research. According to Best and Kahn (1989) and Yin (1989), a single case study emphasizes in-depth analysis.

> The goals of qualitative research are concerned more with understanding than with causes.... The qualitative

> methodologies seek direct access to the lived experience of the human actor as he or she understands and deals with ongoing events. The goal is to describe and analyze the activities and reasoning processes by which persons create their own behaviors and understand and deal with the behavior of others. (Patton, 1990, p. 391)

The aims of qualitative thinking are to see the parts, whole and the tensions (Giarelli & Chambliss, 1988). Qualitative analysis is used to unravel and comprehend the changes in the social world and in the behavior of persons (Patton, 1990). It also can clarify the hidden aspects of institutional cultures (Kuh & Andreas, 1991). Such research often can put individuals within the organization in touch with one another and challenge assumptions made within an institution (Kuh & Andreas, 1991). Qualitative research is focused on an objective of understanding an insider's perspective, naturalistic inquiry, a sense of the unique in context, value-laden inquiry, inductive analysis, personal contact and insight, and design flexibility (Patton, 1990; Schuh & Whitt, 1992). It can be labor intensive, deceptive, and appear to be less difficult than it is (Biklen & Bogdan, 1986). Such techniques are frequently expensive (Whitt, 1991) and may overwhelm the researcher with data and decisions at every juncture (Whitt & Kuh, 1989). It has also been said that qualitative research is less rigorous because it is seen as being subjective, is based on assumptions, and is value laden. Britain (1981) disagreed on this issue. He saw neither experimental nor contextual evaluation as more rigorous. He argues that each carries values and can only be tested in application. Regarding assumptions, it was Britain's belief (1981) that interpreters of both quantitative and qualitative research must make suppositions and leaps in thinking by the very nature of examination and deduction. Kane (1985) warned researchers that "the more familiar the situation is to you, the more likely you are to make premature judgments and the more effort you will have to make to avoid them" (p. 54).

Research Design

The methodology used for this case study was partly quantitative and partly qualitative in nature. Quantitative data collection was in the form of self administered survey. Qualitative methods included open-ended responses that followed each survey question, individual and group interviews, reviews of school records, proceedings of meetings, and personal observations. More specifically, this case study was designed to seek answers to three main research questions mentioned in the introduction to this chapter and discussed in the sections below.

Evolution of Technology Implementation

Pertaining to research question one, I gathered data to gain an in-depth understanding of background information on Kendon school system and to describe the system evolution viewed from the perspective of technological changes from 1989/90 through the present. In other words, I sought to give an account of the Kendon school setting, technological innovations, diffusion of technological innovations, rate of adoption, impacts of technological innovations on instruction, and the influences and roles of individuals and groups within the school system. This was made possible through the reviews of school records such as annual reports and meetings proceedings such as Kendon School Improvement Team. All these sources of data collection provided detailed information on the motives or thinking underlying the emergence of a Kendon technology plan; the range of use of technology; the kinds of technology being used at Kendon over time; the time lines for technology programs; and the kinds of organizational culture specific to Kendon school. This information helped me to understand and describe technological inventions, diffusion processes, and consequences of technological changes in the school curriculum. This section is discussed in detail in chapter four.

Roles and Influences of Change Agents

With Regard to research question two, I attempted to identify individuals and groups within the school system, describe the kind of roles they played during the conceptualization, development, implementation, and evaluation of technology programs, and understand the impacts of organizational culture of the school on technology implementation. The information on these aspects was gathered through a self-administered survey and follow-up personal interviews. The information helped me to classify individuals and groups as technology leaders and followers over the past five years and to understand the dynamics of the school system. This section is discussed in chapter five.

Beliefs, Expectations, and Instructional Practices

Concerning research question three, I sought to understand the factors (beliefs, expectations, instructional practices) that have motivated and/or created resistances to the implementation of Kendon technology. That is, the impacts of philosophical attachment, individual and group attitudes, and the extent of technology adoption in the classrooms and computer laboratory setting. Data were collected through records of meetings, the self-administered survey, personal interviews, and personal observations. This qualitative information is discussed in the chapters five and six.

Population

The Kendon school population considered for this study included all Kendon parents and teachers, staff, and university and community members who are directly involved in Kendon school programs-- thus, all adults who constitute the Kendon school system. When selecting Kendon school and the people within the school system for the study, a number of issues were considered.

Kendon Elementary is a special school, not merely because of the commitment of the faculty and staff to the school mission statement, but because it is one of two elementary schools in

Lansing that has been selected as a Professional Development School (PDS).

One of the goals of the school is to create a learning environment in which students and teachers could effectively apply computers to facilitate their work. Kendon is a PDS which has local and wide area (electronic) networks and every teacher has made it a practice to use computers in the classroom and lab setting to enhance instruction. I could reasonably assume that due to the adoption of schoolwide technology- supported instructional programs by the school system, participants would be willing to share their ideas, expertise, and experiences in school technology implementation with other schools.

The techniques used to recruit the participants for the study were the following.

1. I informally contacted all Kendon teachers for their participation.
2. I requested, from the school principal and some teachers, the names of parents and community members who have been actively involved in the Kendon technology program(s).
3. Letters were addressed to all identified individuals explaining the purposes of the study and requesting their participation on voluntary basis. They were assured of confidentiality of participation and information that may be provided by these people.

During the review of school documents and personal observations, every individual and/or group who was directly involved in Kendon school programs was considered for this study. This kind of inquiry provided an in-depth information pertinent to the main research question one of the study.

Data Collection: Sources of Information

In an effort to seek answers to the three research questions, the inquiry involved a two different approaches to data

collection. Initially, data were collected through review of school documents, participant observations, and formative evaluation which constituted one approach of the data collection. Some of what was learned here formed the basis for constructing instruments used in the second approach. Each approach or technique to the data collection is described in the following sections.

Data Collection for Evolution of Technology Implementation

Concerning the first approach to data collection, I received permission from the school principal to review all technology related documents and audio tapes recorded during group meetings between 1989/90 and 1992/93 school years. As the Michigan State University Professional Development School (MSU-PDS) technology research assistant and the Michigan State University-Kendon Elementary PDS Coordinator, I had the opportunity to be a participant observer in the school system and of the Kendon technology implementation process. The aspect of my role encompassed being physically in the school setting for two full academic years, working with teachers and students in the classrooms and laboratory, observing and taking notes on human and technical matters, attending meetings with Kendon faculty, parents, and community members. Thus, I shared context of technology discussions during special technology meetings, School Improvement Team, and Extended Lunches.

Participants. All Kendon teachers, administrative staff, parents, community members, Michigan State University collaborators, and personnel of Lansing School District who directly involved in Kendon school program were considered in this data collection. Specifically, the data were collected through the following procedures.

Reviews of school technology records and reports. The review of documents and meeting proceedings focused more on "Who", "What", and "How" technology issues. The "Who" was related to individuals and group of individuals; "What" was related to the kinds of influences and roles played by these people. The "How" was related to the manner in which these people used to handle administrative, technical, and human matters related to technology. All key words, phrases, and/or statements by the principal, teachers, and parents were faithfully recorded without reservations.

Audio tapes. All audio tapes recorded during the Extended Lunches, Core Team, and School Improvement meetings between 1989-1990 and the current year (1993-1994) were transcribed. This information helped the investigator to better perceive the individual's personality, attitude, communication skills, beliefs and expectations that have specifically influenced the implementation of technology at Kendon.

Participant observations. As a technology research assistant and PDS Coordinator in this school gave me opportunity to make general observations over a two consecutive school years (1992/93 and 1993/94). Particularly, between January and June 1994, I worked with teachers and students both in the classrooms and computer laboratory. All technical and human issues were carefully observed, especially during the laboratory sessions. These helped me to develop field notes in a form of weekly journals. I casually engaged in some informal discussions with the teachers on their respective uses of the new computers. Again, on three occasions, after School Improvement Team (SIT) meetings, I had opportunity to engage in some informal discussions with two parents on what they "say" about the schoolwide technology implementation.

Formative evaluation. At the end of Winter term, 1994 I conducted an informal formative evaluation, in the form of self-

administered survey of five items with regular and special education teachers (see Appendix C). The purpose was to assess the teachers' needs, concerns, and perceptions in order to improve technology support services to teachers and students.

Summary. Thus, during the first approach of the data collection, information was gathered through reviews of school technology records and reports, which focused on "Who, What, and How" technology issues. In addition, information was collected on audio tapes to understand individual's personality, attitude, communication skills, beliefs, and expectations. Again, through participant observations, some technical and human issues as well as what some Kendon teachers and parents "say" were noted. Finally, formative evaluation was conducted to assess the teachers' needs, concerns, and perceptions. Data collected through this approach are fully discussed in chapter four.

Four major themes were identified during the first approach of the data collection were:

1. Key Technology Actors and their Respective Roles and Influences.
2. Organizational Culture.
3. Beliefs, Expectations, and Adoption of Technology.
4. Perceived Instructional Changes over time and Technology Modeling.

These themes were used to construct instruments for self-administered surveys and personal interviews. This second approach to data collection attempted to seek responses to research questions two and three. That is, theme 1 and theme 2 formed the basis for seeking responses to research question two. Theme 3 and theme 4 were used to seek responses to research question three.

Data Collection For Roles and Influences of Kendon Technology Change Agents and Data Collection for Beliefs, Expectations, and Instructional Practices

For the second data collection approach, two different versions of a self-administered survey, "Teacher version and Parent & Business partner version", were developed. The wording of the former was more directed at the teachers as being part of the school system and also as being the principal end-users of the technology at Kendon. The latter was formulated to seek responses from parents and business partners as being part of the school system as well as being direct or indirect observers to technology applications at Kendon (see Appendix A and B). However, both versions sought the same information.

Participants. In seeking responses to research questions two and three (i.e., second approach), data were collected from 16 individuals and groups within the school system (see Table A below). That is, two teachers who provided less detailed information during the self-administered survey, the school principal, and two network managers were selected. All Kendon faculty members were selected but only nine eventually participated. The participants included the school principal, six regular teachers, and two Special Education teachers. Two Kendon administrative staff members and three parents were selected on the basis of their direct involvement with Kendon technology issues, particularly during the School Improvement Team and staff meetings, as noticed from the school records and confirmed by the school principal. The two participants from the local bank (Kendon business partners) were selected because they directly worked with 4th grade students and their teachers, using telecommunication system as a support, throughout the Winter and Spring terms of 1994. The information gathered from these participants helped to provide detail responses to research questions two and three.

Table A: Participants For Second Approach To Data Collection

	STUDY PARTICIPANTS	
STATUS	NUMBER	PERCENTAGE
Kendon Faculty	9	56
Parents	3	19
Business Partners	2	12.5
Kendon Staff	2	12.5

Stage one: Self-administrated survey. The questionnaires contained 15 types of items which were classified into six sections (A-F). Each type of item was designed to seek responses pertaining to past (i.e., 1989/90-1992/93) and present (1993/94) views. Each type of item contained two questions, except views on training and influences which contained four questions each, thus giving a total of 34 questions.

Each question was scaled from "None to Very High" which provided an opportunity to collect quantitative data from the respondents. Also, an open-ended response format accompanied each question that permitted respondents to provide a detailed explanation (i.e., qualitative data) to each rated item on the questionnaire. In other words, this research combined structured and unstructured inquiry.

This phase of the data collection involved two-stage approach. Stage one was purely a self-administered survey and stage two was follow-up individual and group interviews with some selected teachers. The questionnaire was handed to the participants with cover letters. Three days later I began to receive responses from the participants. I carefully read through those written responses. This helped me to gather additional clues or probes that were used to

prepare the final format for subsequent individual and group interviews with the teachers.

Stage two: Individual and group interviews. Individual and group interviews were conducted to gather additional in-depth information about the technology leadership role and its implications for the technology implementation over a five year period. All the interviews were audio recorded. Some critical clues or probes were used by the researcher to prompt the interviewees. All the major issues raised by the interviewees were written down in a form of synopsis. Since much written information was obtained in the self-administered survey, the follow-up individual interviews with some teachers were relatively short, i.e., between 15-20 minutes. One group interview with the school technology managers lasted about 45 minutes.

Summary. Data were collected through self-administered survey and personal interviews. This second approach to data collection attempted to understand and describe (1) the ways in which changing roles, policies, and procedures in the school system did influence the implementation of technology (i.e., responses to research question two) and (2) the ways in which changes in expectations, beliefs, and instructional practices of various actors within the school system did promote or hinder Kendon teachers' adoption of technology in the curriculum (i.e., responses to research question three). That is, the self-administered survey and personal interviews sought to identify Technology leaders and followers on the basis of their respective roles and influences, organizational culture of the school system, beliefs, expectations, instructional practices, and Kendon technology as a technology model over the five year period. Data collected through this approach are fully discussed in Chapters five and six.

Data Analysis

Overview

Analysis of much of the in-depth qualitative data involved procedures for identifying major content themes in documents, comments, and observations. However, the analysis of quantitative information involved simple comparisons of past-to-present changes in many variables as well as more complex analyses. The more complex analyses were designed to examine the dynamics of people's roles in the school, examine the structure of their perceptions, and trace past-to-present movements in the structure of both.

Analysis of the qualitative data (identification of major themes, subthemes, and issues and concerns) was performed to describe the background of Kendon school and the evolution of technology implementation. This kind of analysis provided answers to research question one.

The data from the self-administered survey and personal interviews were analyzed to classify technology leaders and followers and to understand the kinds of beliefs held by individuals and groups and their expectations, teachers' instructional practices, and the extent to which all these variables have influenced teachers' adoption of technology in the curriculum. These results provided answers to research questions two and three.

The analysis technique used to uncover the structure of relationships among numerous variables, multidimensional scaling (MDS), was selected because it permits the use of data satisfying: (a) only minimal assumptions regarding the level of measurement involved and (b) only very basic triangulation assumptions regarding relationships among variables. This is important when the number of cases is small as is the situation of this study. The primary result of this type of analysis is a graphical display of relationships among entities in a system, rather than statistical inferences. Since responses to each variable were on a unipolar scale, calculated relationships varied from high similarity (low dissimilarity) to low

similarity (high dissimilarity) and, as a result, were relatively easy to interpret.

In other words, multidimensional scaling seemed well-suited to the analysis objectives of this research since it attempts to facilitate understanding by reducing a large and complex set of relationships to a spatial analog in which each entity is represented in a space with just a few dimensions. Interpretation of the spatial plot involves looking for clusters, patterns, flows and structures of entities within the space. The axes themselves do not necessarily mean anything in such analysis.

Analysis of Qualitative Data Regarding Evolution of Technology Implementation

The data collected through the reviews of Kendon school records, meeting proceedings, participant observations, and formative evaluation (i.e., first approach of the data collection) were analyzed to understand the background of Kendon Elementary and Kendon technology vision and implementation process. Information on Kendon school curriculum, individuals and groups within the school system, the nature of their involvement in technology issues and activities, and their concerns were carefully studied. Particularly, attention was given to the following:

- nature of issues, concerns, ideas, suggestion raised and resolutions or decisions made about technology
- kinds and sources of technologies obtained and used each year
- instructional purposes served by those technologies
- all individuals and groups who have directly or indirectly participated in technology discussions and activities
- major comments and statements about and by individuals and groups with regard to technology
- personal and professional interests manifested by individuals and groups

- active and inactive participation, communication and motivational skills manifested during technology discussions and activities
- individual and group frustrations, anxiety, encouragement, and enthusiasm with technology
- technical and personnel support systems
- etc.

This analysis helped me identify the kind of technological innovations that have taken place, the media or technology used, the impacts of the technology on different instructional events, the rate of adoption over the five year period, and different roles and influences of individuals and groups within Kendon school system. These thorough reviews provided detailed information responding to research question one, regarding the evolution of technology implementation in the school system.

Analysis of Qualitative Data Regarding Comments and Observations

All recurring major events, issues, and problems (i.e., contextual information) narrated and/or stated which were identified from the school records, meeting proceedings, written responses to self-administered survey, personal interviews, formative evaluation, and participant observations were carefully noted. Information gathered from all these sources helped me to get detailed information on Kendon parents, community partners, staff, faculty, Lansing School District, and Michigan State University collaborators as well as their respective roles, influences, beliefs, and expectations about Kendon technology implementation programs over the past five years. Thus, this broad picture guided my construction of an historical profile of Kendon technology between 1989/90 and 1993/94 school years.

Analysis Of Quantitative Data on Kendon Technology Leaders and Followers and Data on Beliefs, Expectations and Instructional Practices

Each question in the self-administered survey had response categories ranging from "None" to "Very High", and responses to each were coded 0 through 5. The graphical summary analyses described below were performed using this coding of the data.

Graphical analysis. Dissimilarity coefficients were calculated from data coded from none (0) to very high (5). Two interassociation matrices of Euclidean distances (Spicer, 1972) were calculated--first, one matrix representing data collected from questions 1 and 2 of the questionnaire (see section A of Appendices A and B: "Degree of Influence") with regard to research question two, and second, another matrix, representing variables on questions 3 - 34 (see sections B to F of Appendices A and B) with respect to research question three.

Each matrix was input to the multidimensional scaling (MDS) procedure and a 3-dimensional solution was calculated. The coordinates were then plotted to produce a 3-D spatial representation of distance relationships among the variables involved.

Concerning research question two, this technique was used to see relationships that existed between technology leaders and followers over the five year period (questions 1 and 2 of the self-administered survey questionnaire of Appendices A and B). This technique helped me understand the degree of influence and the kinds of roles played by individuals and groups within the school system over time. I was then able to classify these individuals and groups as either technology leaders (innovators, opinion leaders, or early adopters) or followers (i.e., authority decision-makers or late majority adopters). Also, this information helped me examine the pace or rate of adoption of individuals and groups within the school system and the quality of instruction on the basis of organizational

culture such as technical support systems, inservice training programs, instructional policies, and motivational strategies specific to Kendon school.

Concerning research question three, the analysis technique was used to examine the data in order to identify the kinds of beliefs perceived by the participants of individuals and groups within the school system, their expectations for successful implementation of the technology, and the perceived instructional practices of Kendon teachers (survey questions 3 - 34 of Appendices A and B).

Summary statistics. A descriptive analysis was run to produce summary statistics for all quantitative data obtained through self-administered surveys (questions 1 - 34 of Appendices A and B). All the items on the questionnaire were classified into six domains in the form of tables: Degree of Influences; Technology Involvement; and Nature Of Influences sought responses to research question two. Beliefs and Expectations; Technology Adoption; and Technological Changes Over Five Year Period also sought responses to research question three.

Responses of 0 to 2 were classified as "low", percentages for score 3 were classified as an "average", and percentages for scores 4 and 5 were classified as "high" and percentages were calculated. Categorizing the scores helped me to understand and interpret the responses regarding perceptions of technology implementation.

Analysis Of Qualitative Data on Kendon Technology Leaders and Followers and Data on Beliefs, Expectations and Instructional Practices

The qualitative data gathered through the written open-ended responses to each question in the self-administered survey questionnaire and the structured interviews addressing these same questions were examined to identify themes.

When coding and classifying the themes and subthemes identified, attention was given to the following.

1. Major phrases or statements by the participants that capture the fundamental meaning or significance of Kendon technological innovations.
2. Essential statements by the participants about their personal attributes and professional activities of the leaders and followers with regard to computer applications.
3. Specific qualities, situations, and contexts, that have been the preoccupation of these technology actors to make technology work at Kendon.
4. Other motivational and hindering factors that have influenced teachers' uses of computers in the classrooms and the laboratory.

All individual's words and stories narrated or stated during the open-ended responses and interviews were classified by themes to form common patterns. The technique sought to identify some specific attributes that characterized Kendon technology leaders.

For each type of theme and subtheme identified, a respondent's response was coded as a "1" if the theme was mentioned and was coded as "0" if the theme was not mentioned. Similarity coefficients, using a formula "S4" (Gower, 1985), were calculated from these data. The similarity interassociation matrix was loaded into multidimensional scaling (MDS), and a 3-dimensional solution was calculated. The coordinates were then loaded into a plotting program to produce a 3-D spatial representation of relationships among the variables involved. Thus, the 3D-plots reduced the matrix of relationship analog which sought to reveal patterns in participants' perceptions on the kinds of roles, beliefs, expectations, and instructional changes that prevailed within the school system over the five year period.

Rationale for Combining Quantitative and Qualitative Data

All the variables included in each matrix analyzed were based on the same uni-polar scale, and, as a result, the indices always meant the same thing. With similarity and dissimilarity indices, values were always positive, therefore, there were no negative relationships. The graphical plots helped to see clusters, patterns, flows and structures of entities within the space. These results facilitated the interpretation of the data. Figures I, II, III-IIIC, IVA, & IVB in chapter five and six represent the graphical information obtained from these kinds of statistical analysis.

Both the statistical information (in the form of quantitative data) and personal comments and observations (in the form of qualitative data) were used to answer the three research questions.

CHAPTER 4

EVOLUTION OF EDUCATIONAL TECHNOLOGY IMPLEMENTATION

Introduction

In Spring 1994, I spent several weeks studying Kendon school system and the implementation of technology in the school curriculum. The purposes of this portion of the study were to:

- understand the school context and history
- identify key issues specific to Kendon school system
- describe the evolution of technological innovations
- assess the extent to which the interpersonal dynamics of individuals and groups have influenced and been influenced by the technology implementation.
- examine the various ways in which teaching and learning changed as technological changes occurred in the school from the 1989/90 school year to the present.

A variety of sources were considered for data collection. First, with the permission of the school principal, I reviewed all Kendon technology related documents such as End of Year Reports (see 1993/94 example in Appendix K) and audio cassettes of all meeting proceedings such as School Improvement Team from 1989/90 to 1992/93 school years. Second, data were collected from Kendon classrooms and computer teaching laboratory through my participant observations. Third, in Spring term, 1994 I conducted an informal formative evaluation to assess teachers' needs and concerns, and the extent to which computers were being used in the classrooms and laboratory setting (see Appendix C).

The information gathered from these sources helped me to understand the background of Kendon school context and its organizational management. This information provided evidence pertaining to the purposes outlined above. Some of this information was also used to structure and support evidence gathered for another portion of the study.

The study suggested that the evolution of technological innovations at Kendon School can be described as occurring in four phases over the five year period. Before discussing these phases in detail, I want to begin by describing the school.

Background of Kendon Elementary

Setting and History

Kendon Elementary School is located in the southern part of Lansing, the capital of Michigan. The school was built in 1958 and extended in 1961. Kendon School has 14 classrooms, one medium-sized gymnasium, and a library. There are four small conference/storage rooms located at either end of the building.

Kendon Elementary is a special school, not merely because of the commitment of the faculty and staff, but because it is one of the four schools (two elementary, one middle and one high) in Lansing that have been selected as Professional Development Schools (PDS). As a PDS, Kendon has experimented with making changes in classroom practices and school organization. In collaboration with university faculty and graduate students from Michigan State University, teachers reflect upon their practices, work through their struggles and acknowledge their successes as they create a richer learning community for students.

Kendon School community brings much diversity to the school setting. There are distinct family groups that attend Kendon School: neighborhood students who walk to school and students living in the downtown area. Children and families from the communities that Kendon serves differ along many dimensions: socioeconomic status, prior experience, interest in and concern with education, and

ethnicity. The variables inherent in the Kendon community at large make it a challenging as well as rewarding place to teach and learn.

Kendon mission statement. The mission of Kendon Elementary Professional Development School is to prepare students for the future by working cooperatively with parents, the community, and educational faculty. Together the school will create an organized and supportive learning community. The school system will accept and accommodate diversity. Kendon students will become responsible and productive citizens who will use their strong knowledge base to engage in critical thinking and problem-solving for lifelong learning.

Organizational Culture and Management

In an effort to build a favorable learning community, Kendon staff in collaboration with external agents established a strong organizational culture and management that sought to respond to the aspirations of individuals and groups within the school system.

Kendon staff. Kendon regular staff for 1993/94 school year consisted of a principal, 13 general education classroom teachers, four senior intern student teachers, one special education teacher, one special education consultant, one reading teacher, a part-time librarian, a part-time prevention specialist, three learning specialists, six faculty members and four graduate assistants of Michigan State University, a special education instructional assistant, three "Chapter 1" instructional assistants, one part-time parent Lending Library coordinator, one lunch cashier, eleven lunch assistants, a secretary and two custodians. This staff represented different groups of people and expertise that provided support and knowledge for the students they served.

Student data. There were 333 students during 1993/94 school year attending Kendon Elementary PDS. The number of students per class is presented as follows:

Kindergarten	Grade1	Grade2	Grade3	Grade4	Grade5
61	66	47	52	55	52

Parent/community involvement. The aim of trying to bring Kendon parents and community members into the school has been to help them understand the kind of innovative teaching and learning that the faculty are trying to integrate across the curriculum. The assumption is that parents' involvement in and understanding of the faculty's work will enable them to better support their children's learning efforts in school.

School improvement process. The Kendon staff in cooperation with Michigan Partnership for New Education and the State of Michigan (Requirement of) Public Act 25 established a School Improvement Team (S.I.T). This is a policy-making umbrella for the school and also acts as the site-based management team required for school improvement as mandated by the School District. Membership is voluntary and includes the school principal, Kendon teachers, Michigan State University collaborators, and Kendon parents. A five member Executive Committee facilitates the work of the School Improvement Team.

The Kendon faculty members have been committed to reversing the historical pattern of schools poorly serving diverse populations of students. The concern for helping all students learn about subject matter, about problem solving, and about themselves as individuals is central to the faculty's work. This PDS work has been ongoing at Kendon for five years. In 1989-90, the initial exploration and implementation of PDS goals and projects began. In 1990-91, this work continued and expanded as more teachers participated in PDS related projects and met regularly during the teachers' own time before and after school as well as "extended lunches".

Regarding the extended lunches, Kendon faculty scheduled a school-wide meetings of the faculty once every six weeks for the entire 1992/93 and 1993/94 school years. During those meetings, faculty members discussed the school-wide instructional programs such as literacy, technology, and mathematics projects. These discussions focused mainly on parent-school connections and teaching for understanding in various subjects (e.g., mathematics). As an additional context, faculty worked specifically on building school-wide trust.

In addition, the school faculty decided to experiment with a model of reallocated time that involved hiring part-time teachers and allowed regular teachers to focus on PDS work. Specifically, by hiring part-time teachers, regular staff members could be released from their teaching responsibilities for an entire morning or afternoon every week. During the released time, teachers worked on curricula, met with Michigan State University collaborators, and, in general, identified and solved problems related to their experimentation with new pedagogy. Using a similar organizational framework developed in the preceding years, work toward making concrete PDS goals and principles continues.

Kendon School and University Faculty Alliance. In an attempt to prepare students for the 21st century, Kendon faculty strongly felt that teachers needed an opportunity to work in collaboration with Michigan State University faculty members in developing and designing programs. They also felt the need to voice their views on issues related to PDS work. Despite all the efforts that had gone into establishing a learning community, there was still a need to pay greater attention to building school-wide trust. In 1992-1993, the staff engaged in a number of team building activities designed to help staff members understand different communication styles and build trust between staff members. In 1993-1994 the staff planned to continue team building exercises with continuing attention to building staff trust.

Kendon Technology Vision.

The school's technology vision for the past five school years was that computers and related technologies would become an integral part of instructional activities at the school. When implemented appropriately, computers may be tools that could enhance thinking, problem solving, and communication. The school system, therefore, aimed to create an environment in which students and teachers could apply computers to facilitate their work and learning. Specifically, this required that students and teachers became familiar with multiple capabilities of computers and learned how to apply them to meeting their instructional needs such as word and data processing, publishing, and accessing information. Thus, Kendon school system would continue to prepare students to participate and contribute to a society in which information technologies are central (see Appendix K: 1993/94 Annual Report).

The framework of this technology vision encouraged Kendon faculty to seek external support (equipment, financial, technical, personnel) from the School District, Michigan Partnership for New Education, Michigan State University, and some Michigan business firms. The school took the opportunity to formally introduce computer technology into the school curriculum when Professional Development School Programs were first established at Kendon Elementary in 1989/90 school year. As a strategic plan, the school decided to form a "technology group" in the same year to support the technology implementation plan. The group consisted of one faculty and one graduate student from Michigan State University, the school principal, and one Kendon teacher. Over the past five years, the school has engaged in several technology activities, both small and large scale.

Phases of Kendon Technology Implementation

Overview

The phases of Kendon technology activities that are presented in the rest of this chapter are based on the diffusion of innovations model proposed by Rogers and Shoemaker (1971) in their book entitled "Communication of Innovations". This model suggests three sequential stages in the process of social change: invention, diffusion, and consequences. The social structure, according to the model, consists of the statuses or positions in a social system and the system acts to impede or facilitate the rate of diffusion and adoption of new ideas through what are called "system effects".

According to Rogers and Shoemaker, the main elements in the diffusion of new ideas are: (1) the innovation, (2) which are communicated through certain channels, (3) over time, (4) among the members of a social system. They assert that the characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovations are identified in this model: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. According to this model, innovativeness is the degree to which an individual is relatively earlier in adopting new ideas than other members of his social system.

Five adopter categories are associated with this model: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, (5) laggards. Rogers and Shoemaker (1971) argue further that diffusion occurs within a social system because the system's social structure can have an important influence on the spread of new ideas. It is also noted in this model that diffusion may also change the social structure of a system in the sense that many innovations are of a restructuring nature.

Pertaining to this study, the following phases correspond to the first four adopter categories mentioned earlier:

- phase I --- introduction of technology with innovators

- phase II --- extension of the use of technology with early adopters
- phase III --- slow pace of adoption with early majority
- phase IV --- schoolwide technology implementation with late majority adopters.

In the course of my studies, I was constantly asking myself questions regarding: the kinds of strategies that the technology opinion leaders applied and how these influenced the pace of technology adoption by Kendon teachers, parents, and community business partners (followers); the kinds of teaching and learning processes that were taking place in the classrooms and computer teaching laboratory; and the extent to which these technological innovations were being supported by internal and external agents on both a short and long term basis. At the end of the discussion of each implementation phase, I discuss my reflections on the diffusion process, changes in teaching and learning practices, and sustainability of the innovations.

Phase I: Introduction of Technology with Innovators

In 1989/1990 school year, Kendon PDS launched a formal technology experimental programs. This involved Kendon faculty and students, some faculty and students of Michigan State University, and grants from Apple Computers and Kellogg Foundation. A technology group, consisting of the school principal, one Kendon teacher, and two Michigan State University collaborators, was formed in Fall 1989 to manage the implementation plan. During the Fall and Winter terms, the group engaged in a needs assessment process to set priorities for technology innovations. A number of technology projects were considered and tried out in one fifth grade classroom.

The fifth grade multimedia project. In the spring of 1990, a group of Kendon fifth grade students and their teacher, one professor and a graduate student from the College of Education, Michigan State

University (innovators) started to operate a "Computer Corner" project with one Apple Macintosh and a Pioneer Laserdisc Player at the back of the classroom. The students were first introduced to the basic concepts of using computer keyboard, mouse, and some simple typing using Microsoft Works. Later, with the assistance of the class teacher, six students were selected to form an "operators team" (OT). They were trained to use the Macintosh, Microsoft Works, Laserdisc Player, and HyperCard. When the operators became competent enough the class launched into experimenting with the following activities as part of technological innovation efforts (Kendon Elementary PDS Annual Report, 1990/91).

1. *The MicroExploratorium Project.* A simulated multimedia program developed by two professors and some graduate students at Michigan State University represented science and museum exploration. The participating students used the program to engage in hands-on science activities.

2. *The Kendon Videodisc Project.* A videodisc, prepared by three professors and some graduate students of the Michigan State University , captured activities inside the Kendon School as well as its surrounding neighborhood. A HyperCard interface was designed to encourage the students to write about themselves, classroom, school, and/or neighborhood. This personalization of the videodisc excited students and spawned interest in writing which was carried into other projects such as the development of hypercard databases and databanks.

3. *The Voyager and the Solar System Project.* A videodisc, with a HyperCard interface, provided the students with an opportunity to view some distant places and objects in a simulated "Solar System". The students then used the computer to write stories about their simulated space "trips".

4. *The Weekly Eagle Project.* As writing became more important in this class project, three students were started a classroom newspaper, "The Weekly Eagle", using Microsoft Works. The rest of the participated in the writing of the newspaper

covering many subject-matter areas, including science and mathematics. The success of the project quickly spread into other classrooms. Some 3rd grade students submitted articles for publication. The fifth grade operators team (OT) became editors of Kendon newspaper, "The Weekly Eagle" which was published three times a week.

5. *Famous African Americans Project.* One undergraduate student from Michigan State University designed a simple database with Microsoft Works. In this program, Kendon students typed information gathered from books in the library, their teachers, and parents about various influential African Americans.

6. *Fractal Trees Project.* One graduate assistant designed a Hypercard stack called "Fractal Trees" which taught about the relationship between initial settings of equation parameters, the size, and shape of the fractal tree drawn by those equations. Students in this class were encouraged to use this program as an educational game to enhance their mathematics skills.

Reflections on Phase I

At the outset of Kendon school's involvement with technology, the school endorsed a vision of integrating technology into instruction and established a small group of people especially interested in technology. However, the first adoption of technological innovations was based on the personal decision of one teacher to welcome outside agents to bring applications of technology into his classroom. This teacher had very little knowledge of modern instructional technology, but he embraced the effort with personal enthusiasm and encouraged other teachers to get their students involved in some of the projects done by his class. In other words, the first adoption was a modest "bottom-up" start which was well publicized within the school.

Kendon school faculty members recognized that they could not effectively implement the technology without the support of external agents or expertise. The idea of inviting university faculty

and graduate students, parents, and community business partners to support the innovations was a first important decision. Subsequently, the formation of technology group, consisting of internal and external agents, to manage or support the innovations was a strategic plan.

The technology group felt teachers and students could learn together about these tools, considering the newness of this instructional tool to the school. However, they decided to empower the students first. This approach was more of student-centered that required classroom teacher's maximum supervision and participation. This implies that even if students interacted directly with the technology, the intervention of classroom teacher was indispensable.

The exploratory nature of multimedia instructional activities experienced in the fifth grade classroom was more of discovery learning processes. The students had to interact directly with the learning tools (i.e., student-technology interactive process) to make sense of the embedded content. During this process, the class teacher had little control over the students' learning. The role of the teacher was, therefore, more or less of classroom management. Of course, this radical change required new class management skills as well as personal and professional interests. The implication of this shift of instructional practices is discretion of the class teacher to decide either to accommodate or reject the innovations.

The success of the fifth grade students' technology projects, especially the creation of class "newsletter", lead me to assert that if students are given the appropriate learning tools and supervision, they can take control of their own learning. That is, empowering students through student-centered approach could be a strategic plan to technology implementation in schools. However, teacher guidance is always important to make such learning happen.

Considering the limited equipment with which the innovations started, teacher's lack of expertise in technology, and, to some extent, student-centered approach, lead me to conclude that the

sustainability of the innovations during this first phase was a major problem. Particularly, the technological innovations would have ended if the external agents had decided to withdraw their services and commitments. Therefore, for any effective school innovative programs, teachers need the necessary skills and knowledge to sustain the programs.

Phase II: Extending the Use of Technology with Early Adopters

The excitement generated through the 5th grade multimedia activities encouraged the technology group to introduce those activities into other classrooms during 1990/91 and 1991/92 school years. After numerous discussions among technology group (leaders) and Kendon teachers and parents (followers), the school system agreed that it would be better working towards some common goals in all the classrooms. Prior to this collective decision on the spread of technology innovations, three teachers had then voluntarily started exploring the potentials of 3 Macintosh microcomputers received through the "Classroom of Tomorrow Project" which was launched by Michigan State University. The purpose and activities of this project are beyond the scope of this study.

In 1990/91 school year, Kendon received 4 additional Macintosh microcomputers and printers from Apple Computers grant through Michigan State University to support teachers' technology efforts. The total number of computers for curriculum activities increased to 11 (8 Macintosh and 3 Apple II GS). With these, the technology group then decided to put 1 Macintosh microcomputer and 1 ImageWriter printer in as many classrooms as possible. Encouraged by the success of the 5th graders, all teachers and students at Kendon began to explore the potentials of these instructional tools through individual and group projects. Particularly, some Kendon teachers began to use MicroSoft Works to improve writing across the curriculum.

The graduate student started to introduce different programs to some few skilled and interested teachers. One such program was KidPix, a painting program aimed at children. It became an instant hit in two 3rd grade classrooms. Teachers in these two classes encouraged their students to use both Microsoft Works and KidPix for writing projects. Both teachers and students in these 3rd grade classes then started working with the 5th grade students on different technology projects.

As part of the strategic plan, the technology group teamed up with these two 3rd grade teachers (i.e., the few early adopters). The group was then reconstituted to include the school principal, three Kendon teachers, and two Michigan State University collaborators. Although members of the technology group, except the university collaborators, had limited skills in the technology applications, they were highly enthusiastic, optimistic, and worked hard to master the technology in a short period of time. The group provided the necessary technical and moral support to novice technology users (teachers). The members of the new technology group were then perceived as early technology leaders and the rest of the people within the school system were perceived as technology followers.

Early opinion leadership role. In spite of the continuous support from the technology group, it appeared that some teachers were pessimistic about technological "revolution" at Kendon. Considering the general concerns about teachers' inexperience with the new tools, the technology leaders had to find solutions to two major problems. First, they were concerned about (a) how to help a teacher to effectively use computer with which she or he had never worked before, and (b) how to accommodate teachers' differences in needs and skills across all six grade levels (K-5). All these required new approach to organizational culture in the school, particularly staff development and technical support.

As part of the solutions to these problems, the graduate student started to visit classrooms with the intention of helping the

teachers and students become comfortable with the new instructional tools. On the school bulletin board, teachers were asked to post requests for computer help on the basis of their individual needs and schedule. For several weeks the graduate student moved from classroom to classroom trying to address each teacher's particular problems. This permitted the technology team to identify some of the teachers' concerns about the technology. For instance, it was observed that some teachers (i.e., inexperienced ones) became very frustrated and annoyed because the computer and graduate student did not have any magical solutions to their problems with the technology. However, those teachers who were more technology enthusiasts began to realize the potentials of computers in the curriculum and, therefore, gladly decided to meet its challenges.

Innovations decisions. At the end of the 1990/91 school year, the school system took two important decisions that eventually modified the approach to Kendon technology implementation process. First, the technology team felt the need to develop a local network. The rationale behind the networking, according to the technology team, was that networks are widely recognized today as the most rapidly growing area in the computer industry. For instance, Local Area Networks (LANs) provide the ability to share information between computers located as close as next room and as far as the other side of the world. The second important decision was to allow teachers to take their computers home for the Summer vacation, 1991.

Summer technology training. Throughout the Summer term, 1991 the graduate assistant engaged in one-on-one computer sessions at some teachers' own residence. It was during this time, without the pressure of classroom activities, that some teachers started to understand the value added to their instructional toolboxes. For example, before the summer vacation, one first grade

teacher had a vague idea of how to turn on the computer. But, at her home, after one hour demonstration by the graduate student, this first grade teacher suddenly began working on her first lesson plan using Microsoft Works. Two hours later, she began pasting MacPaint graphics and then started discussing the advantages of using HyperCard and PageMaker for desktop publishing. By the end of the summer vacation she was able to effectively use the Microsoft Works program to write her letters and prepare grade report sheets for her class.

Early electronic networking: Information services. The 1991/92 school year started and Kendon teachers were excited to discover what they could do with a local area network (LAN) and wide area network (WAN) to enhance instruction and professional development programs. After consultation with Lansing School District, Office of Professional Development Schools, and the personnel of computer support services of Michigan State University, the technology group decided to introduce Kendon to the world of computer networking. In less than two weeks of Fall term, 1991 all the 8 Macintosh computers in the school building were interconnected to form a local area network and wide area networks, using 2 Farallon Star Controllers. The network was equipped with a LaserWriter printer. The technology group focused on two important information technologies.

Electronic mail. Every teacher was provided with an electronic mail account on the Michigan State University IBM-3090 mainframe computer. The concept of electronic messaging was demonstrated and discussed. Teachers had the opportunity to correspond with some Michigan State University faculty. The potentials realized with Electronic-Mail were great. For example, the telebridge modem with six telephone lines gave the staff an opportunity to share documents on the network. From his office at Michigan State University, a professor could prepare a document on

his Macintosh and send it to be printed on the LaserWriter located in the Kendon library that could be instantly shared among teachers.

Bulletin boards services (BBS). A second advantage of having a modem and a phone line was the use of BBS. The IBM mainframe runs a BBS which could access information from a worldwide network of users. By expanding the notion of Electronic-Mail, the experience with BBS showed how easy and efficient it was for people from distant locations to exchange information.

Specialized individual and group activities. Despite the growing interests of Kendon teachers in technology, the technology team realized that the computers in the building were not adequately used. The success of some few teachers' independent study such as 1991 Summer sessions encouraged the school principal and the graduate student to search for new strategies of staff development. Some special individualized and group projects were introduced in Fall 1991. The graduate student started to introduce different programs to teachers. For example, the Reading Specialist and the Librarian became more interested in developing a HyperCard stacks to assist children in categorizing books. One Special Education teacher was also particularly interested in using Spreadsheet to organize her students' grades.

Microsoft works. The teachers' concerns about the inefficient use of the available integrated software (i.e., word processor, spread sheet, database management, and communication built in MS Works) became a compelling argument to search for new ways of optimizing the capabilities of the program. While some teachers were interested in organizing their students' grades, others were more concerned with teaching typing skills and word processing. Lower grade-level teachers attempted to use the program for drawing. The graduate assistant tried to accommodate, as much as possible, the particular needs of each teacher. Given the constraints

of the graduate student and teachers' time not all teachers were exposed to the same amount of learning about the new technologies and their applications. However, most teachers had the opportunity to express their particular needs and work on a solution.

The "Mini Computer Laboratory" in the school library. After having worked together closely for several months, the graduate student and two Kendon teachers (the current network managers) determined to try something on a bigger scale. Since both teachers had considerable knowledge in using Microsoft Works for writing projects with their 3rd graders, they proposed a group writing activity. They designed a four-week program aimed at improving their students' writing skills using Microsoft Works. It was then decided that all 8 Macintosh microcomputers in the building would be brought to the library so that two students could work on one computer. This four-week program focused on typing editing, spell checking, graphic design with KidPix program, importing pictures or graphics into word processor, and printing.

Each meeting in the laboratory lasted one hour. The two third grade teachers teamed up to help each other during the laboratory sessions. These few teachers gradually became valuable resource or support staff for the entire school. After the four-week try period the computers were returned to the classrooms.

Kendon school: A learning center for the community. Every new step in the development of school community and the promotion of modern technology in support of such development brings new challenges. Many Kendon students are not exposed to stimulating learning environments outside the school building. Given social and financial constraints of some Kendon families, the Kendon technology group decided to expand its technological innovation programs to the community at large. Thus, it would have been an opportunity for the participants to learn how to use different computer programs such as word processing, household budgeting,

and database management. Such activities were intended to attract Kendon parents and community members to formal school activities in a way of directly or indirectly engaging them in their children's in and out of school leering assignments.

Reflections on Phase II

Teacher's prior technology experience, inservice training, beliefs, and expectations play an important role in her or his adoption of technological innovations. Following the enthusiasm generated in phase I and encouragement received from the fifth grade teacher, a few teachers decided to give a try to these technological innovations in their classrooms, despite the fact that they had very little knowledge in technology. These early adopters, therefore, took this decision on the basis of voluntarism, enthusiasm, belief, and personal interest.

The spread of the innovations required reorganization of school culture in order to cope with teachers' frustrations and concerns. The school technology group had to pay special attention to staff development and technical support systems. The temporary one-on-one technology assistance in the classrooms, small group technology sessions, and Summer technology independent study offered by outside agents posed challenges to many Kendon teachers as to either adopt or reject the technological innovations.

One important observation that characterizes early technology adoption process at Kendon was "idea sharing" strategy among peers. The cooperative teaching and learning approaches, with regard to technology, adopted by two 3rd grade teachers served as a springboard to the innovations process. The reconstitution of the technology group to include these two early adopters was seen as an important decision to spread the innovations.

These early adopters of classroom technology applications had to share computers with other teachers who had earlier on received computers through the District's grant for "Classroom of Tomorrow" project. In fact, as some of these teachers wanted to keep the

computers for longer period of time, the rotation strategy slowed down the rate of adoption.

Despite the increase in number of computers in the school to 11, it was critical at this stage to build teachers' confidence and trust about the innovations. The outside agents had to temporary explore a wide variety of activities with all teachers. All the 8 Macintosh microcomputers were temporary installed in the school library to form a mini laboratory. Having exposed teachers to new programs, networking activities, and cooperative projects in this mini computer laboratory, they began to realize the potentials of these tools, but their involvement was still low.

New teaching and learning styles began to emerge as a result of these technological innovations. For instance, team teaching and small group writing projects in the mini computer laboratory practiced by the 3rd grade teachers and students, during the four-week pilot project, started to shift the "individual" to "group" instructional processes in these classrooms. These new experiences began to spread across grade levels and many teachers started to get interest in the technology. Of course, this phase laid grounds for teacher-centered approach to the implementation.

During this phase, the school still needed more equipment, external agents were the pivot of the innovations, and student-centered approach was still maintained. All these issues indicated that the sustainability of the innovations was still questionable. However, demonstration of personal and professional interests and skills acquired from the outside agents as well as leadership role played by these early adopters was an indication of gradual sustainability of the innovations.

Phase III: Individual and Class Projects with Early Majority Adopters

During the Fall Term, 1992, the technology group studied the status of the school and its technological role in Lansing School District, especially as a model for Lansing Public Schools. From a

synthesis of the incentives and potentials generated by the school principal and some few teachers, the school set up new goals that could effectively respond to Kendon technology vision as well as an action plan that provided specific tasks for the 1992/93 school year. The two broad goals were to:

1. Reinforce "Active, Cooperative, Individualized, and Interdisciplinary Learning" through the use of stand-alone computers and electronic networking.
2. Focus on novice technology users to improve their basic skills in software applications such as Word Processing, Spread Sheet, Database Management, Printshop, and Hypercard.

The technology group, now composed of two university collaborators (including myself), the school principal, and two Kendon teachers, decided on what the teachers could do with the existing computers, new ways of facilitating teachers' computer competency that would directly help them improve instruction in the classrooms, and how best the graduate assistants could adjust their schedule to meet with each teacher's training time. The school principal requested all teachers to sign up for computer competency training as part of the PDS program. Six novice (technology) teachers signed up for the training. Having conducted an informal needs assessment, we identified specific needs and time constraints of each teacher. We established priorities and developed a working plan for each teacher in order to optimize the training periods. The teacher competency training activities mainly focused on hands-on activities. These included connecting the devices together (keyboard, mouse, monitor, computer, and printer), switching on and off the computer, creating or opening files from the hard and floppy disks, and running different programs. Some specialized computer activities continued with some individual teachers.

One graduate student assisted two 2nd grade teachers in their classrooms throughout the whole school year. Activities in these classes were <u>student-centered</u>. One major concern with these two

classes was student computer competency training. The goal was to teach students to acquire declarative and procedural knowledge in computer technology. In this context, competency means being able to switch on a computer, insert a proper disk, run the program, make a print out, and switch off the computer without any assistance. After three weeks of training, they were comfortably able to identify various parts and functions of microcomputers. For example, they could easily identify and use the keyboard, the monitor, mouse, computer, and the printer. In addition to the declarative knowledge, they devoted most of their time on hands-on practice with computers.

As a result of this experience and enthusiasm about this new writing tool, one class decided to establish a class "Newsletter". The class teacher developed a strategy that allowed her students to write stories based on their experience, interests, actions, imaginations, and objects. The stories were edited either by the class teacher or in some cases by their parents. On Fridays, the students wrote their stories using Microsoft Works, with the assistance of the graduate student. They easily edited their scripts on the screen individually or in small groups before printing. Each student produced two hard copies every week: one for the class newsletter and the other for his or her parents.

Towards the end of the Spring semester, the students wrote an average of three stories. Most of the students who initially started with one page story made a remarkable progress, writing up to two pages. Few students wrote up to three or four pages. Some parents helped their children to compose the stories at home and requested them (children) to type them on the computer and print out hard copies in school.

In the other 2nd grade classroom, students used arithmetic software to learn how money is being used. The students worked in groups of two. By the end of Spring semester students in this class were able to identify different denominations and their values. With

this software, students engaged in addition, subtraction, multiplication, and fraction problems.

Another technology project was more teacher-centered. I worked closely with four teachers in the following areas (software applications): Word Processing, Spreadsheet, Printshop. Due to conflicting schedule among teachers, one-on-one training program was developed. With the Printshop program, I assisted the school principal to learn how to use the built-in graphics, some imported graphics, and make banners, signs, and letterheads. The text practice with this program gave us the opportunity to review some basic skills in word processing such as entering characters, cutting, pasting, deleting, formatting, saving, retrieving, and printing documents. At the end of the school year, she used the program to produce 300 "Certificates of Awards" to the school athletes.

One 1st grade teacher and the school librarian were interested in learning about computers in general and word processing in particular. We went through the steps of writing a letter or creating a document. They practiced typing , editing, formatting, spell checking, saving, and printing a document. Having completed three sessions, the 1st grade teacher started writing memos for her church activities. The librarian also started writing her personal weekly reports with computer. At the latter part of Spring term, she developed interest in creating an electronic database for the school library.

In one 4th grade classroom, I assisted one teacher to effectively use spread sheet in MS Works to create a grade book, discipline, and an attendance records for her class. The practice involved: creating a new and opening an existing spread sheet, entering and changing text, values, and formulae, copying and moving cell contents, naming, saving, and printing a spreadsheet. At the end of Spring term, 1993 she was very happy to realize how the program helped her to calculate the "Totals, Averages, and Percentages" of her students' grades as well as viewing the graphical representations of the students progress in different content areas.

In addition to teacher-centered activities, I assisted students in this class to use some software programs such as Sim City, Mathblaster, Kids Pix, and Once Upon a Time for writing projects and mathematics problem solving. For example, with graphics such as the sun, moon, and houses in "Once Upon a Time" program, students were able to create short stories and type them on the computer. Also, with the Mathblaster, they did some arithmetic problem solving on the computer such as additions, subtractions, decimals, and multiplications.

Kendon Grant Proposal. In 1992-1993 school year, Kendon school submitted a proposal to the School District requesting 40 Macintosh microcomputers to support the faculty's efforts towards accomplishing the technology vision. The school requested 3 computers for each classroom and one file server, all of which had to be interconnected to form a local area network to facilitate shared use of software and cross-classroom collaboration. This would have allowed students to use the computers individually or in pairs during regular classroom time. One stipulation of the proposal was that the computers would remain in the classrooms.

What this arrangement did not facilitate was the use of computers for large group instruction that involved many students interacting with computers after each presentation or teacher demonstration. For example, there are a range of thoughtfully designed programs for mathematics, social studies, and science programs that require large groups of students to explore data, manipulate variables, make and test hypotheses, and process large amounts of information, etc., on the computer. These kinds of group assignments require a computer facility such as a computer teaching laboratory that could accommodate classes of 30 students at a time.

Summer program. During the Summer vacation, my colleague (i.e., other graduate assistant) and I volunteered to work with any interested teacher during the Summer vacation of 1993. One-on-one

weekly computer sessions were scheduled with a few teachers who signed up. The school allowed these teachers and others to take their computer home. We focused the training on each teacher's personal needs.

Reflections on Phase III

The pace of adoption perceived in the 1992/93 school year was relatively slow. This necessitated new approach to the implementation strategies. A number of issues had to be revisited by the school system to ensure active participation of teachers. More importantly, this required engaging every teacher in all technology discussions and teacher-centered approach had to be adopted. This shift of implementation strategies implied that staff development and technical support strategies needed special emphasis in order to keep teachers' confidence and trust about the innovations.

The emergence of teacher-centered approach was greeted with more teacher participation in technology programs and activities. With these changes teachers began to assume new technology roles in the school. For example, all major technology decisions were taken by teachers instead of the technology group. At this phase, teachers began to consolidate ideas and expertise, thus indicating that the implementation process was moving gradually from individual to small group, and then to large group activities. The specialized individual and small group activities by some novice technology teachers seen in 1992/93 school year may explain the teachers' renewed eagerness and commitment to Kendon mission statement and technology vision and how wide the technology was being spread in the classrooms. In other words, Kendon technology implementation process has followed "bottom-up" approach.

Concerning classroom dynamics, the teachers' active participation in technology programs and their acquired declarative knowledge served as vehicle for them to provide guidance to student learning about the technology and effectively organize classroom

instruction. The fact that student-centered approach was still maintained, both discovery and guided learning were very common in Kendon classrooms. The combination of these two instructional processes shifted student-technology interactive process to a situation in which technology only served as a vehicle for classroom instruction. That is, instructional practices were more of teacher-technology-student interactive processes.

At this implementation phase, external agents still initiated and supported many class technology activities. These activities were mainly centered on students and practically no new equipment was received to attract teacher active participation. All these factors implied that the innovations were still not sustainable. However, the teachers request for additional computers from the School District to support technology vision, reorganization of the school culture, mass participation of novice technology teachers, and the continued support from the university, to large extent, implied that the innovations would grow.

Phase IV: Schoolwide Implementation with Late Majority Adopters

The 1993/94 school year marked a tremendous change in the history of Kendon technology implementation programs over the past four years, particularly in equipment, staff development, instruction, and general perceptions on the dynamics of the school system. As part of the strategic planning for the promotion of effective uses of the new computers in the curriculum, teachers' needs and concerns received special attention from the technology group. During the first week of the school year, Fall 1993, Kendon faculty and two Michigan State University graduate students conducted a needs assessment and set priorities for the kinds of training, software, and other technology support services needed for the implementation of the schoolwide computer applications in the classrooms.

At the beginning of 1993/94 school year, Kendon school received a District grant of 40 computers. This initially provided the school with 3 computers for each classroom and 1 file server. All these computers were interconnected to form a local area network (LAN) and wide area network (WAN), replacing the existing network configuration.

The needs for training programs were identified, such as basic introduction to the hardware (Macintosh) and new software for both teachers and students. Training programs were organized according to individual and/or group needs. Two 5th grade teachers, members of the technology group, were designated by the teachers themselves as the school-based network managers. They attended 8-week network management and technology training sessions offered by Lansing School District. Throughout the Fall term of 1993 all the teachers participated in the school's short term and long term technology inservice programs. These programs were coordinated by the two Michigan State University graduate students and the new network managers.

Concerning software selection for classroom applications, each teacher described the various ways and specific content areas in which he or she expected to use computer programs to support classroom instruction. The selection criterion had to conform with Lansing School District's technology specifications as specified in Lansing School District Curriculum Guide, 1993/1994. Based on the local needs of Kendon teachers, the network managers, with the assistance of two Michigan State University graduate students, identified appropriate software programs for all grade levels and across disciplines. The selection and purchase schemes were limited by the funds available. In 1993/94 school year, there were five programs on the network: MS Works 3.0; Hypercard Player; Macintosh Basics; Kid Works 2; The Writing Center; TeachText; and Play Room.

1. *Computer Laboratory Development.* As the training advanced and the concept of "critical mass" began to gain full momentum, the teachers perceived the need for more "hands-on"

activities for both students and teachers so as to become active users of computers. In view of this the idea of developing a Macintosh Computer Laboratory emerged. The technology group, in consultation with Kendon teachers, addressed a memorandum to Lansing School District. In the month of November, representatives from the School District and Michigan State University collaborators and Kendon faculty met to talk about the implications of the laboratory on instruction as well as technical issues involved. As a result of this meeting, a formal proposal was sent to Lansing School District for a computer laboratory. In the month of December, 1993 permission was granted by Lansing School District to withdraw one computer from each classroom. In the second week of January, 1994 a Macintosh computer teaching laboratory of 15 computers was established. Currently, the 15 computers are "stand-alones".

In winter and Spring terms of 1994 the laboratory was extensively used to support the classroom instruction. All the teachers sent their students to use the laboratory to complement the classroom activities. Thus, the laboratory was highly considered as an extension of the classrooms. The main programs used in the laboratory during 1993/94 for instruction were Kid Works 2 (Multimedia) and MS Works 3.0. The Kid Works 2 was the program used mostly by all the grade levels for reading, writing, and painting skills. The 3rd, 4th, and 5th grade students equally used the MS Works for their writing projects.

During the laboratory sessions, students worked individually or in groups of two. Except for the two network managers (i.e., 5th grade teachers), all the teachers received (technical) assistance from the graduate students during the laboratory sessions and were often assisted by the teacher specialists. The teachers always were required to come to the laboratory with prepared learning objectives and graduate assistants were there only to give technical support.

2. *Telecommunication In Education.* In addition to regular classroom and laboratory technology applications, the school established a telecommunication project to support the Kendon 4th

Grade-C.A.S.E Credit Union Partnership Venture. In the month of March, 1994 a workstation of one IBM computer (PS/2), one monitor, one modem, and one printer was installed in each of the two 4th grade classrooms. The first electronic communication or business transaction began in mid March, 1994. This system permitted the 4th grade students to access the Credit Union database for financial information.

Looking to the future. In pursuit of long-term technology goals and ensuring continued efficient and effective applications, the school plans to use the following strategies during the 1994-1995 school year.

1. Two MSU graduate assistants will continue to work with teachers and students in the classrooms and the computer laboratory until teachers become comfortable with the technology. In a way of preparing for full disengagement, teachers would have full control of the computer laboratory sessions, unlike last school year.
2. The school will solicit additional MSU collaboration in the form of a "Technology Internship Program" to ensure one-on-one and/or small group "hands-on" activities in the classrooms and computer laboratory.
3. In September, the school will initiate "Parent-Teacher-Student (PTS)" Technology Club. The purpose is to get parents actively involved in their children's learning (both in and out of school) through "mini technology projects" such as using computers to create house (family) budgets.
4. Two-hour teacher inservice training sessions per month will be organized to ensure ongoing staff development. Three-hours of released time per week for maintenance would be required for the Network Managers (two 5th grade teachers) to ensure school wide smooth running of the hardware and software.

5. To ensure continued practice, provisions will be made for teachers to take some computers home during the Summer break.

Reflections on Phase IV

In 1993/94 school year, the sharp increase in the number of computers (i.e., from 11 to 51) resulted in schoolwide adoption of computers in the classrooms and the computer teaching laboratory.

The school continued to hold the belief that educational technologies are not self-implementing, with technology constantly changing, and applications varying so widely, upgrading the technological skills of Kendon faculty and students (as end users) is an essential first step for effective implementation of technology programs. At this phase, the emphasis on student-centered was shifted to teacher-centered approach. The particular attention attached to in-service training and technical assistance, especially in the laboratory, motivated all Kendon teachers and students to effectively use the technology as an instructional tool.

The schoolwide technological innovations brought new instructional challenges to teachers. As parents and community partners got involved in school technology programs, teachers had to modify their traditional teaching style to accommodate the experiences and expertise that the external agents would bring into the classrooms. The collaborative teaching encouraged or facilitated both one-on-one, small and large group instructional practices. These implied that teachers had to acquire new skills in time and classroom management. Regarding knowledge acquisition, the traditional classroom seatwork was supported by practical or real world problem solving. For instance, it was amazing to see students in two 4th grade classrooms talking with their bank partners about banking operations as well as working with them as bank tellers at the computer terminals and searching on-line information from the main bank.

Regarding the long term support of the innovations, the schoolwide applications of computers in the curriculum brought many hopes. For instance, the bottom-up approach adopted in the school to demonstrate that computers could be equally used in the laboratory as in the classrooms indicated the long term commitment of the teachers. In addition, the shift from student-centered to teacher-centered approach, and the 40 computers and the network management in-service training offered to two Kendon teachers by the School District were clear evidence of sustainability of technology applications in the curriculum.

It is critical at this stage of our technological efforts to reflect on number of issues that may enhance or jeopardize the future of Kendon technology vision. More importantly there is a need to consider the sustainability of the existing equipment and pedagogical innovations. First, failure to address the unforeseen technical problems such as computer break-downs that accompany any technology implementation in organizations or in schools may cause discontinuity of the implementation process or inefficient use of the technology. Considering the limited technical services received from the School District in 1993/94 school year, depending solely on central office personnel may likely render the technology ineffective and inefficient. For instance, teachers may tend to reject the technology if they have to wait for days and/or weeks before technical problems could be fixed. These issues lead me to conclude that for efficient and effective implementation of technology in our schools both technology and pedagogy should advance together. In other words, both administrators and teachers need to get seriously involved in technology in order to sustain technological innovations in school curriculum.

CHAPTER 5

CHANGING PATTERNS OF TECHNOLOGY LEADERSHIP

Overview

This chapter discusses the (1) individuals and groups within the Kendon school system and their relative influences, (2) kind of roles they played during the conceptualization, development, implementation, and evaluation of technology programs, and (3) perceived attributes of Kendon technology leadership roles. The information on these aspects of leadership was gathered through questions 1 and 2 of the self-administered survey (see Appendices A & B) and through follow-up personal interviews. The information gathered from these techniques was supported by participants' own comments and my personal observations. All these data helped me to classify individuals and groups as technology leaders and followers over the past five years and to understand the dynamics of the school system.

The Roles and Influences of Key Technology Actors

Identification of Actors and Their Relative Influences

The information gathered through stage one, as indicated in chapter 3, helped me to identify five distinct groups that constitute the Kendon School System. They are (I) Lansing School District (Top Administration); (II) Kendon Staff; (III) Kendon Parents; (IV) Community Business Partners; and (V) University Collaborators. Three different groups were further identified within Kendon faculty members with regard to technology: the School Principal; Network Managers, and Regular Kendon Teachers. In other words, there were

seven constituent groups (i.e., core of the school system) implementing the technology plan. The analysis was on the basis of self-administered survey and follow-up structured interviews. Because I found that technology planning at Kendon was initiated by faculty at the school, the School Principal (PRD), Network Managers (NWM), Regular Kendon Teachers (TEA), and University Collaborators (MSU) were classified as technology leaders. For the same reason, Lansing School District (LSD), Kendon parents (PAR), and Community Business Partners (BUS) were classified as followers. The following sections give a full description of these actors and the amount and kind of influences each has exercised on Kendon technology implementation.

Figure I shows a three-dimensional plot of multidimensional scaling results for the set of influence variables (questions 1 and 2), representing past and present influences of the actors listed above. The points for each of these actor shown in this plot are presented in two forms: past (i.e., suffix "PAS") and present (i.e., suffix "PRE").

Before I begin with a discussion of the plot, let me explain how to understand it. First, the plot provides a spatial representation of relationship among the actors which exist in the data. That is, the points are close together in this space when actors are perceived very similarly. Conversely, points which are far apart in space are perceived differently for actors. In addition, if the perception of a particular actor has shifted sharply from past to present, then the past and present points for that particular actor will be relatively far apart. Furthermore, if perceptions of actors shift in a similar way from past to present, it should be possible to identify some general trends in the coordinated space.

It might be possible to attach some interpretations to the axes, but this is not the main purpose of the plot. The primary purpose is to provide a graphic means of seeing which points go together and an opportunity to look for trends in the relationships among different points and clusters in the space. The numbers

(numerical labels) which appear on the axes make it possible for the reader to examine the coordinates listed in Appendix B. It is possible to use the coordinates to locate exactly where each point is in the three dimensional plot. The ranges of numbers on each of the axes only extend as far in positive and negative directions as necessary to include all the points in the three dimensional space.

Based on my examination of this three dimensional plot, I felt I could identify four different zones representing groups within the Kendon school system and how the perceptions of these shifted over time. First, I will discuss the results pertaining to the zones which relate to arrows "1" and "2," and later I will discuss observations pertaining to arrows "3" and "4."

In Figure I, zones A, B, C, and D represent individuals and/or groups within Kendon school system. They are clustered according to their perceived degree of influence on Kendon technology implementation over the past five years. Regarding the technology followers, Zones A and B represent the perceived influences of Lansing School District (LSD), Kendon parents (PAR), and community business partners (BUS) in the past (1989/90-1992/93) and present (1993/94) respectively. Concerning the technology leaders, Zones C and D represent that of Kendon school principal (PRP), teachers (TEA), network managers (NWM), and Michigan State University (MSU) collaborators.

The nature of clustering indicates two distinct groups, each representing the amount and kind of influence it had on the technology implementation. Regarding technology followers (zones A & B), arrow 1 indicates that the perceptions of these groups have shifted in this direction over the past five years. With regard to technology leaders (zones C & D), arrow 2 indicates that the perceptions of school principal and university collaborators have shifted in almost the same direction as the followers. For both leaders and followers, Figure I shows that there were shifts of positions from zones A & C (in the past) toward zones B & D respectively in 1993/94 school year. The arrows "1" and "2" in

Figure I: Degree of influence of Kendon technology leaders and followers.

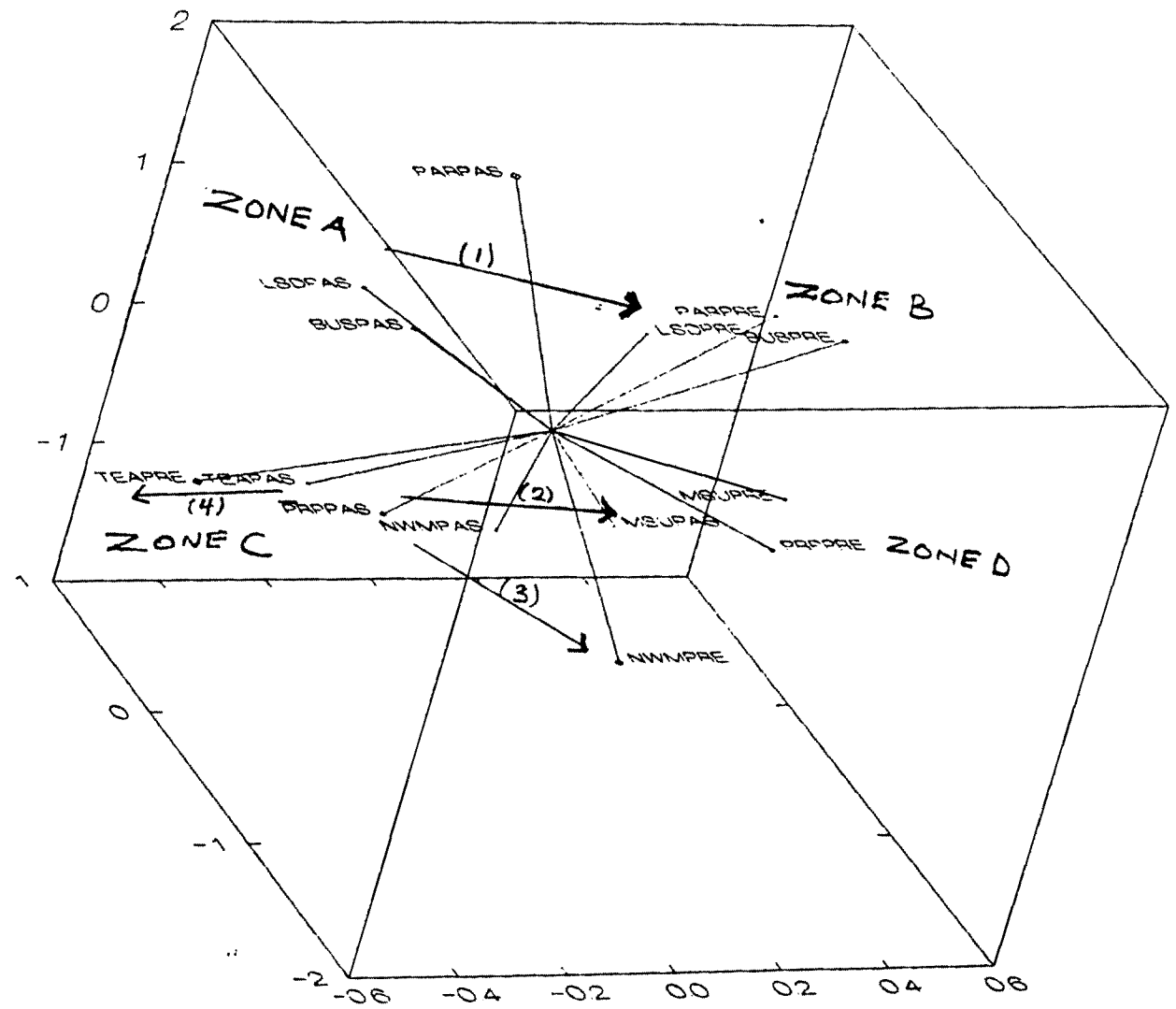


Figure I indicate that the perceived influences of both technology leaders and followers shifted in the same direction. Brief explanation of these categories is given in Table B below.

Looking at the summary statistics of the same data, Table B shows that only 29%, 20%, and 31% of the participants perceived that Lansing School District, Kendon parents, and business community partners had a high degree of influence. In addition, the percentage score of Lansing School District dropped from 29% to 20% in the 1993/94 school year, those of other followers remained constant. The same table shows that, for the 1989/90 and 1992/93 school years, 69% of the participants rated the degree of influences of the school principal high, followed by Michigan State University collaborators (53%), then teachers (50%). Thus, the school principal was perceived as the key technology leader. In the 1993/94 school year, 80%, 86%, 75%, and 66% of the participants perceived the degree of influences of Kendon network managers, school principal, teachers, and Michigan State University collaborators, respectively as high.

From both summary and graphical analyses of the same data, the percentage scores of the participants over the five year period suggest that the individuals and/or groups located in zones A and B played inactive roles in the technology implementation process, thus qualifying them as technology followers. Also, the percentage scores representing those in zones C and D suggest that these individuals and/or groups played active roles, thus qualifying them as technology leaders.

In zone C of Figure I, you may observe that in the past, the perceived degree of influence of the school principal was close to those of the teachers. In zone D, notice that the perceived influence of the school principal, in the present, was closer to those of Michigan State University collaborators than to the teachers. The perceived influences of the network managers lie between the teachers on the one hand and the school principal and Michigan State University collaborators on the other hand. Table B shows that, the

perceived key technology leadership role shifted from the school principal to the new designated network managers.

TABLE B: DEGREE OF INFLUENCES OF INDIVIDUALS AND GROUPS WITHIN KENDON SCHOOL DISTRICT

		LSD	PRP	NWM	TEA	PAR	MSU	BUS
		(Percentage Scores)						
PAST	LOW	50	6	-	6	80	7	54
	AVERAGE	21	25	-	44	0	40	15
	HIGH	29	69	-	50	20	53	31
PRESENT	LOW	47	0	0	6	40	7	31
	AVERAGE	33	20	14	19	40	27	38
	HIGH	20	80	86	75	20	66	31

Number of Cases =16

Technology Leaders
PRP=Kendon School Principal
NWM=Kendon Network Managers
TEA=Kendon Teachers
MSU=Michigan State University Collaborators

Technology Followers
LSD=Lansing School District
PAR=Kendon Parents
BUS=Kendon Business Partners

PAST = Between 1989/90-1992/93 School Years
PRESENT = 1993/94 School Year

In Figure I, you may also observe that among the teachers, arrow 3 indicates that the perceptions of network managers (i.e., two teachers) shifted in nearly the opposite direction from the rest of the teachers as shown by arrow "4". This change of direction among teachers could be attributed to a number of reasons. Regarding the teachers in general, in the 1993/94 school year, the teacher-centered approach to the implementation process, as discussed in chapter 4, empowered teachers to assume new roles.

For example, the technical support and administrative roles assumed by the network managers gave them new responsibilities besides their classroom technology applications. The fact that the teachers themselves designated two of their colleagues as in-house network managers gave them (i.e., all teachers) additional powers and influences. The schoolwide teachers' formal adoption of computers in the curriculum in the same year gave them new influences over the technology implementation.

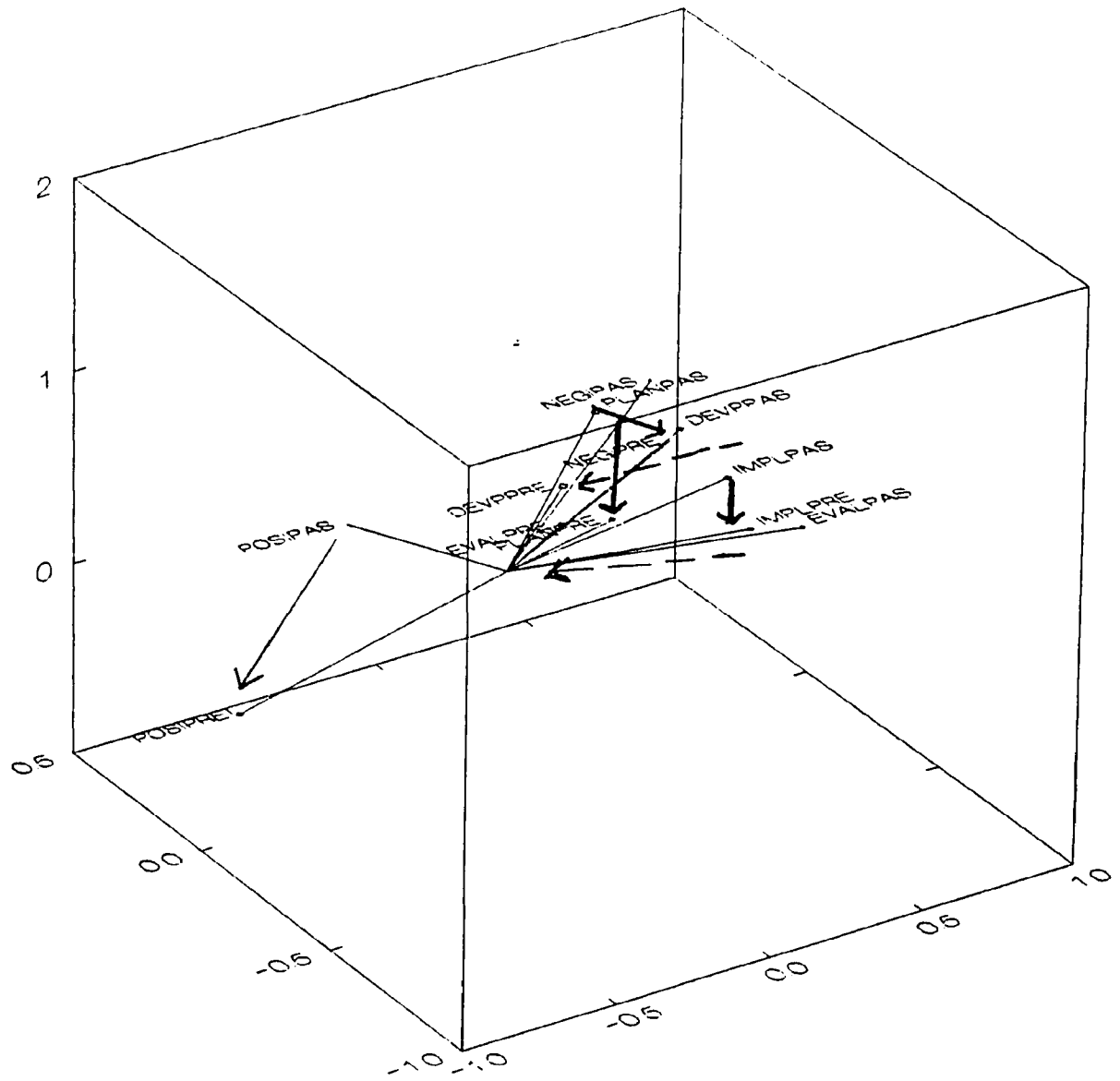
Regarding the network managers, the technical expertise, some technology administrative duties, and the trust and confidence that the school system invested in these two teachers gave them greater control over the technology implementation. All these factors indicate that the teacher-centered approach provided opportunities for all teachers to pursue the bottom-up approach to the implementation process and also to actively participate in the technology leadership role.

Roles and Perceived Negative and Positive Influences

Figures II shows a three-dimensional plot of multidimensional scaling results for perceived roles at various stages of the implementation process and the positive and negative influence variables (questions 3, 4, & 11- 14 of Appendices A & B). The full plot and its coordinates representing the set of roles, influences, organizational management, and instructional variables gathered through questions 3 - 34 of Appendices A & B are presented in Appendices E & F.

Regarding questions 3 and 4, Figure II shows that the respective roles played during planning, development, implementation, and evaluation stages as perceived by the participants have shifted over the past five years. From Figure II, you may observe that planning and implementation variables have

Figure II: Roles and positive and negative influences.



moved in the same direction from their positions in 1989/90 -1992/93 to their positions in the 1993/94 school year, as indicated by solid arrows. While participants' perceptions of planning shifted sharply in the 1993/94, that of implementation moved only a little. The development and evaluation variables both shifted in a different direction from their positions from 1989/90-1992/93 to their positions in 1993/94, as indicated by the dashed arrows. The different directions of the arrows suggest that the participants had two different opinions, one for planning and implementation variables and another for development and evaluation variables.

Table C above is a summary statistics of quantitative information collected under questions 3 and 4 of Appendices A & B. The percentage scores of the participants who rated high the role played by the individuals and/or groups during the development (DEV) stage of the implementation increased from 20% in the past (i.e., 1989/90-1992/93) to 36% in the 1993/94 school year; that of implementation (IMPL) increased from 27% to 40%; and that of evaluation (EVAL) increased from 27% to 43%.

TABLE C: TECHNOLOGY INVOLVEMENT AT EACH STAGE OF THE IMPLEMENTATION

	PLAN		DEVP	IMPL	EVAL
			(Percentage Scores)		
	LOW	50	53	53	46
PAST	AVERAGE	20	27	20	27
	HIGH	30	20	27	27
	LOW	60	57	53	50
PRESENT	AVERAGE	13	7	7	7
	HIGH	27	36	40	43

Number of Cases = 16

PLAN = Planning Stage
DEVP = Development Stage
IMPL = Implementation Stage
EVAL = Evaluation Stage

PAST = Between 1989/90 &1992/93 School Years
PRESENT = 1993/94 School Year

The fact that in Figure II, the past and present shift for the perceived roles played during the development (DEV) and evaluation (EVAL) stages was in one direction while the past and present shift for the perceived roles played during the planning and implementation phase was in different direction goes along with the observation that, in Table C, the positive shifts for the perceived roles played during development and evaluation stages were larger than those for planning and implementation. Together, those results suggest that more people within the school system began to assume shared technology responsibilities in the 1993/94 school year. The results of these two analyses show that the kinds of influences that actors within the school system had on the technology

implementation program depended on the amount and kind of role played during the planning, development, implementation, and evaluation stages.

Concerning questions 11-14, from Figure II you may notice that the participants' perceptions of negative and positive influences shifted in different directions from the past to the present, as indicated by the arrows. Furthermore, while the shift for perceived negative influences was minimal, the shift for positive influences was large.

Table D below gives summary statistics of quantitative information collected under questions 11 through 14. The table shows that the low percentage of the participants who perceived high negative influences (NEGI) remained the same (9%) over the past five years. However, perceptions of positive influences (POSI) increased from 36% in the past to 55% in 1993/94 school year.

TABLE D: NATURE OF INFLUENCES

		POSI	NEGI
		(Percentage Scores)	
PAST	LOW	18	46
	AVERAGE	45	45
	HIGH	36	9
PRESENT	LOW	9	36
	AVERAGE	36	55
	HIGH	55	9

Number of Cases = 16

POSI = Positive Influence
NEGI = Negative Influence

PAST = Between 1989/90 &1992/93 School Years
PRESENT = 1993/94 School Year

The large shift for perceived positive influence (POSI) and small shift for perceived negative influence (NEGI), as shown in Figure II, is consistent with the observations that, in Table D, the percentage scores of participants who perceived positive influences high increased considerably in the 1993/94 relative to the previous years and those of perceived negative influences, on the average, increased slightly. These observations from both summary and visual analyses suggest that more people responded positively to the technology and this showed a sign of sustainability of the innovations.

Observations. This section represents the participants' views as well my personal observations. The role that each actor in the school system played had both its advantages and weaknesses with regard to Kendon technology implementation plan over the past five years. Regarding positive aspects, some parents felt the long term technology vision set forth in 1989/90 school year had positive influence on the technology plan. One significant observation was the kind of leadership role that was manifested by the school principal and few teachers. According to some teachers, despite certain initial pessimism expressed by a majority of the teachers and despite inadequate technical support from the School District, the school principal and some teachers were still optimistic about the technology implementation. "The school principal did not give up seeking out resources, support, etc.... , and the teachers I worked with were dedicated to pursuing the technology plan", said one teacher. As the school principal stated " I basically do not dwell on negative views, so I tried to move on. I listened to both parents and teachers and went back to make it work. We attempted to move forward by providing a lot of support for all teachers in spite of shortcomings. Our desire to motivate teachers and students positively influences". She noted that just simply talking about the needs and the importance of technology during that time with teachers and students was driven home because it was highly

stressed. "Though the technology program started with few computers, still we saw more teachers and students waiting to take turns", indicated one upper grade teacher. As indicated in the school technology report (Kendon Annual Report, 1991/92), Michigan State University initiative of "Tomorrow Computer Classrooms" project at Kendon became a motivating asset to Kendon technology implementation plan, even to those teachers who initially experienced frustrations.

As more time, equipment, and support personnel became available during the 1993/94 school year, both teachers and parents began to develop positive attitudes towards the technology plan. The in-house seminars offered to teachers by both the Michigan State University collaborators and network managers have been very helpful. One lower grade teacher commented "Technology managers work hard and have done a lot to help us. The school principal continues to support, PTA is getting more involved and committed to helping the teachers' technology efforts. As a result of these cooperative effort, students enjoy technology." Another teacher added "Of course, the computer laboratory and the after-school computer training sessions have had positive influence on the teachers' general adoption of the computers in their respective classrooms. As the number of computers continues to increase, as we saw in 1993/94 school year, we hope to maximize our time for computer practice that may likely result in teachers' and students' expertise in the technology applications".

Attributes of Kendon Technology Leadership Roles

This section presents a set of themes on perceived qualities of Kendon technology leaders with regard to beliefs, expectations, and instructional practices gathered through the written open-ended responses to each questionnaire in the self-administered survey and the structured interviews addressing the same questions. Appendices G presents the three-dimensional plots of multidimensional scaling result for the themes (see Appendix H for

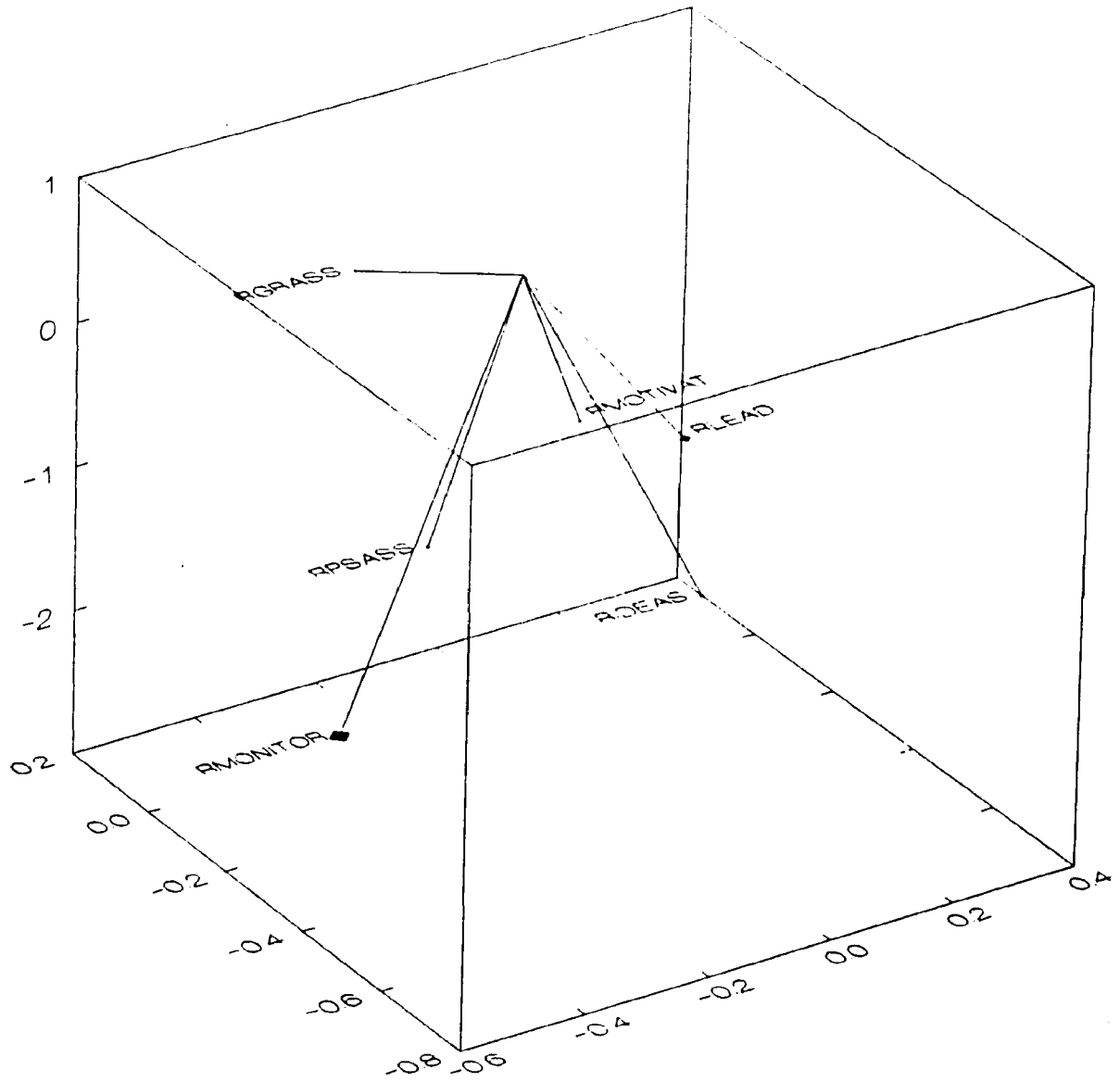
the coordinates of the themes). The plots of each category of the attributes are presented in Figures IIIA, IIIB, and IIIC and in Tables E, F, and G. The description of each variable is presented in Appendix I.

Leaders' roles. Figure IIIA below presents the major role variables (attributes) which were associated with technology leadership as perceived by the participants. The perceptions of technology leaders' group assistance (RGRASS) and personal assistance (RPSASS) to teachers and students, motivational strategies (RMOTIVAT) they used, and rich ideas (RIDEAS) that the leaders generated are located at the top of the graph. Table E below shows that 53% of the participants indicated that the leaders demonstrated or provided group assistance, 40% of the participants indicated that the leaders used motivational strategies, and about 33% stated that the leaders provided rich ideas and personal assistance to teachers and students.

Two issues associated with the leaders' attributes were the perceived role of the leaders as front-runners or leaders (RLEAD) and the monitoring strategies (RMONITOR) they used. You may observe that the two variables are located at bottom of the graph. Table E shows that 20% of the participants indicated that some leaders served as front-runners or leaders and about only 7% stated that the leaders monitored the technology implementation.

Three major observations are associated with Figure IIIA and Table E. First, the positive extreme of the location of perceived leaders' group assistance to teachers and students and high percentage score of the participants who indicated that the leaders provided group assistance suggest that the leaders highly considered group or collaborative work as effective strategy for the success of the technology implementation. Second, tvational strategies and personal assistance of the leaders as well as the extent to whiche proximity (for both Figure IIIA & Table E) of perceived motih some leaders served as front-runners indicates that the leaders moderately considered these factors as important. Third, the

Figure IIIA: Major role variables.



the extreme position of perceived leaders' monitoring strategies on the graph and the extreme low percentage score of the participants for this factor suggest that only few leaders paid attention to monitoring strategies such as the extent to which teachers and students were using computers in the curriculum.

TABLE E: THE ATTRIBUTES OF KENDON TECHNOLOGY LEADERSHIP ROLES

Themes	Present (Percentage Scores)
RGRASS	53.3
RMOTIVAT	40.0
RIDEAS	33.3
RPSASS	33.3
RLEAD	20.0
RMONITOR	6.7

Number of Cases = 15

Leaders' beliefs. Figure IIIB represents the principal belief variables (attributes) which the participants perceived of Kendon technology leaders. Three major observation are associated with the spatial representations of the perceived beliefs of the leaders. First, variables associated with leaders' belief that technology is useful (BUSEFUL) in the curriculum, that teachers had to be enthusiastic (BENTHUSI) about technology, and that teachers needed encouragement (BENCRGMT) in order to adopt the innovations are tightly clustered in the form of triangle. Table F below shows that about 73% of the participants perceived that the leaders strongly believed that the technological innovations were useful, that the leaders showed enthusiasm, and that they encouraged the followers to actively get involved.

Figure III.B: Major belief variables.

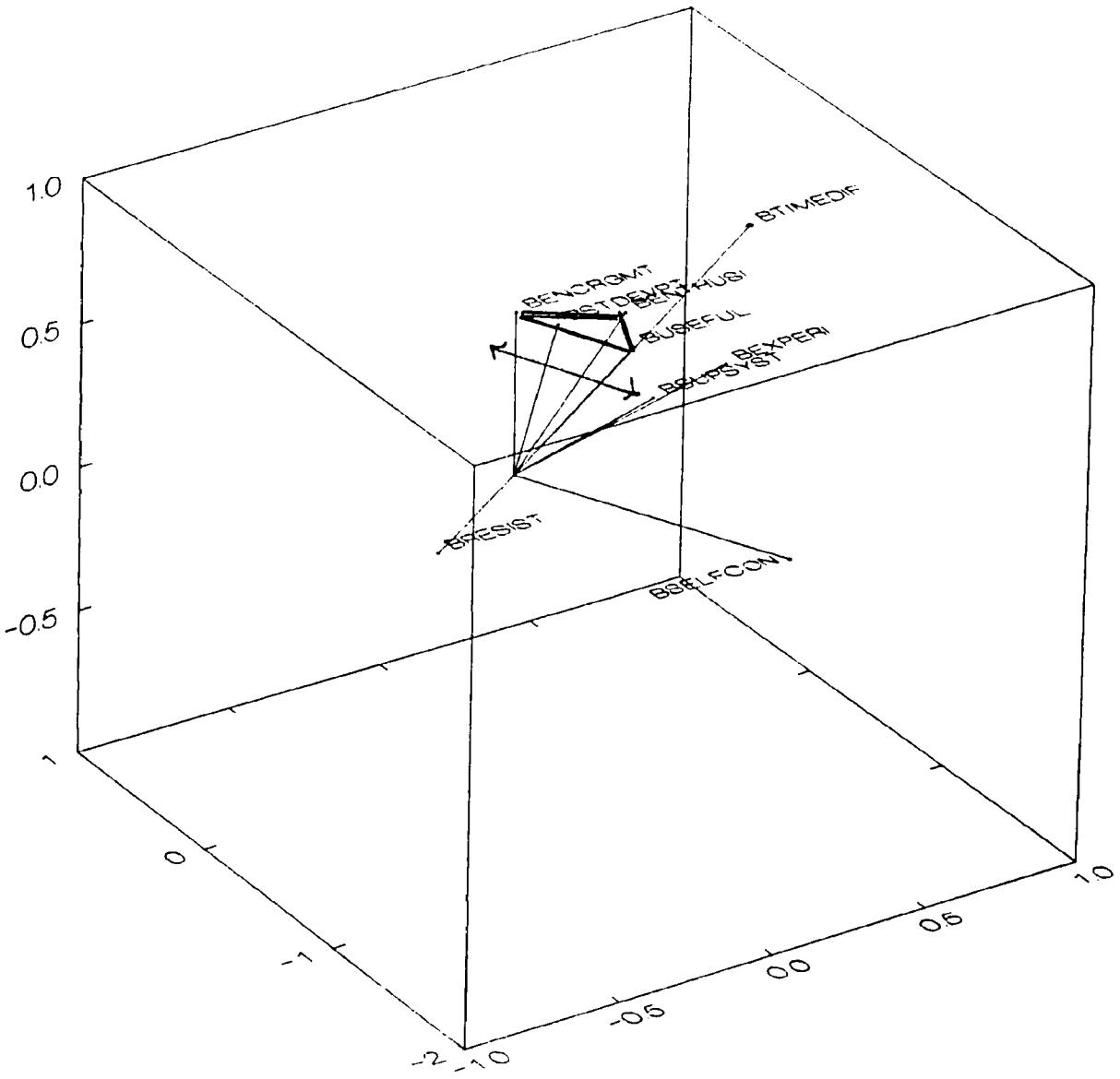


TABLE F: ATTRIBUTES OF KENDON TECHNOLOGY LEADERSHIP BELIEFS

Themes	Present (Percentage Score)
BUSEFUL	73.3
BENTHUSI	73.3
BENCRGMT	73.3
BSTDEVPT	66.7
BSUPSYST	66.7
BEXPERI	66.7
BTIMEDIF	53.3
BSELFCON	33.3
BRESIST	20.0
	Number of Cases = 15

Second, for effective implementation of technology in the curriculum, the variables associated with leaders' beliefs in teachers' knowledge or experience (BEXPERI) in technology, about the need for staff development (BSTDEVPT) and technical support (BSUPSYST) to teachers efforts are tightly clustered together horizontally. The perceived beliefs in the these six factors have also closely clustered with their belief that time made it difficult (BTIMEDIF) for teachers to learn and master the technology. All these seven variables have clustered at the top of the graph. Table F shows that about 67% of the participants indicated that the leaders believed that teachers' staff development, technical support systems, and technology experience were very important. About 53% of the participants also perceived that the leaders believed that time made it difficult for teachers to learn and master the technology.

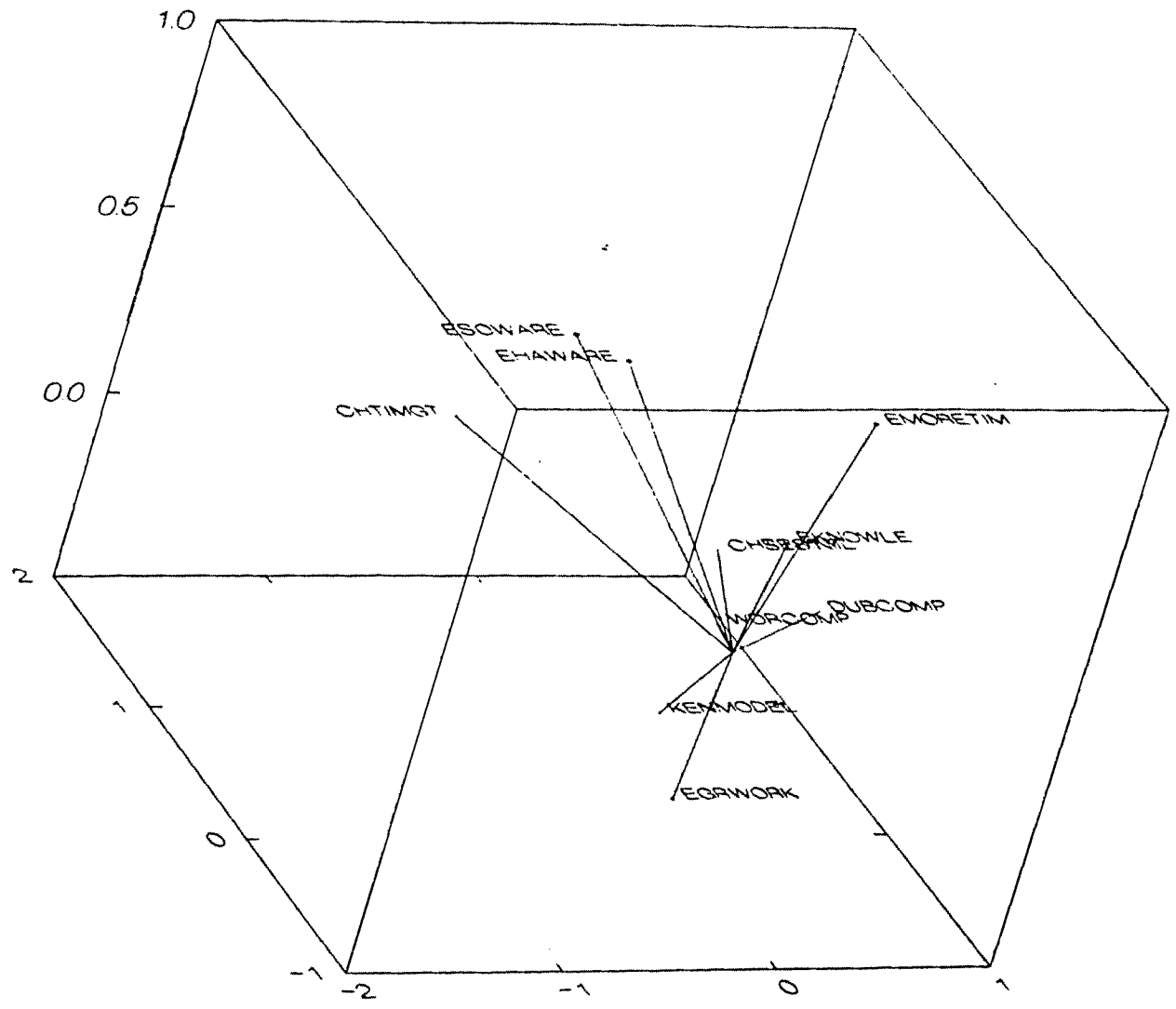
Third, two major issues are associated with this analysis. You may notice that the perceived leaders' beliefs in teachers' resistance (BRESIST) to change or adopt the innovations and teachers' self confidence (BSELFCON) applying the tools in the

curriculum are located at the bottom of the graph and they are widely dispersed. Table F shows that about 33% of the participants felt the leaders believed in individual's self confidence as a factor of adoption or rejection of the technology in the curriculum. Only 20% of the participants agreed that the leaders were concerned with some teachers' frustrations and resistance to the innovations. The positions of these attributes suggest that the perceived leaders' beliefs in these two factors were weak.

The spatial locations of the participants' perceptions of Kendon technology leaders' beliefs in the usefulness of technology in the curriculum, enthusiasm about technological innovations, encouragement to teachers, staff development, support systems, and teachers' technology experience as well as the high percentage scores of the participants for these factors suggest that these attributes of the leaders influenced or contributed to the schoolwide adoption of technology in the curriculum. The close proximity of the perceived time difficulties to those variables also suggest that leaders always considered time as a potential factor for the success of the implementation. The locations of perceived leaders' beliefs in self confidence and resistance as well as the low percentage scores of the participants who indicated that the leaders believed in these two factors implies that the leaders did not see these factors as potential problems to the success of the technology implementation.

Leaders' expectations. Figure IIIC shows that four major observations are associated with the spatial locations of participants' perceived expectations of the leaders. First, concerning the impacts of technology on instruction, the locations of participants' perceptions of leaders expectations that the applications of technology in the curriculum would effect changes in teaching (CHTESTYL) and learning (CHSTINT) styles are close to the perceived leaders' expectations of teachers to acquire more knowledge about technology (EKNOWLE). The perceptions of leaders' expectations for teachers' group or collaborative work (EGRWORK) in

Figure IIIC: Major expectation variables.



also close to expectations of instructional changes and teachers' knowledge. The perceptions of leaders' expectations of time changes (CHTIMGT) to respond to technology activities in the classrooms is located far from the rest of the expectations of instructional changes.

Table G shows that about 53% of the participants indicated that the leaders expected changes in teaching and learning styles and also expected teachers to acquire technology skills and knowledge before they could effectively integrate technology in the curriculum. 40% agreed that the leaders expected more group work or instruction from the teachers. With regard to time, only 20% of the participants perceived that the leaders expected changes in time management to respond to technology activities in the classrooms.

Second, you may notice from Figure IIIC that the position of the participants' perceptions of leaders' expectations for more technology time (EMORETIM) lies right on top of expectations of instructional changes, teachers' knowledge and team work. Table G shows that about 67% of the participants agreed that the leaders expected more time for teachers to learn about and master the technology.

Third, regarding equipment, the locations of participants' perceptions of leaders' expectations that the withdrawal (WDRCOMP) of half of the computers and doubling (DUBCOMP) of the number of computers would affect instruction are close to those of instructional change variables and teachers' knowledge about technology. From the same figure, the participants' perceptions of leaders' expectations of hardware (EHAWARE) and software (ESOWARE) are spatially located far from the rest of the expectation variables except changes in classroom time management. Table G shows that 60% of the participants indicated that the leaders expected instruction to be positively affected if the number of computers in the school is increased or doubled. About 53% also stated that the leaders expected instruction to be negatively affected if half of the computers are withdrawn from the school.

TABLE G: THE ATTRIBUTES OF KENDON TECHNOLOGY LEADERSHIP EXPECTATIONS

Themes	Present (Percentage Scores)
EMORETIM	66.7
DUBCOMP	60.0
EKNOWLE	53.3
CHSTDINT	53.3
CHTESTYL	53.3
WDRCOMP	53.3
EHAWARE	40.0
EGRWORK	40.0
KENMODEL	40.0
ESOWARE	33.3
CHTIMGT	20.0

Number of Cases = 15

40% of the participants agreed that the leaders expected more hardware and about 33% of them agreed that the leaders expected more software in the classrooms. Fourth, the location of participants' perceptions of leaders' expectations of Kendon technology becoming a model (KENMODEL) is close to the expected teachers' group or team work. 40% of the participants agreed that

the leaders expected to see Kendon technology as a model within Michigan public schools.

The synthesis of these four observations suggest that the participants perceived that the technology leaders expected more time and equipment for teachers to learn and master the technology in order to effectively use the technology to enhance teaching and learning in the classroom. Another implication with this analysis is that the leaders expected Kendon teachers' teamwork or co-teaching to be a model for technological innovations within schools. However, the leaders did not worry about the issues of software and time management problems in the classrooms.

General Observations and the Participants' Own Comments on the Key Technology Actors

The following sections represent the participants' general comments and observations, as stated or narrated under questions 1-4 of Appendices A & B as well as the structured interviews. Information collected during the review of technology reports, meeting proceedings, and my personal observations is also included.

Lansing School District

According to the participants, the Kendon technology implementation plan has been influenced by the School District through its administrative and financial powers, being a final decision-maker and financial controller. The participants observed that the School District did not directly participate in the planning, development, and implementation of the technology plan, but the School District responded favorably to teachers' requests with regard to technology. However, despite the promises from the District, some teachers and parents who participated in the study stated that the School District slowed down the technology implementation process because of its complex administrative formalities and limited technical support to teachers' efforts, particularly in the computer teaching laboratory setting during the

1993-94 school year. "I feel the School District has hampered, to some degree, many of the things we considered important due to its limited resources and personnel", stated one teacher. Another teacher added "The Lansing School District gives more talk than action". As one parent put it "From my observation, I am not sure how involved the District is but I know it does monitor the progress of the technology plan through the school's annual reports." However, a majority of the teachers who participated in the study indicated that the 40 Macintosh computers granted to the school and the inservice training which the School District offered to two Kendon teachers (the designated network managers) had significant impacts on the technology implementation plan. Another important contribution was the approval and support of Assistant Superintendent for Instruction to establish a computer teaching laboratory to support group staff training and instruction. Despite the encouragement and material support from the District, some participants observed that some agents in the District Office served as gatekeepers or catalysts to interfere with the implementation process. One teacher commented "It seems the technology support personnel and few others in the District Office do oppose the computer laboratory plan and that they do not want to give any technical support expected from the District". Two of the teachers strongly suggested that the school and the District need to work closely together to support the technology plan, particularly the technical assistance.

Summary. The study indicates that the District Office provided equipment and financial assistance, but the on-going technical support and technology in-service training have always been the responsibility of the school administrator (principal) and her collaborators. In general, it appeared the District Office was highly supportive in words but slow in actions during the period between 1989/90 and 1992/93 school years. In 1993/94 school year, the study revealed that the District's grant of 40 microcomputers and

encouragement to teachers' efforts had a very positive impact on the innovations. In conclusion, the participants felt the District Office and the school need to work more closely to sustain the technological innovations at Kendon.

The School Administrator: Principal

All the teachers, staff, parents, and community business partners who participated in the study recognized the great positive impacts the school principal has had on the technology implementation since 1989 to the current year. They all acknowledged that she was the key person in getting funding from the School District. In addition, she has worked hard with Michigan State University collaborators in soliciting financial assistance or grants from Professional Development School Program, Michigan Partnership for New Education, Kellogg and Apple Computers to support Kendon technology programs.

One parent indicated that, initially, some parents did not know exactly the kind of influences the school principal had on the technology implementation plan. Yet they acknowledged that she has always been enthusiastic about the entire PDS program. One parent emphasized "The school principal plays a very active role in the school programs. She is always visible, very committed to the PDS program, Chapter I program, etc. She works very hard to seeing that all the school programs are successful." Both Kendon parents and business partners noted that she has been very cooperative and dedicated leader especially with the technology projects. One representative from CASE Credit Union (a local bank) commented "She is always dedicated to what is best for the school".

According to some teachers who participated in the study, the principal is always willing to stand firm to support their programs even when the School District opposes the teachers' ideas. They commented that she has tried hard to uphold all the PDS principles and ideas (see Appendix J). Some teachers revealed that she gives the necessary encouragement and time to her teachers. In addition,

she has been an excellent source of ideas. One teacher stated " She's always encouraging, supportive, and open-minded. I like that!!" These teachers had observed that the more the number of computers increased in the school, particularly 1993-94 school year, the more she got involved with technology activities. According to them, this was quite visible in 1993/94 school year: working with teachers and students in the computer laboratory, attending meetings with Michigan State University support personnel and her network managers, etc. One parent happily explained "Being a principal, mother of school age children, teacher and a good friend of all Kendon parents she has always managed to get everybody involved in the school programs. She is very visible, helpful, caring, and has great communication skills. She is great, one of the best principals in the world."

According to the school records and proceedings from the School Improvement Team and Staff meetings, the principal has played a major role during the planning, development, implementation, and evaluation stages of the technology plan. When the technology project started in 1989/90 school year, she made sure the plan was consistent with goals and objectives set for students' success. She led the staff and technology team to develop program plan, monitored the projects, and answered hard questions by teachers, parents, and School District authorities. During the implementation stage she tried to caution and assure her collaborators that it was their first year of experience with technology and that they should work out the problems and issues together. As an ongoing assessment she made some major contributions to technology discussions, listened to suggestions for how to make the technology program better.

As a technology support person and Michigan State University-Kendon Coordinator, I had an opportunity to work closely with the school principal and make personal observations on technology issues. During the school-wide computer implementation in 1993/94 school year, she was very involved at all stages of the

implementation. She encouraged the staff to talk about what needed to be done and how they would do it. She focused on the utility of the programs and teachers' motivations. Particularly, she was much concerned with what the staff could use to make the school-wide technology plan smooth and rewarding for both teachers and students. As an assessment strategy, she always asked those basic and compelling questions during the staff and School Improvement Team meetings such as : What business are we in? How is it going? What evidence do we have? etc.

Asked as to how she sees Kendon becoming a technology oriented school, she replied "I feel it is time we find alternative ways of doing new things. Not always doing old things." According to her, when the School District first proposed a district-wide technology plan in early 1990s, many schools refused to embrace the idea. This was an opportunity for her to pursue new ways of improving the school curriculum, so she accepted the idea wholeheartedly. As a school principal, she has been working hard with all her collaborators to win the competitive edge of the district- wide technology implementation plan.

Summary. The study reveals that the school principal has been very supportive, committed, and dedicated to goals and needs of technology in the lines of teachers and students. She has always been a forerunner in the school technology efforts. She is aware and understands the impacts of technology on present and future instructional activities. She promotes the technology ideas with emphasis on needs. All her actions are being accompanied with examples, motivations, enthusiasm, cooperation, openness, and self confidence.

Parents

Three Kendon parents participated in the study. Two of them have served on the School Improvement Team for the past four years and the other one is an administrative staff member at Kendon. The

responses gathered through the self-administered survey and the personal interviews from these parents indicated that Kendon parents had very little influence on the technology implementation in the early years between 1989/90-1991/92. "I feel parents had very little to do with technology development at that time, unfortunately" said one parent. This could be understood by the fact that they had limited knowledge about the long term goals for the technology plan. One parent noted "I am not sure of the amount of influence Kendon parents had on these programs other than the input of those who served on the School Improvement Team (SIT) and Parent Teacher Association (PTA) meetings." One parent expressed the concern about some parents' passive role in the school activities. "I wish there were more parent participation but only few attended School Improvement meetings with teachers. "Even those who manifested interest in working with children, their commitment was not strong," said one parent. However, those who actively participated in the school meetings assumed the responsibility of explaining the technology perspective to other parents. From my personal observations, during 1992/93 and 1993/94 school years, some Kendon parents began to assume new responsibilities. I noticed from the reviews of Kendon annual reports and work plans that, some parents' active technology involvement was a result of the faculty's efforts to get all parents engaged in the school programs. Their input during the SIT and PTA meetings has had very positive influence on the technology implementation. The PTA has made substantial financial and physical contributions towards the school's Library Automation. One parent noted that over the past year more parents have gained understanding of Kendon technology plan. One teacher commented "Kendon parents, in general, are beginning to like the school-wide computer applications but unfortunately, they do not give much support." Another parent added "Some parents want a variety of computer programs for their children but they are not willing to contribute financially."

Summary. Between 1989-92, Kendon parents did not play any significant role during the planning and development stages. Though they had some influence, yet it was not strong enough. This was due to their limited understanding of the long term technology plan. However, between 1992/93 and 93/94 school years, those who served on the School Improvement Team constructively worked with Kendon faculty on the technology plan. As they become more involved with technology programs and with more brainstorming from the staff, they would gain more influence on the technology plan.

Business Community: Partnership

According to some Kendon teachers the business community was not involved in the school technology programs until 1993-94 school year when a telecommunication system was set up to support local Credit Union and the 4th grade classes partnership project. Up until now, their involvement is limited to the two 4th grade classes, according to SIT reports. This limitation is explained by the fact that this partnership venture is in the experimental stage and it was originally designed only for these two 4th grade classes. However, the school expects to expand the program to all grade levels in the near future, according to the two 4th grade teachers and the school principals (i.e., project coordinators).

The parents feel the financial and personnel support systems from the local credit union has, to some extent, influenced the technology program. As one parent indicated "Although I personally did not see a lot of business people in the school. But I am sure the amount of equipment and time spent with students had been very influential." Another parent said "I love bank representatives working with students, especially the electronic transactions in the classrooms." As a technology support person, I had the opportunity to observe the students in these classes being trained as "Bank Tellers" by the bank representatives. For example, from the computer terminal, one bank representative (Teller) would explain to some individuals or small groups of two or three the basic operations

involved with bank deposits, withdrawal, and checking the balance in a customer's account. One teacher acknowledged, "The Credit Union has brought their knowledge into the classroom. This has provided a very important hands-on learning skills to the students." Another teacher added, "This has been possible due to their cooperation and willingness. They really create natural influence and show commitment."

Summary. The community business community was not involved in the school technology programs until 1993-94 school year. The financial and personnel support systems from the local credit union had, to some extent, influenced the technology program. However, their involvement was limited only to the two 4th grade classes.

Teachers

The responses from the survey and interviews did indicate that between 1989/90 and 1990/91 school years few teachers participated in the planning and development of the technology plan. This was explained by the fact that majority of them lacked confidence and experience in educational technology. However, every teacher responded positively to all technology related proposals and discussions in the planning stages. One teacher hinted "As I was hesitant initially due to my lack of experience, I decided to give my only computer to a colleague for the cause because I thought it was important for us all. "Even those few teachers who did not directly use computers for instruction in the classroom were willing to write technology reports", indicated another teacher.

Between 1989/90-1992/93 school years, there was no defined school-based policy regarding computer applications in the curriculum. The teachers found it difficult to implement the District's technology guidelines because, according to some teachers, they were inappropriate or incompatible with the teachers' normal classroom practices. According to the teachers, this was

evident by the fact that those teachers who had computers in their classrooms made personal decisions as to how best she or he had to use the computer for instruction. In 1992-93 school year, a team of five teachers and the school principal met once a week after regular school hours and during the reallocated time periods to search for appropriate programs that could be installed in the curriculum.

As computers became more available in the school through the Districts' grant in 1993/94 school year, the teachers' behavior towards technology began to change. Through individual and group interests as well as the necessary support systems from the network managers and the Michigan State University collaborators every teacher is actively involved in the technology implementation plan. According to one teacher, the common vision developed for 1993/94 technology work plan has made all the teachers interested in computers, thus facilitating teachers' adoption of the school-wide technology implementation.

All Kendon parents who participated in the study said majority of Kendon teachers have played a vital role to make the school wide technology implementation plan a success. One parent revealed "I think from the outlook, our teachers are doing a great job. They seem willing to attend all meetings and participate actively in all technology related topics. In fact they are doing what they can to nurture the program along." The Business representatives equally commented that the teachers have been very cooperative and supportive. "Most of the teachers really wanted computers for their students so they worked hard to acquire the needed skills to teach with the technology", added one parent.

The teachers pointed out that the 4th and 5th grade teachers have played an outstanding role. One teacher narrated "Those teachers always work hard on computers with their students and for themselves as adult learners." Another teacher complimented "They have worked in teams to help each other". In general, the study discovered that majority of the teachers have tried to put in maximum effort for the technology implementation. Yet they need

more time to master and/or do research on the software for effective and efficient application in their respective classrooms.

Summary. The teachers have been very receptive to the technology plan despite some pessimistic views manifested in the 1989/90 and 1991/92 school years. They have been very cooperative, accommodating and dedicated to the school-wide technology programs during 1993/94 school year. Peer mentoring or collaborative efforts as well as personal and professional interests had been the cornerstone to teachers general adoption of Kendon technology implementation plan.

Network Managers

Respondents' comments regarding network managers. At the time of the study only few parents knew what the position of network manager was. One parent said "This is a new term to me." Those who were aware of this position recognized that upon their nominations as network managers in 1993/94 school year, these two 5th grade teachers have demonstrated a very strong leadership role regarding the school-wide technology implementation plan. The two business representatives noted that these managers work very hard, and take their responsibilities seriously. What one teacher said about one of the network managers, "One of our network managers has been very wonderful. When we started first, she told us that now she has acquired her own computer and has started practicing seriously at home. And if any teacher needed help, she or he should feel free to call on her. Now, she is the contact person who is always ready to assist us. Her kids are learning fast".

In general, the teachers gave much credit to the network managers for making 1993/94 a successful year at Kendon particularly with computer applications in the classrooms and laboratory setting. One teacher narrated "The network managers have worked hard to give us sufficient training to be self sufficient in computer applications both in the laboratory and classrooms. They

are helpful, very involved, and accommodating." Another also supported "They have done an excellent job especially for the staff with whom they had to work. In fact, they worked hard to get everybody involved."

The extra training which the network managers received from the School District played a significant role in the technology implementation plan. One lower grade teacher stated that the teachers listened to the network managers with confidence about the software and computer technical advice because they (teachers) felt the latter were more knowledgeable. The teachers stressed that the managers have always been very patient and sensitive to teachers' frustrations with computers. One teacher stated "I appreciate that kind of attitude and available support in the building."

Group interview with network managers. During the small group interview with the network managers, time and monetary incentives (rewards) were the major concerns. According to them, they don't have enough time to go through the network programs in order to render appropriate services to their colleagues. They think more release time would help them to learn more in order to take full control of the management problems. In addition to that they feel both PDS and LSD should arrange paid Summer technology sessions for both network managers as well as the rest of the teachers. According to them this would help to alleviate some problems such as fatigue, family time demands, and personal appointments being experienced during the after-school technology sessions.

Regarding the maintenance and management of the hardware and software, they complained that the training received from the School District was incomplete. After the inservice training they expected some frequent follow-ups from the trainers but not even a single one happened. Even if they called for technical assistance, the District's technology personnel seldom responded to their needs.

These important technical handicaps, sometimes created frustrations for them and their colleagues, they admitted. In an effort to maintain and/or restore teachers' confidence and their credibility as network managers, according to them, they have to put in extra hours both after school and during the weekends at home searching for possible software and hardware solutions.

Asked why they accepted to be network managers, one responded that personally she enjoyed being a network manager or becoming one of the school technology leaders, though no monetary rewards were attached to the position. On the other hand, her colleague said she accepted because it was an opportunity to improve her technology performance through the extra training from the District. That is, one accepted the position on personal interest and the other was based on professional development motives. Questions regarding their future plans as network managers, one replied that she would not continue the work if monetary rewards or other related compensation are not considered by the School District. Contrary, her counterpart said she would continue even if the School District refuses to give her a compensation.

For evaluation purposes, the network managers think it would be nice to request the teachers to document or keep log of all their computer activities in the classrooms. That is, keeping track of time spent, types of software used and the number of students per day, all major and minor technical (hardware and software) problems, and students' attitude toward computers, during individual and group hands-on activities. Regarding the probable solutions to those technical and managerial problems in the future, they strongly feel the top administrators should always be informed of any situation or incidents that might jeopardize or interfere with the smooth running of the school technology programs. For instance, they strongly recommended that the school Principal, the network managers, and Michigan State University collaborators should meet with the Assistant Superintendent of Instruction to discuss these technical problems. More specifically, they entertained fears that if the

Assistant Superintendent of Instruction, who endorsed the original laboratory proposal, changes position or leaves the School District, the computer laboratory plan would collapse or discontinue for the simple fact that there would be no support from the technical personnel. They further suggested that the school should submit another proposal for a permanent laboratory, after six successful months of experimentation, since the original laboratory proposal was accepted on provisional basis. According to them, this is the time the school needs the laboratory to be connected to both the school local area network (LAN) and the District's wide area network (WAN). They feel the networking would help Kendon students to conveniently access library information and other educational resources to compensate for the schools limited library resources. Thus, making the school technology plan more cost-efficient and effective.

Summary. The network managers' inservice training from the School District, their personal and professional consciousness, and commitments have contributed to staff development and the subsequent school-wide adoption of the technology implementation. Despite those efforts, these network managers need more time to work out computer problems. Equally, they need monetary incentives or other compensation for the services.

MSU Technology Collaborators

According to Kendon parents who participated in the study, the participation of Michigan State University technology personnel strongly encouraged the School District to endorse the Kendon technology plan. "They have helped to build a solid link between technology and students" said one parent. Some teachers remarked that although in the first years (1989/90-91/92 school years), only the upper grades received support from Michigan State University collaborators, this continued collaboration has helped a great deal towards the schoolwide technology implementation plan. The

teachers indicated that inadequate personnel from the university limited the kind of support systems it planned for Kendon initially until 1992/93 school year when two additional graduate students got involved in the technology program. One teacher stated "1993-1994 school year has been the best for Michigan State University with regard to Kendon technology implementation". According to the teachers, the technology services have increased significantly since the computer teaching laboratory was developed in January, 1994. As one teacher stated "We received more weekly support in the laboratory and this helped many teachers who often got stuck like me"

Despite all those important support systems received from the university, Kendon teachers expected more regular visits or follow-ups of the university faculty. Again, some teachers felt the Michigan State University collaborators left too much work for the network managers. who really had limited time for the schoolwide technology assignments.

However, Kendon parents and teachers feel very good about the kind of assistance being received from the university personnel.

Summary. The technical expertise, self and professional commitments of MSU collaborators and material incentives from PDS and MPNE had been very instrumental in getting the technology plan in place. However, Kendon teachers expected more regular visits or follow-ups of Michigan State University faculty members responsible for the various PDS projects at Kendon.

Internal Agents

The school administrators . The participants indicated that the school principal has been very supportive, committed, and dedicated to goals and needs of technology in the lines of teachers and students. She has always been a forerunner in the school technology efforts. She is aware and understands the impacts of technology on present and future instructional activities. She

promotes the technology ideas with emphasis on needs. All her actions are being accompanied with examples, motivations, enthusiasm, cooperation, openness, and self confidence.

Kendon faculty. The study indicated that teachers were very receptive to the technology plan despite some pessimistic views manifested in the 1989/90 and 1991/92 school years. They worked cooperatively, accommodated and dedicated to the school-wide technology programs during 1993/94 school year. Peer mentoring or collaborative efforts as well as personal and professional interests had been the cornerstone to teachers general adoption of Kendon technology implementation plan.

In-house technology managers. The designation of two teachers by the teachers themselves as network managers had positive impacts on the implementation process. The special inservice training which they received from the School District, their personal and professional consciousness, and commitments all have contributed to staff development and the subsequent school-wide adoption of the technology implementation. Despite those efforts, the participants realized that these network managers needed more time to work out computer problems. Equally, they needed monetary incentives or other compensation for the services.
External Agents.

The school district. Regarding the top administrators, the study indicates the School District was highly supportive in words but slow in actions during the period between 1989/90 and 1992/93 school years. However, in 1993/94 school year, the District's grant of 40 microcomputers and encouragement to teachers' efforts had a very positive impact on the innovations. The participants felt the District Office and the school need to work more closely to sustain the technological innovations at Kendon.

University alliance. The technical expertise, self and professional commitments of Michigan State University collaborators and material incentives from PDS and MPNE had been very instrumental in getting the technology plan in place. However, Kendon teachers expected more regular visits or follow-ups of Michigan State University faculty members responsible for the various PDS projects at Kendon.

Kendon parents.. Between 1989-92, Kendon parents did not play any significant role and that they did not have strong influence on the implementation. However, between 1992/93 and 93/94 school years, those who served on the School Improvement Team constructively worked with Kendon faculty on the technology plan. As they become more involved with technology programs and with more brainstorming from the staff, they began to gain more influence on the technology plan.

Community business partners. The financial and personnel support systems from the local credit union had, to some extent, influenced the technology program. Their support and participation in some classrooms enhanced students' understanding of real world applications of the subject-matter such as mathematics applications in banking.

CHAPTER 6

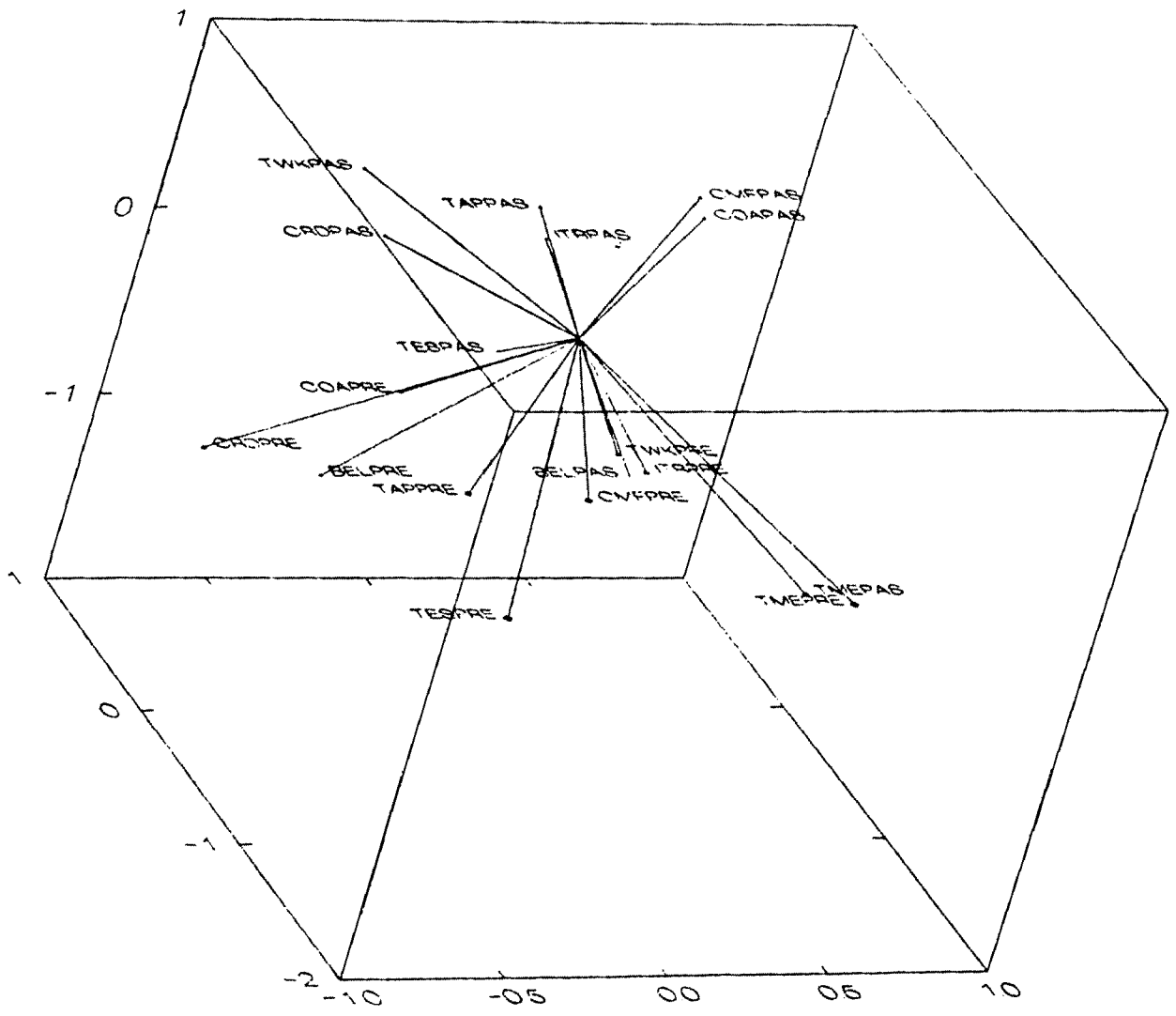
CHANGING PERCEPTIONS OF EDUCATIONAL TECHNOLOGY

Overview

This chapter discusses the (1) participants' perceptions of Kendon teachers' expectations with regard to organizational culture of the school as well as teachers' beliefs in and adoption of technological innovations and (2) participants' perceptions of technological changes in the school curriculum over the past five years. The data on these aspects of changing perceptions were collected from responses to questions 5-10 and 15-34 of self-administered survey (see Appendices 1 & 2) and follow-up personal interviews. The information gathered from these techniques was supported by participants' own comments and my personal observations. All these data helped me to understand the extent to which organizational culture of the school system and teachers' personal beliefs have influenced the technological innovations over the past five years.

Figure IVA represents subsets of perceived beliefs, organizational, instructional, and general technological change variables gathered through questions 5-10, & 15-34 of Appendices A & B. The full plot and its coordinates are presented in Appendices E & F. These graphical presentations are supported by summary statistics in Tables H, I, J, & K.

Figure IVA: Teachers' beliefs, expectations, and adoption of technology.



Beliefs, Expectations, and Adoption of Technology

Figure IVA above represents a subset of beliefs, organizational, and instructional variables (questions 5-10, & 15-28 of Appendices A & B). All the variables are presented in two forms: past (i.e., suffix "PAS") and present (i.e., suffix "PRE"). Regarding the organizational culture of Kendon school, the participants' perceptions of teachers expectations of more technical support (TES), inservice technology training programs (ITR) before effectively integrating these modern instructional tools into the curriculum, and more teamwork (TWK) during the implementation process have shifted from their locations in the past (1989/90 -1992/93) in approximately the same direction to their locations in the 1993/94 school year. The location of participants' perceptions of teachers' beliefs (BEL) in technology as a potential tool to support traditional instruction was close to organizational culture of the school. The location of participants' perceptions of teachers' expectations of time (TME) for technology activities was also close to organizational culture of the school.

Table H below shows that the percentage score of the participants who rated the teachers' expectations of more technical support high increased from 23 % in the past to 69% in the 1993/94 school year, that of inservice training programs increased from 25% to 58%, that of team work increased from 30% to 50%, and that of beliefs in technology increased from 54% to 75%. With regard to time factor, the percentage score of the participants who perceived that competing demands on time made it difficult for teachers' technology assignments remained 77% over the past five years.

Three major issues are associated with the graphical locations and summary statistics. First, the participants' opinions about teachers' expectations with regard to time had been very high over the past five years. This implies that time factor poses potential problem for teachers to effectively integrate technology in the

TABLE H: BELIEFS AND EXPECTATIONS

		BEL	TES	ITR	TME	TWK
		(Percentage Scores)				
PAST	LOW	15	54	67	15	60
	AVERAGE	31	23	8	8	10
	HIGH	54	23	25	77	30
PRESENT	LOW	17	23	17	15	42
	AVERAGE	8	8	25	8	8
	HIGH	75	69	58	77	50

Number of Cases = 16

BEL = Beliefs in Technology
TES = Technical Support
ITR = Inservice Training Programs
TME = Time Limitations or Constraints
TWK = Team or Collaborative Work

PAST = Between 1989/90-1992/93 School Years
PRESENT = 1993/94 School Year

curriculum. Second, the shifts of opinions about organizational management with respect to technology are moving closer to that of time. This convergence of opinions suggest that time plays a major role in the implementation of new programs. Third, one major exception is that the participants' opinions about teachers' beliefs changed to different direction in the 1993/94 school year, as indicated by arrow "3".

Concerning the adoption of technology, the participants' opinions about the extent to which curriculum called for the use of technology (CRD), the extent to which teachers applied technology in the curriculum (TAP) and in different content areas (COA), and how

teachers felt comfortable using technology (VMF) shifted in the past to one direction in 1993/94 school year.

Table I below shows that the percentage scores of the participants who realized that curriculum highly called for the use of computers increased from 14% in the past to 54% in the 1993/94 school year, that of the participants who saw that technology applications in the classrooms were high increased from 8% to 58%, that of the participants who perceived that technology was highly integrated into the content (subject-matter) areas increased from 8% to 46%, and that of the participants who perceived that Kendon teachers felt more highly comfortable using computers to teach increased from 8% to 50%. Looking at both graphical and summary information, these shifts of opinions were consistent with those of organizational culture of the school. This implies that the organizational culture of Kendon school also influenced the adoption of technology at Kendon.

In general the participants' perceptions about teachers' beliefs in technology, expectations, and adoption of technology in the curriculum increased substantially in 1993/94 school year. These perceptions are quite consistent with the new direction that teachers took in 1993/94 as previously discussed in chapter 5. The perceived high positive attitudes or image about teachers with regard to technology goes along the schoolwide adoption of computers in the curriculum in 1993/94 school year.

Summary. The participants' perceived that teachers expected more team work, preservice and inservice technology training, technical support services, and time for technology activities. They perceived that teachers' beliefs in technology highly affected the implementation process. They perceived that in the 1993/94 school year, the teachers felt comfortable with the technology and that technology was highly used in the curriculum.

TABLE I: TECHNOLOGY ADOPTION

		CRD	TAP	COA	CMF
			(Percentage Scores)		
	LOW	57	59	67	42
PAST	AVERAGE	29	33	25	50
	HIGH	14	8	8	8
	LOW	31	8	36	0
PRESENT	AVERAGE	15	33	18	50
	HIGH	54	58	46	50

Number of Cases = 16

CRD = Curriculum Demands on Technology
TAP = Technology Applications in the Curriculum
COA = Technology Applications in Content Areas
CMF = Comfort or Teachers Ease of Using Technology

PAST = Between 1989/90-1992/93 School Years
PRESENT = 1993/94 School Year

The Participants Own Comments On Teachers' Beliefs, Expectations, and Adoption of Technology.

This section captures the general observations and some pertinent remarks gathered through questions 5-10 and 15-28 of the self-administered survey and personal interviews as well as some information gathered from the reviews of the school annual reports.

Perceived General Beliefs (BELPAS/PRE, Questions 5&6)

Between 1989/90 and 1991/92 school years and the present, majority of the teachers had changed their thoughts about the technology plan. Some of these beliefs were principally based on teachers' prior knowledge, expectations, and personal commitments.

As one teacher narrated "At first my insecurity had two effects: first it caused me to feel inadequate, confused, and frustrated with myself. Second, it made me more determined to improve my skills and attitude about technology instead of fearing it." Some teachers believed that the technology would be helpful if used to reinforce but not to replace traditional mode of instruction.

As for the school principal, she had a very strong sense of self and professional confidence in what she was doing. According to her, she tried to remain on the competitive edge of the District-wide technology implementation efforts by being a front-runner for hard as well as easy tasks that confronted her staff. As she put it "I believed that my knowledge of the need and importance of technology in the lines of teachers, students, parents and others was clearly expressed and respected. These shared efforts were an outgrowth of my beliefs and convictions about the importance and success of the school-wide technology implementation plan".

According to some Kendon parents the lack of enthusiasm developed by some teachers during the 1989/90 and 1991/92 school years was not a major problem for the long term technology vision at Kendon. One parent reported "My feeling was that new ideas always take time to fully go into effect." The business representatives and the parents equally had strong belief in computers as useful tools for students' learning. But they equally anticipated that this would not happen unless the students received the necessary encouragement from the teachers. Over time, as technology support services, equipment, and training became more available, especially in 1993/94 school year, those initial misconceptions or pessimistic views began to fade out. Teachers started to revitalize their hopes that computers could be effectively implemented in their classrooms. A fourth grade teacher stated "This year (i.e., 1993/94 school year) I feel more knowledgeable, confident, and comfortable, even though there's still a lot to learn". One parent commented " as every teacher has begun to develop a

desire for technology, I believe the implementation plan would fit well into the school curriculum in the subsequent years".
In general the participants strongly believed that computer competency during the early school age is absolutely indispensable due to future job market prospects. One lower grade teacher commented "I believe the early stages of computer technology (K-5) in our schools will help our students to build a solid foundation for computer uses in the future.

Curriculum Demands (CRDPAS/PRE, Questions 7 & 8)

The Kendon parents have always encouraged their children and the teachers to apply technology in the curriculum. One mother stated "My son was using a computer in the kindergarten which really impressed both my husband and myself. And with more computers in the classrooms and the laboratory, I feel more positive about his learning." Another parent also revealed "I have been actively involved in Kendon curriculum changes since 1992. Of course, I know my child has used computers in her classroom about once a week during the two and half years she has been at Kendon". In general, the parents emphasized that now that we have more computers in the school, we should extensively apply them in many curriculum areas such as math, reading, science and writing.

In fact, according to the school technology reports, the School District had made it a policy to integrate computers in the curriculum, particularly as teaching and learning tools in the classrooms. Unfortunately, some teachers pointed out that there is no where in the curriculum that mentions the strategies for measuring the extent to which computers are being used by teachers and students. One teacher said "I do not believe there is anywhere on the students' report to indicate computer usage in the curriculum." The teachers expressed the concern that no formal study had been conducted to assess the extent to which teachers apply technology in the curriculum. One teacher remarked that the school has technology standards but there are no defined policies by the school

system that would ensure teachers' compliance with the technology plan in their respective classrooms.

In spite of these concerns, some teachers mentioned that in 1993/94 school year, there has been more computer applications in the curriculum. One teacher stated "We see more computer programs in teachers' lesson plans because they feel it is trendy now... and probably this will continue to increase. Even those whose teaching assignments are not directly involved with technology have begun to extensively use the computer for publishing students' stories and reports." One special education teacher insisted "If the school is to abide by the technology vision then computers need to be used widely in the curriculum."

Perceived General Expectations (TESPAS/PRE, Questions 9 &10)

During the 1989/90 and 1991/92 school years, both Kendon parents and teachers felt that there was a need to use computers to support instruction. Unfortunately, there were not enough computers for every teacher for there were only eight computers for all 13 regular teachers, two special education teachers and three instructional assistants. The only short- term alternative solution was to encourage teachers to develop shared attitude towards technology usage in the school. Again, those who frequently used the computers lacked the necessary support systems. One teacher indicated that they expected a lot of support from both Michigan State University and the School District as initially promised but the teachers received less from the from the School District.

After the general adoption of computers in the curriculum, the teachers expected more ongoing technical assistance and staff development from the School District. "Of course, I expect to learn more and do more to help my students to become computer literates but... ", said one lower grade teacher. With regard to laboratory applications, while some teachers expected to learn new things about computers from the technology support person that could be used in the classrooms, others expected more different programs for

each subject-matter area such as mathematics and science. One third grade teacher narrated "My students are knowledgeable about all the available programs (MS Works and Kidworks 2) now". Contrary to novice computer users, the few teachers who received computers in the early Kendon technology program expected less support. One of them stated "I feel reasonably capable of using my computer for the tasks that I have to do."

In her role as school principal, it has always been her major preoccupation to acquire both technical and financial support systems. "I will continue to seek financial assistance for our resource personnel. And I expect to receive more help from them that would encourage teachers and students to efficiently use the computers in the classrooms and the laboratory", she emphasized.

Preservice & Inservice (ITRPAS/PRE, Questions 15-18)

In general, most of the teachers indicated that they did not receive any substantial technology training in their college education. This lack of technology experience initially created fears (posed problems) for some teachers. With regard to inservice training, the respondents indicated that during the 19989/90-1992/93 school years there was not much inservice training in computers. This was explained by the fact that the emphasis on technology training was less because there were few computers in the school. Furthermore, there were no long term technology training plans, particularly with respect to time allocation, though the long term technology vision was strongly stressed. However, this was not a major problem because inservice training was planned each time the school received new equipment. In addition, the introduction of computers in the curriculum was a gradual or slow process. This gave the teachers enough time to learn about the technology and its implications in the curriculum.

As enough time and resources were made available for technology inservice training, especially during the 1992/93-1993/94 school years, the teachers started gaining confidence for

the effective and efficient use of the technology. One teacher commented "Working with Carol and Carol (i.e., the two network managers) has improved my skills and understanding of different functions of computers. As another teacher put it "I would not have known the varied uses of computers had it not been the assistance of our Michigan State University collaborators". Another continued "My computer skills are improving thanks to Michigan State University collaborators. I hope this new knowledge would have an influence on some teachers".

Needless-to-say, well defined training programs, particularly with strong emphasis on teamwork, initiated in 1993/94 school year have had a very significant impacts on the school-wide technology implementation plan. This has helped many teachers to gain more computer experience. Again, this has been a strong motivational factor for some teachers to put in extra time for more computer practice. One upper grade teacher emphasized "I am seriously planning to work more on my computer during this Summer vacation." The idea of increasing the inservice training each time the school received new computers has enhanced technology applications in the school. Despite those improvements, both parents and teachers expressed the need for more inservice-training. "I still need more in-service training" one teacher said.

Technology Demands On Time (TMEPAS/PRE, Questions 19 &20)

According to some parents the teachers were overburdened with technology time demands. One parent explained "learning to adjust to some school changes always demands more time". The parents had observed that the school is saturated with many competing programs besides the classroom routine. One parent commented "Deciding what the school priorities are in relation to technology pose another problem for school innovation programs". According to one business representative, it seems that teaching career is very time demanding and would take a major effort and time to work on these new technology assignments.

Time to learn and master these new teaching tools has always been a major concern of the teachers. According to them they never have enough time to study the technology. They feel there is too much to do all the time. One teacher stated "I have too much to teach in too little time. And I do not have enough time to learn how to effectively use computers myself, let alone teach my students now". Another teacher added "I feel I am too tired at the end of the day to do two hours inservice training". In general, the teachers insisted that they needed more time with the network managers. Unfortunately, the latter also needed more time to work with their students in the classroom. The teachers revealed that between 1989/90 and 1991/92 school years, there were no planned technology training programs for the teachers so that made staff development very difficult. One teacher stated "The first responsibility went to my family and then to my students. Receiving training after school was difficult. The school principal admitted that the competing demands on time made it hard to set priorities for Kendon instructional programs. However, she emphasized that technology remained at the top of her list. Fortunately, as training schedules were planned ahead for 1993/94 school year, it made training sessions easier and increased teacher participation.

Applications in the Content Areas
(TAP-COAPAS/PRE, Questions 21-24)

According to Kendon staff and parents, not much was seen using computers in the curriculum during the 1989/90 and 1991/92 school years. In 1992/93 school year, computers were moderately used for some class projects. According to parents, business representatives, and teachers 1993/94 school year has been a successful one for the technology implementation in the curriculum. For example, the two business representatives indicated that for each classroom presentation, they used computers to do the transactions. Some teachers stated that they used the technology more often for individual and group instructions. One teacher

explained "I normally use technology to support instruction in social sciences, a little in mathematics, and writing". Another teacher narrated "Since 1992/93 school year, I have used computers frequently for different content areas and class projects such as Mathematics, Reading, and Writers' Worships. I make more computer generated study sheets for my students". In general, computer applications across subject-matter areas had been very low in the lower grades.

Ease of Use of the Technology
(CMFPAS/PRE, Questions 25 & 26)

From some parents' own observation, Kendon teachers in general found it hard initially to adjust to the technology. Some teachers equally admitted that they lacked self-confidence, experience, and knowledge using computers for routine instruction in the classroom. Even 1992/93 school year in which technology was becoming more popular in the school, only a few students and teachers felt comfortable using computers for mathematics, language arts, and story writing.

During the 1993/94 school year, parents, business representatives, and teachers realized that a majority of the teachers began to feel at ease using these teaching tools. One teacher stated "I know what I am doing now. In fact, I feel more secure and I am enjoying learning more." One lower grade teacher explained that during the Spring term, 1994 she enjoyed using computers for teaching some basic things such as writing names, simple words, days of the week, etc.

Despite the general improvement in teachers' computer competency, there is still more room for improvements. One teacher commented "The more applications become varied, the more I realize that I have a lot to learn. In fact, the technology support of Michigan State University has certainly helped me to feel more comfortable using computers for my personal assignments". The school principal added "As I continue to learn more about computers with different

applications, I am beginning to understand more what the computer terminology means by "user-friendly".

Team Work (TWKPAS/PRE, Questions 27 & 28)

Collaborative or team work (study groups) is one of the important strategies common among Kendon teachers. As a means of facing those technology challenges posed in early years, 1989/90-1991/92, some few teachers became more determined to increase their computer literacy through cooperative efforts. As I observed during an Extended Lunch in April, 1994 , this continued peer interaction, joint technology assignments, and the designation of network managers (as peer-mentors) by the teachers have resulted in all Kendon teachers a very positive attitude towards technology. From my own personal observations, it was a very positive experience to see the school principal, special education teachers, teacher specialists, and the class teacher all working together in a computer laboratory session. "Discovering new things together with students and co-teachers in the computer laboratory was quite exciting and encouraging to learn and teach here", said one lower grade teacher. Another teacher proudly narrated during a school improvement meeting "With these new educational tools, teachers are beginning to assume shared responsibilities in elementary schools. For example, the preparation of group study reports, particularly editing, is now seen as a joint effort since teachers can conveniently take turns in their respective classrooms through the school network system." Regarding partnership project, the teachers felt the on-line computer system helped both 4th grade teachers and their business partners to work together as a team to accomplish the project's goals. Similarly, teachers and students can easily share class information on the school local area network, according to the participants. In 1993/94 school year, both individual and cooperative learning were becoming more active, thus promoting competitive learning environment. As one upper grade teacher stated "Every student wants to write good articles or

stories that could be read by other students and teachers on the network."

Summary. The participants stated that teachers' beliefs in technological innovations were principally based on their prior knowledge, experience with the technology, and personal commitments. According to the participants, teachers believed that technology would be helpful if it is used to reinforce but not to replace traditional instruction.

Some teachers indicated that there was no school policy to assess the impacts of technology on instruction. Regarding the diffusion of the innovations, the participants stated that the pace was gradual or slow but that gave the teachers enough time to learn about the technology. Kendon teachers in general found it difficult initially to adjust to the technology. Some of them admitted that they lacked self confidence, skills, and knowledge. Despite the general improvement of teachers' computer competency in the 1993/94 school year, there is still more room for improvement.

Collaborative or team work, particularly study groups and co-teaching is one of the important strategies common among Kendon teachers. This has helped teachers to develop positive attitude towards the technological innovations.

General Instructional & Technological Changes

Figure IVB represents another subset of Appendices E regarding the perceived changes in instructional quality through technology applications (questions 29-30), how the participants perceived Kendon technology as a model for other schools (see questions 31-32), and the extent to which the participants perceived how instruction would be affected if the number of computers in the school is doubled up or half of them is withdrawn (questions 33-34). Related information is provided in Table J and K.

In Figure IVB, you may notice that the participants' perceptions on technological innovations and quality of instruction

changed gradually each year, from 1989/90 to 1992/93. The flow of these perceived changes (C-90 through C-94) is presented in a curve form (see curve "A"). The participants' opinions on the outcome of instruction (1) should half of the computers be withdrawn (see arrow "C") from the school and (2) should the number of computers be doubled-up in the classrooms were closer to the perceived general technological changes . The perceptions of Kendon technology as a model, from 1989/90 through 1992/94 school years, followed the directions of the kind of technological changes perceived in the same school years.

TABLE J: TECHNOLOGICAL CHANGES OVERTIME

	C-90	C-91	C-92	C-93	C-94
			(Percentage Scores)		
LOW	100	91	75	58	33
AVERAGE	0	8	17	25	17
HIGH	0	0	8	17	50

Number of Cases = 16

C-90 = 1989/90 School Year C-91 = 1990/91 School Year.
C-92 = 1991/92 School Year C-93 = 1992/93 School Year
C-94 = 1993/94 School Year

Figure IVA: Subject of beliefs, organizational, and instructional variables.

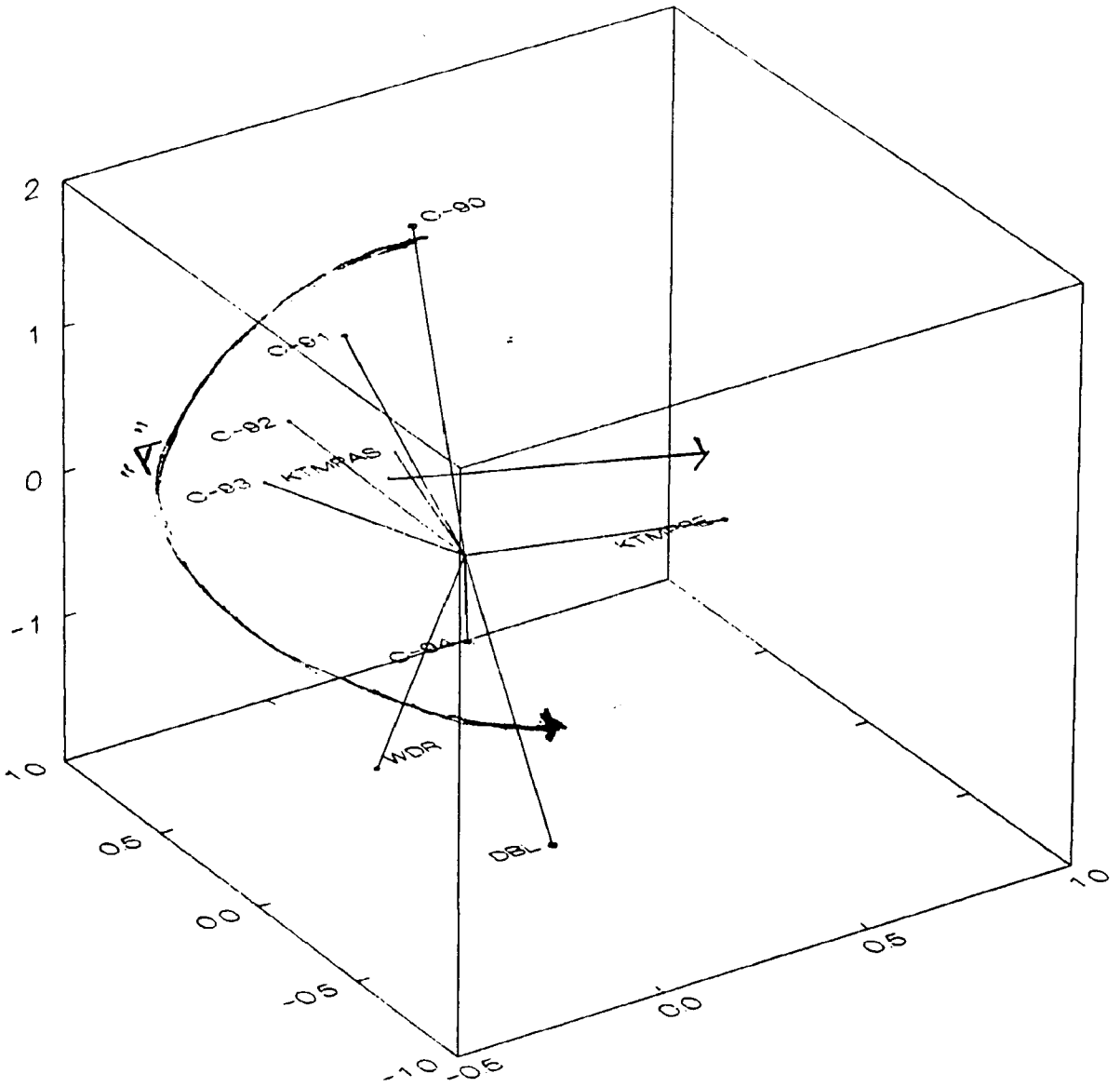


Table J above indicates 100% of the participants rated the overall technological changes low in 1989/90 school year as compared to 91% in 1990/91, 75% in 1991/92, 58% in 1992/93, and 33% in 1993/94. However, 50% of the participants rated the overall changes high in 1993/94 as compared to 17% in 1992/93, 8% in 1991/92, and 0% in 1990/91 and 1989/90 school years. Considering Kendon technology as model to other schools, Table K below shows that 55% of the participants rated Kendon technology model (KTM) high in 1993/94 as compared to 17% in the preceding years. Regarding the impacts of quantity of hardware in the school, 54% of the participants felt instruction would be highly affected if half of the computers are withdrawn (WDR) from the school. On the other hand, 69% of the participants indicated that instruction would be affected if the number of computers in the school is doubled or increased (DBL).

The increase in percentage scores of participants who rated high the organizational culture of the school system and teachers' beliefs in technological innovations as discussed earlier in Figure IVA, lead me to assert here that some of these technological practices at Kendon could be adopted by, or serve as a model for other schools.

Summary. The participants' perceptions of technological innovations and quality of instruction changed gradually each year, from 1989/90 to 1992/93 school years. These perceptions shifted sharply in the 1993/94 school year. The participants felt instruction would be highly affected if the number of the computers in the school are increased or decreased. All the participants noted that some aspects of Kendon organizational management and instructional practices with regard to technology could be adopted by other schools.

TABLE K: WITHDRAWAL, DOUBLING, & MODELING OF TECHNOLOGY

		WDR	DBL	KTM
		(Percentage Scores)		
PAST	LOW	-	-	66
	AVERAGE	-	-	17
	HIGH	-	-	17
PRESENT	LOW	31	8	45
	AVERAGE	15	23	0
	HIGH	54	69	55

Number of Cases = 16

WDR = Withdrawal of Half of the Computers
DBL = Doubling the Number of Computers
KTM = Kendon Technology as a Model

PAST = Between 1989/90-1992/93 school Years
PRESENT = 1993/94 School Year

The Participants' Own Comments and Personal Observations on Technological Changes And Modeling

The following sections describe what the participants' general observations were and some specific comments or remarks under question items 29-34 for self-administered survey and personal interviews. These are supported by information gathered from the reviews of the school annual reports.

Perceived Changes (C-90 - C-94, Questions 29 & 30)

From the start of PDS programs at Kendon, more importantly between 1989/90 and 1991/92 school years, some parents felt they were constantly playing "catch-up" regarding who was teaching what subject to what child. There were curriculum changes in

mathematics, reading, and writing but technology was less used. Trying to evaluate each year the student learning was frustrating because of staff changes resulting in changes of teaching styles. The parents had to supplement their children's education each year with Summer School Programs. Despite those efforts the parents realized that their children still had problems especially with spelling and writing skills. One parent commented "We do not think the overall quality of instruction did improve. Now we are in favor of many of these new programs such as the CASE Credit Union project and the Computer Laboratory. But these are relatively new concepts. I would like to see better results in writing and reading skills.... and I hope the computers would help our children in these areas". Both parents and teachers were happy to say that 1992/93 was an excellent year with regard to staffing. One teacher complimented "A very willing teacher who feels academics is highly important for our children's learning improvements".

Some parents commented that substantial changes have taken place during the 1993/94 school year. More importantly, they felt the technology program is really being put into use. One business representative hinted "It seems that both classrooms where I worked the teachers were highly interested in developing technology applications to support instruction. One teacher explained "Because of our Network Managers both teachers and students are highly involved with technology applications in instruction".

Kendon as a Technology Model (KTMPAS/PRE, Questions 31 & 32)

According to the study participants, between 1989/90 and 1992/93 school years, Kendon technology could not be considered as "Model". Some of the arguments raised were that the school was not able to move the plan ahead fast enough and also the cooperation amongst the School District, Michigan State University, and Kendon faculty was very weak. One teacher narrated "We were too loosely divided". According to the school principal, the PDS program stipulated the long term technology goals and rationales, but during

those years Kendon staff did not have enough technology savoir-faire and experience to embrace the PDS technology agenda. "Needless-to-say, several teachers quickly understood the potentials of the technology plan. They took technology training sessions seriously and worked hard at home over the weekends and during the Summer vacations. Now, they are the outstanding technology leaders amongst Kendon teachers", said the school principal.

Despite the schoolwide teachers' adoption of computers in the curriculum in 1993/94 school year, some parents still feel it is too early to tell the prospects of these new instructional tools. However, some parents have begun to feel good or be optimistic about the technology. One stated "I am more impressed with the school now than when we started few years ago. For example, there are more parent and community involvements and commitments now. And I think, those would help to sustain the implementation of the technology plan in the school".

The teachers feel more has happened during the 1993/94 school year to show accomplishments for their efforts. One teacher expressed "We have had excellent technology programs this year, particularly the computer laboratory applications". Up till this point, some teachers feel Kendon technology plan could not be considered as a model for other schools. The teachers strongly feel that their computer competency has to be reinforced with more training and individual practice so as to make the school-wide technology implementation plan more effective and efficient as a model. One teacher stressed "technology implementation is very difficult, but there is got to be a better way".

In general, the teachers acknowledged that Kendon technology program is at the experimental stage and that it would be premature to be considered as a model for other Professional Development Schools. One teacher emphasized "All Kendon teachers and Michigan State University collaborators need to work hard to make Kendon PDS a real technology model". The school principal narrated "Considering the progress we have made so far, it is possible that

certain aspects of our technology plan could be disseminated as a model such as team teaching, support systems of few Kendon teachers, and the facility arrangements. In particular, a computer teaching laboratory where both students and teachers receive immediate assistance from knowledgeable support persons. Also, keeping track of utility and our continual evaluation strategies could be a potential good model, I think... " It was interesting to learn that every teacher who participated in the study proudly recommended the computer laboratory setting and application modes as a model for other schools statewide.

Number of Computers (WDR & DBL, Questions 33 & 34).

The question on the kind of impacts the technology would have on instruction if the School District decides to withdraw half of the computers from the school in future, the parents, business representatives, and teachers felt it would have negative effects on instruction. One parent lamented "This would be a step backward for the school improvement efforts. I would see that very disappointing and a setback to all the hard work over the last several years".

According to some teachers the increase in number of computers made instruction and time management easier, especially for the lower grades. As one teacher stated "Finding and connecting time for each student or small groups of students often made things easier for Kindergarten classes. Students always have space in the laboratory and classroom during the day to choose different exciting computer programs for practice". One teacher indicated "I would be furious! I am just beginning to make real progress then 'out goes the rug under my feet' ". Another teacher added, "This would be devastating. We have just started learning to effectively integrate computers in the curriculum and.... Of course, the School District would not only lose our confidence but also the state's time, money, and educational innovation efforts". However, one teacher stated that instruction would go on regardless of School District's decision. One business representative commented "I think they could still

adjust because our world of communication is now more importantly linked by computers. The school needs more computers for students' technology practice towards the future".

The parents and business representatives feel if the number of computers is doubled each student would have more computer time. One teacher added "We would not have to pair students at the workstations. This would be a real asset because we would be able to expand our present programs and efforts to accommodate both individual and group instruction".

Summary. There were curriculum changes in mathematics, reading, and writing but technology was less used. Despite those changes, the parents realized that their children still had problems especially with spelling and writing skills. They hoped the full integration of computers in the curriculum would help the children in those areas.

Some teachers noted that, during the 1989/90 and 1992/93 school years, Kendon technology could not be considered as "Model" for the fact that the school was not able to move the technology plan ahead fast enough and also the cooperation among the School District, Michigan State University, and Kendon faculty was very weak. Despite the schoolwide teachers' adoption of computers in the curriculum in 1993/94 school year, some parents still feel it is too early to tell the prospects of these new instructional tools. However, some parents narrated that parents and community involvements and commitments would help to sustain the implementation of the technology plan in the school. Some parents, business representatives, and teachers felt the decrease in the number of computers would have negative effects on instruction. One parent lamented, "this would be a step backward for the school improvement efforts". Some lower grade teachers hinted that the increase in number of computers made instruction and time management easier for them. In general all the participants were

optimistic that doubling the number of computers would help teachers to accommodate both individual and group instruction.

Observations Regarding the Computer Laboratory

The following sections describe what I personally observed for a period of six months (from January to June, 1994) at Kendon computer teaching laboratory. The information presented here seeks to complement what the participants said about Kendon teachers' uses of and attitude about computers in education.

During the 1993/94 school year, serving as Michigan State University technology support person, I worked with Kendon students and teachers in the classrooms and computer laboratory. As the laboratory was on experimental basis, I decided to give more support here to ensure smooth running of instructional activities. During the computer laboratory sessions four significant events drew my attention that were closely observed for a period of six months. They were: Modes of Learning, Teacher Laboratory Preparation, Technical Matters, and Management problems.

Modes of Learning

Using the computer laboratory as an extension of classrooms, different learning styles became visible here such as individual, cooperative, teacher guided, and student control learning processes. First, students in the upper grades (i.e., 4th and 5th) worked more independently than the rest. These 4th and 5th grade students often came to laboratory with their individual prepared manuscripts of their writing assignments. Each student did his or her own typing, editing, formatting and spell checking without the assistance of others. These students had control of their learning. They often worked on their individual writing projects seriously with less supervision or sometimes without supervision. Second, both individual and cooperative learning skills were highly common with 3rd and 2nd grade students. In these classes, some intermediate computer literates preferred helping their colleagues or always

manifested their desire to help others instead of working alone or doing some more advance work during the hands-on assignments. Amongst the same skilled students, others tried to finish their assignments in short period of time and then ask for teacher's permission to help other students as peer computer assistants. The unskilled computer users always preferred working in small groups of two or three. For instance, with the program "Kid Works 2", students first worked together to select some desired objects or pictures, then engaged in mutual discussions about the objects. Through these group interactions they always came up with a shared story that they wrote on the computer. The writing phase was also engaging. It was a common scene to see or hear the groups exchanging words and opinions. For example:

> Anne eats pizza a lot", John wrote. Mary observed as John was writing, read silently, then suddenly shouted: "No, I don't like this sentence. Can we write another one?" John rejected "No, I like this sentence." Thomas intervened, "It is my turn. Let me write one sentence about my dog". John and Mary agreed, "OK, let's go boy!

Again, during the hands-on activities, everybody wanted to stay on task or demonstrate skills to the group, especially when editing and formatting a text. This often ended up with partners struggling to take turns at the keyboard and mouse.

Third, the lower grade students (i.e., 1st and Kindergarten) enjoyed working in groups especially with multimedia program (Kid Works 2). These lower grade students needed more guided instruction from the teacher or computer assistants. It was interesting to see that the students were more disciplined in the laboratory than their seniors in other classes. The major discipline problems were found among the 2nd and 3rd grade classes, whether the class teacher was present or not. Another important observation common amongst all the grade levels was student's curiosity about what other student was doing. I often saw students watching what

was happening on other computer screens. They frequently questioned their colleagues "How did you do this? Will you show me... ". Needless-to-say, such exciting mixed learning modes at this teaching laboratory was a rich experience for me as I am interested learning more things about technology and cognition.

Teacher Laboratory Preparation (Old and New Mind Sets)

In the early weeks of computer laboratory sessions, some teachers came to the laboratory without any prior preparation or lesson plan. They often came with the expectation that the computer support person would do the teaching. As one teacher put it "I did not have time to think about what my kids would do in the laboratory. Next time I'll plan something in advance." These unprepared practices sometimes forced students to express discontentment. For instance, in one situation a student furiously shouted "Sir, I don't know what to do!"

Sometimes, these teachers were obliged to ask me questions such as "What should we do today?" Out of frustration, one teacher was inclined to confess to the class "I don't know how to do this, kids. I am embarrassed. I've to ask the network managers how to do it. I have to come and learn more about the program if not next week I'll not come with the students." Again, on two different occasions, the teachers on duty here became so frustrated that they had to complain to the school principal about the laboratory applications. They argued that it was not necessary to come to the laboratory for they did not have the mastery skills to teach with the computers. I felt such incidents might have been necessitated by lack of understanding of the laboratory goals and objectives or it was the teachers' deliberate intention to shift their responsibilities to technology support persons. I further assumed that the teachers were not comfortable or technically ready to use the technology and that they did not want to be held accountable for any instructional activities in the computer laboratory. In an attempt to understand the probable causes of those attitudes, I reported the incidents to

the school principal. This resulted in an informal conversation with the school principal, network managers, the teachers in question, and myself to share lights on the role of the teacher and that of the support persons. Of course, the network managers insisted that the teachers should always use the laboratory as an extension of their classrooms. Therefore, they should come with their instructional objectives or lesson plan. "Prince, we have all agreed on how teachers should use the laboratory", she stressed. However, she assured them of extra training sessions.

Leaving the laboratory lesson planning or activities solely to the support persons without prior information often created confusion in the laboratory. In one situation a teacher stated "I learned that last week the laboratory session was chaotic. We need to plan or organize the laboratory assignments well ahead". Unfortunately, some initiatives taken by the support persons sometimes didn't meet the teacher's desired goals. These observations made the principal and the network managers to encourage the teachers frequently, during the staff meetings, to appropriately use the computer laboratory according to their class lesson plans.

With a sense of cooperation, duty, and encouragement to those teachers, the principal frequently came to work with them in the laboratory as way of discovering new things together about these instructional tools. On many occasions, the principal requested or assigned the Teacher Specialists to help teachers in the computer laboratory.

Contrary to those frustrations due to lack of preparedness, some teachers in the lower grades used the technology appropriately as a direct support to their traditional teaching styles. Thus, instead of asking students to use pen and paper to write down a set of words, the teachers rather asked them to use computers. Using the edit commands the teachers were able to help each student or group of students to make immediate corrections. This made instruction more efficient for them.

Perceived Attitude and Beliefs in the Laboratory

While some teachers were seen as fairly enthusiastic and cooperative with the technology support persons others were seen as indifferent and uncooperative. Usually some teachers discussed in advance with the laboratory support person their lesson plans. In times of absence these teachers would inform the support persons what they expected him to do with the students, especially when they had to come with a substitute teacher. They were always open to discuss with the support persons what went wrong and what went bad after each particular laboratory session.

In contrast, some teachers, intentionally or unintentionally, often failed to inform the support persons of change of their schedule. Some of them sometimes just sent part of the class to the laboratory, while these teachers would be working with the remaining students in the classroom. Such situation quite often put the support persons in an unpleasant situation. On one specific occasion the school principal came to work with the students in the laboratory while the teacher was in his classroom with half of the class. At the end of the laboratory session, she asked me to make sure teachers always stayed with their students in the laboratory. She insisted that teachers should effectively allocate the laboratory time for computer applications instead of always sticking to the old instructional practices.

Some teachers preferred discussing their technology needs directly with the network managers or other teachers instead of Michigan State University technology support persons. In general, teachers and students' laboratory attitude was quite positive, despite minor frustrations. For example, it was sometimes interesting to hear what the teachers said. "I am pleased using the laboratory because they (students) are writing faster. They are now quite familiar with the keyboard and the mouse. That's great", said one first grade teacher.

Technical Matters:

One important technical problem experienced was power failure. On two different occasions the whole class lost their text due to (1) disconnection of power supply cable from the main switch. and (2) school-wide electricity supply outage. Both students and teachers complained about the efficient and effective uses of the technology. According to the teachers, they preferred using their pen and papers rather than wasting time on the technology without positive results. For immediate and future precautions, I advised students and teachers to save their text or information, at most every ten minutes, when using computers. In view of preventive and backup support measures, the technology support persons reported the incidents to the school principal and the network managers. The school ordered three uninterruptible (backup) power supplies that are capable of supporting all the 15 computers for at least twenty minutes.

One important observation issue was the misuse of certain computer functions or commands. For instance, some students sometimes used "Shift" key instead of "Command" key when cutting or pasting text. Sometimes both teachers and students panicked because they were afraid or worried to lose their data or text due to minor mistakes in program manipulations. They had to run to the network managers or other technology support persons for assistance. Under such emergency cases, the network managers always found prompt solutions to those problems by leaving their own students. Coping with such situations often demanded time, effort, and class management skills on the part the managers.

Another frequent technical problem was program interference. The main menu program, called "Launch", often made it difficult for users to access some software applications such as Kid Works 2. This often made the technology not user-friendly or inefficient. Whenever such problems occurred, the support person and the teachers had to go round helping the students to search for the desired program. However, such interferences became less

problematic as teachers and students became more familiar with file retrieval techniques.

Apart from minor software problems in the classroom and in the laboratory, printers posed minor problems for some teachers. A teacher once reported "I can't print in my room but the network manager does not want me to change or switch printers." The telecommunication system for the 4th grades project too had its own specific problems. Sometimes the 4th grade teachers had problems accessing the Credit Union database. However, they always managed to get through (i.e., on-line connection). In general, hardware was of less problematic. For instance, no computer system broke down throughout the entire 1993/94 school year.

Facility Management

The inadequate space for the school's competing programs such as Reading and Technology that used to take place in the same facility (i.e., media room) frequently created noise problems in the facility. This often resulted in teachers' frustration because the children found it impossible to follow the teacher's laboratory instructions, leading to loss of laboratory control. In one situation, both one Special Education (reading) teacher and one lower grade teacher sharing the facility lost patience which made them shout at their students for silence. When the network managers heard of the news, they immediately consulted the two teachers for appropriate solution. Insufficient laboratory time allocation was another concern of the teachers. For instance, some lower grade teachers often complained that the 30- minute laboratory session was too short. One time, as one first grade class was not ready to leave the laboratory at the end of the laboratory period, the support person asked "Do you need more time?" The teacher replied, "Oh yes, I want to stay longer. My children would love it."

Summary. During the computer laboratory sessions four significant events drew my attention that were closely observed for a period of six months. They were: Modes of Learning, Teacher Laboratory Preparation, Technical Matters, and Management problems.

Regarding modes of learning, individual, cooperative, teacher guided, and student control learning processes were common. Students in the upper grades (i.e., 4th and 5th) worked more independently than the rest. These students had control of their learning. Both individual and cooperative learning skills were highly common with 2nd and 3rd grade students. The skilled students finished their assignments in short period of time and then helped other students as peer computer assistants. The unskilled computer users always preferred working in small groups of two or three. The lower grade students (i.e., 1st and Kindergarten) enjoyed working in groups especially with multimedia program (Kid Works 2). These lower grade students needed more guided instruction from the teacher or computer assistants. These students were more disciplined in the laboratory than their seniors in other classes. The major discipline problems were found among the 2nd and 3rd grade classes.

Some novice technology teachers often became frustrated due to misuse of certain computer functions or commands. With a sense of cooperation, duty, and encouragement to those teachers, the principal frequently came to work with them in the laboratory as way of discovering new things together about these instructional tools. Some teachers preferred discussing their technology needs directly with the network managers or other teachers instead of Michigan State University technology support persons. In general software and hardware were less problematic. However, insufficient laboratory time allocation was a major concern of the teachers. For instance, some lower grade teachers often complained that the 30-minute laboratory session was too short. In general, teachers and

students' laboratory attitudes were quite positive, despite minor frustrations and concerns.

CHAPTER 7

SUMMARY, DISCUSSIONS, CONCLUSIONS & RECOMMENDATIONS, AND SUGGESTIONS FOR FURTHER STUDY

Summary

Central Focus Of The Study

The central concerns of this study were to systematically map: the course of technological changes, changing factors affecting dynamics of the school system for technology implementation, and instructional and attitudinal changes. More specifically, the study sought to gather evidence from school records and personal observations to establish an historical profile of technology development at Kendon; to examine the various ways in which the external participants such as the School District and internal (local) schoolhouse participants such as teachers and administrators within Kendon school system have influenced the school technology implementation program over the past five years; and to examine the philosophical, attitudinal, and pedagogical issues that the individuals and groups within the school system hold for technology implementation in the curriculum and their implications for Kendon school curriculum innovation goals. Thus, I was particularly interested in learning about the dynamics of interacting factors in Kendon school as a possible new paradigm of effective technological change-- a paradigm for technology implementation processes and procedures.

Background and Setting

Kendon Elementary is one of the four Professional Development schools in Lansing, Michigan. The school was built in 1958, covering 32,000 square feet. The mission of Kendon Elementary is to prepare students for the future by working cooperatively with parents, community members, and educational faculty. The goal is to create an organized and supportive learning environment where the school system accepts and accommodates diversity and developmental programs to meet individual needs. Technology has been considered as a strategic instructional tool over the past school years (i.e., since the beginning of Kendon Professional activities in the school). The school technology vision strongly stresses preparing students to participate and contribute to a society in which information is central. Kendon Elementary enjoys the cooperation and support of State of Michigan Board of Education, Michigan Partnership for New Education, Lansing School District, Professional Development School Programs, and Michigan State University.

Theoretical And Professional Issues

Research shows that change in schools requires leadership, staff development, modification of the organizational structure, and the involvement of people from all aspects of educational system (Fullan, 1982). According to Senge (1990), shared vision, which is essential for success of change, must evolve through the dynamic interaction of organizational members and leaders. I designed this study purposely to seek contextual information specific to Kendon Elementary to examine these claims in the context of technological changes.

Second, I was interested in understanding the extent to which some teachers and school parents are resistant to a school's innovation programs, particularly using technology as innovative tools; why schools experience slow pace of technology implementation process; and what influences adoption of technology in school curriculum. According to Stacey (1992), visions can die or

fail to develop if too many people are involved at the beginning of the technology implementation, when leaders fail to advocate their views, when superficial talk rather than grounded inquiry and action is the method used. Senge (1990) argues that the professional isolation of teachers limits access to new ideas and better solutions, drives stress inward, fails to recognize and praise success, and permits incompetence to exist and persist to the detriment of students, colleagues, and the teachers themselves. Lortie (1975) confirms that isolation allows conservatism and resistance to innovation in teaching. Fullan & Hargreaves (1991) think participatory or collaborative site-based management is the answer. Fullan (1993) proposes six key elements to change: vision; public and political support; networking, teaching and learning changes; shift of roles and responsibilities at the school, district, and state levels from control to support and shared decision making; and policies need to be aligned around beliefs and practices of new system. According to OTA (1988), some barriers to greater use of technology in our schools are mainly associated with lack of equipment, inadequate or inappropriate training, and teachers' anxiety about new technology. To avoid teachers' anxiety and accountability, McKenzie (1993) suggests that the school principal and his or her staff need to accept the concept of 'mutual adaptation' that may lead to shared leadership role and ownership. In addition, the school administrator needs to break down the traditional isolation of schools from external resources by inviting a rich flow of ideas and possibilities, especially from school parents, communities, and universities. Thus, appropriate involvement of local businesses and universities provides the school system with human and financial resources and helps with marketing the school technology programs.

Many school administrators, teachers, and parents are not interested in technology for technology's sake, but rather for better teaching and better learning experiences for students. As a proponent of educational technology for developing countries, this

study, conducted in a country where academic computing is well advanced, would provide me with some useful information on the kinds of planning, development, implementation, and organizational structures and support systems appropriate for a specific school context, especially in Africa.

Methodology

The investigation was in the form of a case study which focused on the examination of Kendon school records and personal observations, plus the examination of beliefs, expectations, and general perceptions of Kendon faculty, staff, parents, and community business partners, over the past five years (1989/90-1993/94).

To achieve the study purposes, answers were sought to the following main questions (1) What changes occurred in the uses of technology and how did these interact with other influences and outcomes?; (2) What changes occurred in roles, policies, and procedures in the school system over time and how did these influence the implementation of technology?; and (3) In what ways did expectations, beliefs, and instructional practices of various actors within the school system change and how did these promote or hinder Kendon teachers' adoption of technology in the curriculum?

Rationale for this case study. If technologies are being used in classrooms and laboratory settings, then there is a need to understand the dynamics (strengths and weaknesses) within the school system that influence teachers' adoption of technology in the curriculum and the kinds of instructional changes that take place as a result of technology implementation. The combination of both quantitative and qualitative methodologies in a case study like this one, not only captures the general picture of the school system and its related issues and problems, but also provides some specific complementary information that facilitates understanding a complex system.

Data collection and data analysis. Sixteen people within the school system participated in the study. The research involved a two-stage approach to the data collection. Review of school documents, participant observations, and formative evaluation formed stage one. Some of what was learned here formed the basis for constructing quantitative and qualitative questionnaire used for self-administered survey and follow-up individual and group interviews which formed stage two.

Statistical analysis (visual and summary) was used to describe the data gathered in self-administered survey and personal interviews. The statistical analysis was supported by the participants' general comments and my personal observation data. Major findings are discussed in the following sections.

What I Learned from the Study

Overview

The review of literature, Kendon school records, informal formative evaluation and interviews, and my personal observations at Kendon school context (i.e., stage one) and self-administered survey and follow-up interviews (i.e., stage two) helped me to identify some important issues pertinent to technology implementation in a complex school system. I learned about gradual and sharp diffusion of innovations over time; system dynamics, particularly the shifting roles of technology leaders and followers within a school system; the importance of preservice and inservice training for effective technology implementation; the need for support systems from within and outside the school context; the role of perceptions/changing perceptions; the need for collaboration or team work among individuals and groups within a school system; the effects of belief systems and expectations on technology adoption; time constraints; and technological effects on instruction.

Evolution of Educational Technology Implementation

Lessons learned at four distinct phases of the implementation process with respect to diffusion of innovations, instructional practices, and sustainability of technological innovations are presented in the following sessions.

Phase I: Introduction of Technology with Innovators (1989/90). Lessons learned at this phase of the implementation are described as the following.

Innovation decisions. The first adoption of technological innovations was based on the personal decision of one teacher to welcome outside agents to bring applications of technology into his classroom. In other words, the first adoption was a modest "bottom-up" start which was well publicized within the school. The idea of inviting external agents to support the technological innovations was a first important decision. Subsequently, the formation of technology group, consisting of internal and external agents, to manage or support the innovations was a strategic plan. The decision of the innovators to empower the students first was a more student-centered approach. The success of Kendon 5th Grade Multimedia Project, which started on small scale and supported by a few technology leaders, contributed to later schoolwide adoption of technology. This supports Stacey's (1992) assertion that visions can die or fail to develop in the first place if too many people are involved at the beginning of a new program. The Kendon experience also confirms that of Senge (1990) which states that trying to get everyone on board in advance of action cannot work because it does not connect to the reality of dynamic complexity.

Instructional strategies. The kind of learning style in this experimental class was more of discovery or exploratory since students directly interacted with those new multimedia learning tools. The role of the teacher was, therefore, more of classroom

management. The creation of a class "newsletter" through students' own efforts indicates that empowering students through student-centered approach could be a strategic plan to technology implementation in schools. However, teacher guidance is always important to make such learning happen.

Sustainability. The issues of limited equipment, teacher's lack of expertise in technology, and student-centered approach, lead me to conclude here that the sustainability of the innovations during this first phase was a major problem.

Phase II: Early Adopters (1990/91 &1991/92) Some of the lessons learned at this phase are presented as the following.

Diffusion decisions. The need for staff development and technical support required a new approach to organizational management such as the designation of network managers in the school in order to spread the innovations. Two individual teachers were the early adopters. Their decisions to adopt the innovations were on the basis of voluntarism, enthusiasm, belief, and personal interest. Despite the increase in number of computers in the school from 4 to 11, it was critical at this stage to build teachers' confidence and trust about the innovations.

Instructional practices. The early technology adoption process at Kendon was "idea sharing" strategy among peers. The early adopters practiced cooperative teaching and learning styles. Team teaching and small group writing projects practiced by these two teachers and their students started to shift the "individual" to "group" instructional processes in these classrooms.

Sustainability. Given the fact that the school still needed more equipment to attract more teachers, that the external agents were the pivot of the innovations, and that the student-centered approach

was still maintained, the sustainability of the innovations was still questionable. However, demonstration of personal and professional interests, the new technology skills acquired as well as the leadership role played by these early adopters were indications of greater sustainability of the innovations.

Phase III: Early Majority Adopters (1992/93). The following are the lessons learned at this phase.

Diffusion decisions. The pace of adoption perceived in the 1992/93 school year was relatively slow. In general, most of the teachers indicated that they did not receive any substantial technology training in their college education. This lack of technology experience initially created fears (posed problems) for some teachers. This finding confirms that of Collins (1987) that since teachers typically teach as they were taught, upgrading the technological skills of education faculty is an essential first step for preparing technologically literate entry-level teachers. This necessitated new approaches to implementation strategies. Staff development and technical support strategies were emphasized. This move to teacher-centered approach was greeted with more teacher participation in technology programs and activities. Teachers began to assume new technology roles in the school. For example, all major technology decisions were taken by teachers instead of the technology group. Teachers began to consolidate ideas and expertise, thus indicating that the implementation process was moving gradually from individual to small group, and then to large group activities. In other words, Kendon technology diffusion process continued to follow a "bottom-up" approach.

Instructional practices. The fact that a student-centered approach was still maintained but with maximum teacher guidance, both discovery and guided learning were very common in Kendon classrooms. The combination of these two instructional processes

shifted "student-technology" interactive process to "teacher-technology-student" interactive processes.

Sustainability. The external agents continued to initiate and support many class technology activities and these activities were mainly centered on students. In addition, no new equipment was received that school year to enhance hands-on activities. All these factors implied that sustainability of the innovations were still questionable.

Phase IV: Late Majority Adopters (1993/94). The lessons learned at this phase are described as the following.

Schoolwide diffusion. The 1993/94 school year marked a tremendous change in the history of Kendon technology implementation programs over the past four years, particularly in equipment, staff development, instruction, and general perceptions on the dynamics of the school system. The sharp increase in the number of computers (i.e., from 11 to 51) resulted in schoolwide adoption of computers in the classrooms and the computer teaching laboratory. The emphasis on a student-centered was shifted to a teacher-centered approach. The particular attention given to in-service training and technical assistance motivated all Kendon teachers and students to effectively use the technology as an instructional tool.

Instructional practices. The schoolwide technological innovations brought new instructional challenges to teachers. All Kendon teachers got involved in collaborative teaching, therefore, one-on-one, and small and large group instructional practices became common in Kendon classrooms. In addition, the traditional student classroom seatwork was supported by practical or real world problem-solving using computers. For instance, community business partners became more involved in Kendon instructional

programs. More specifically, it was amazing to see students in two 4th grade classrooms talking with their bank partners about banking operations as well as working with them as bank tellers at the computer terminals. In addition, the students used the classroom telecommunication workstations to search for information from the main bank.

Sustainability. The schoolwide applications of computers in the curriculum had many hopes. For instance, the "bottom-up" approach adopted in the school, the shift from student-centered to teacher-centered approach, and the 40 computers and network management in-service training offered by the School District were clear evidence of sustainability of technology applications in the curriculum. However, for the fact that university collaborators were the major providers of technical assistance to teachers and students, sustainability of the innovations remained a potential problem until the School District assumes greater financial responsibility for the support which is needed.

What the Participants Say about Changing Patterns of Technology Leadership

Over the past five years, the school principal, a few Kendon teachers, and Michigan State University collaborators were classified as technology leaders. The Lansing School District, Kendon parents, and community business partners were classified as followers.

Roles and Influences of Technology Leaders

The school administrator (internal agent). The participants indicated that the school principal, has been very supportive, committed, and dedicated to goals and needs of technology in the lines of teachers and students. She has always been a forerunner in the school technology efforts. She is aware and understands the impacts of technology on present and future instructional activities.

She promotes the technology ideas with emphasis on needs. All her actions are being accompanied with examples, motivations, enthusiasm, cooperation, openness, and self- confidence.

Kendon faculty (internal agent). The study indicated that teachers were very receptive to the technology plan despite some pessimistic views manifested in the 1989/90 and 1991/92 school years. They worked cooperatively, accommodated and dedicated to the school-wide technology programs during 1993/94 school year. Peer mentoring or collaborative efforts as well as personal and professional interests had been the cornerstone to teachers general adoption of Kendon technology implementation plan.

Technology managers (internal agents). The designation of two teachers, by the teachers themselves, as network managers had positive impacts on the implementation process. The special inservice training which they received from the School District, their personal and professional consciousness, and commitments all have contributed to staff development and the subsequent school-wide adoption of the technology implementation. Despite those efforts, the participants realized that these network managers needed more time to work out computer problems. Equally, they needed monetary incentives or other compensation for the services.

University collaborators (external agents). The technical expertise, self and professional commitments of Michigan State University collaborators and material incentives from PDS and MPNE had been very instrumental in getting the technology plan in place. However, Kendon teachers expected more regular visits or follow-ups of Michigan State University faculty members responsible for the various PDS projects at Kendon.

Roles and Influences of Technology Followers

The school district (external agent). Regarding the top administrators, the study indicates the School District was highly supportive in words but slow in actions during the period between 1989/90 and 1992/93 school years. However, in 1993/94 school year, the District's grant of 40 microcomputers and encouragement to teachers' efforts had a very positive impact on the innovations. The participants felt the District Office and the school need to work more closely to sustain the technological innovations at Kendon.

Kendon parents (external agents) Between 1989-92, Kendon parents did not play any significant role and that they did not have strong influence on the implementation. However, between 1992/93 and 93/94 school years, those who served on the School Improvement Team constructively worked with Kendon faculty on the technology plan. As they become more involved with technology programs and with more brainstorming from the staff, they began to gain more influence on the technology plan.

Community business partners (external agents). The financial and personnel support systems from the local credit union had, to some extent, influenced the technology program. Their support and participation in some classrooms enhanced students' understanding of real world applications of the subject-matter such as mathematics applications in banking. Among the leaders, between 1989/90-1992/93, the school principal was classified as the key technology leader. The study reveals that the school principal has been very supportive, committed, and dedicated to goals and needs of technology in the lines of teachers and students. She has always been a forerunner in the school technology efforts. She is aware and understands the impacts of technology on present and future instructional activities. She promotes the technology ideas with emphasis on needs. All her actions are being accompanied with examples, motivations, cooperation, and self confidence.

Shifting Roles of Leaders and Followers.

Upon the designation of network managers in 1993/94 school year, the key technology leadership role shifted from the school principal to the network managers. In addition, some of the teachers and university collaborators' influences shifted to the network managers. Interestingly, not only some of the teachers' influences shifted to the two groups (i.e., key technology leaders), but also the overall beliefs, expectations, and instructional roles changed direction. The participants' perceived an increased shift of positive influences from the past (1989/90-1992/93) to present (1993/94) by all groups within the school system, except the School District which showed decreased influence on the technology implementation. This may imply that both leaders and followers, with the exception of Lansing School District, began to assume shared responsibilities which influenced the general adoption of technology in the school. Such shifts support the statement by Fullan (1993) that to achieve change in the classroom, administrative roles and responsibilities need to shift at the school, district, and state levels. This kind of peer-mentoring system supports the argument by Fullan & Hargreaves (1991) that participatory or collaborative site-based management is the answer to teachers' anxiety. Such in-house support systems also supports the view of Wenid and Matthews (1983) that if technology is to work, it must be supported by all personnel within the school system.

Characteristics specific to Kendon technology leadership role.

The major characteristics of the leaders identified as high were group assistance, personal assistance, motivational strategies, and rich ideas forerunners with strong communication skills. Monitoring strategies and the role of some leaders as front-runners were identified as low among the leaders. In addition to those high and low attributes, the participants noted that the leaders showed confidence, enthusiasm, encouragement, hard work, open-mindedness, and commitment.

The participants noted that the technology leaders expected more time and equipment for teachers to learn and master the technology in order to effectively use the technology to enhance teaching and learning in the classroom. Again, the leaders expected Kendon teachers' teamwork or co-teaching to be a model for technological innovations within schools.

The study indicated that more people got involved at development, implementation, and evaluation stages in the 1993/94 school year, thus augmenting the shared responsibilities among technology leaders and followers. This was consistent with the perceived shared influences of technology leaders and followers. The dynamics of Kendon leadership role confirms the conditions of dynamic complexity by Serge (1990) that one needs a good deal of reflective experience before one can form plausible vision; and that shared vision, which is essential for success of change, must evolve through the dynamic interaction of organizational members and leaders.

What the Participants Say about Changing Perceptions of Educational Technology

The extent to which the participants perceived Kendon teachers' beliefs, expectations, adoption of technology, and the impacts of technology on instruction are discussed in the following sessions.

Perceived Teachers' Beliefs

The participants perceptions of Kendon teachers' beliefs shifted their locations in the past (1989/90-1993/94) to relatively high locations in the 1993/94 school year. They perceived that teachers' beliefs in technology moved to a new direction in 1993/94 school year and this highly affected the implementation process. According to them, teachers' beliefs in technological innovations were principally based on their prior knowledge, experience with the technology, and personal commitments. Teachers believed that

technology would be helpful if it is used to reinforce but not to replace traditional instruction.

Perceived Teachers' Expectations

The participants' perceptions of teachers expectations of more technical support, inservice technology training programs before effectively integrating these modern instructional tools into the curriculum, and more team work during the implementation process shifted from their locations in the past (1989/90 -1992/93) in approximately the same direction to their locations in the 1993/94 school year. The participants' perceived that teachers expected more team work. This finding supports the argument by Fullan & Hargreaves (1991) that participatory or collaborative site-based management is the answer to teachers' anxiety. Such in-house support systems also supports the view of Wenid and Matthews (1983) that if technology is to work, it must be supported by all personnel within the school system. Preservice and inservice technology training, technical support services, and time for technology activities were some of the other perceived expectations. These issues confirm the OTA (1988) findings that, some barriers to greater use of technology in our schools are mainly associated with lack of equipment, inadequate or inappropriate training, and teachers' anxiety about new technology. One important observation was time factor. Over the past five years, time constraints or limitations remained unchanged. Time to learn and master these new teaching tools has always been a major concern of the teachers. Some teachers expected a school policy that would stipulate the assessment of organizational culture of the school and the impacts of technology on instruction.

Teachers' Adoption of Technology

The participants' opinions about the extent to which curriculum called for the use of technology, the extent to which teachers applied technology in the curriculum and in different

content areas, and how teachers felt comfortable using technology shifted in the past to one direction in 1993/94 school year. The participants stated that the pace at which teachers adopted the technology was gradual or slow but that gave them enough time to learn about the technology. The study revealed that Kendon teachers in general found it difficult initially to adjust to the technology. This was mainly due to lack of self confidence, skills, and knowledge. Despite the general improvement of teachers' computer competency in the 1993/94 school year, there is still more room for improvement in order to effectively integrate the technology in the curriculum.

Impacts of Technology on Instruction

The participants' perceptions of technological innovations and quality of instruction changed gradually each year, from 1989/90 to 1992/93 school years. These perceptions shifted sharply in the 1993/94 school year. The participants also felt instruction would be highly affected if the number of the computers in the school are increased or decreased. In general all the participants were optimistic that doubling the number of computers would help teachers to accommodate both individual and group instruction.

Kendon Technology as a Model

The participants' perceptions of technology as a model, from 1989/90 through 1993/94 school years, shifted in the directions of the kind of technological changes perceived in the same school years. The study indicated that, during the 1989/90 and 1992/93 school years, Kendon technology could not be considered as "Model" for the fact that the school was not able to move the technology plan ahead fast enough and also the cooperation among the School District, Michigan State University, and Kendon faculty was very weak. However, in the 1993/94 school year, all the participants noted that certain aspects of Kendon technology programs could be disseminated as model such as team teaching, technical support

systems from within the school (i.e., network managers), and computer teaching laboratory facility, a place where both students and teachers receive immediate assistance from knowledgeable support persons.

What I Learned from the Computer Teaching Laboratory.

During the computer laboratory sessions four significant events drew my attention that were closely observed for a period of six months. They were: Modes of Learning, Teacher Laboratory Preparation, Technical Matters, and Management problems.

Regarding modes of learning, individual, cooperative, teacher guided, and student control learning processes were common. Students in the upper grades (i.e., 4th and 5th) worked more independently than the rest. These students had control of their learning. Both individual and cooperative learning skills were highly common with 2nd and 3rd grade students. The skilled students finished their assignments in short period of time and then helped other students as peer computer assistants. The unskilled computer users always preferred working in small groups of two or three. The lower grade students (i.e., 1st and Kindergarten) enjoyed working in groups especially with multimedia program (Kid Works 2). These lower grade students needed more guided instruction from the teacher or computer assistants. These students were more disciplined in the laboratory than their seniors in other classes. The major discipline problems were found among the 2nd and 3rd grade classes.

Some novice technology teachers often became frustrated due to misuse of certain computer functions or commands. With a sense of encouragement to those teachers, the principal frequently came to work with them in the laboratory as way of discovering new things together about these instructional tools. Some teachers preferred discussing their technology needs directly with the network managers or other teachers instead of Michigan State University technology support persons. In general software and

hardware were of less problematic. However, insufficient laboratory time allocation was a major concern of the teachers. In general, teachers and students' laboratory attitudes were quite positive, despite minor frustrations and concerns.

Recommendations for Educational Practice

Lessons learned from this study, in addition to my educational technology experiences in the United States, especially at Michigan State University and Kendon Elementary PDS, Audio Visual Center of University of Sorbonne, Paris and professional experience in Cote d'Ivoire, Africa lead me to make the following conclusions and recommendations.

1. *Teacher and student empowerment.* Considering the relative slow pace of diffusion of Kendon technological innovations, any school system planning to integrate technology in the curriculum needs to consider the adoption of student-centered and teacher-centered approaches to the implementation process. Empowering both students and teachers would not only accelerate the rate of adoption but may likely encourage the combination of discovery and guided instructional practices.

2. *System dynamics based on shared vision.* For any effective school and college technology implementation, shared vision, particularly among site-based participants, need to be emphasized to ensure strong internal dynamics within the school system. Again, as technology is not self-implementing and also continues to change, educational technology planners or proponents need to solicit the mutual collaboration of external service providers such as university and community partners, school parents, and school districts. Such alliance and administrative responsibilities need to be built on shared vision and equal decision making powers. Too much control from within and outside the school

system tends to cause teachers' (end-users) resistance to adoption and/or slows down the implementation process.

3. *Professional development strategies.* Many teachers currently lack the necessary skills to effectively apply technology in classrooms and the competing demands on time make it difficult for teachers to master the technology for classroom applications. Despite the reallocation time being practiced in some schools, particularly PDSs, to help teachers improve their technology competency, we experience that there is still room for teachers to master the tools for effective and efficient implementation in the classrooms. It is, therefore, suggested that School Improvement Team, School District, State, and National Education policy makers as well as school business partners need to provide opportunities for teachers to participate in technology workshops and Summer Technology Programs. Such training should be accompanied by monetary and/or other related incentives. Again, considering the relative importance of this technology in our educational system, it is suggested that computer competency courses need to be introduced as part of the "Core Courses" in all educational institutions that prepare students for future classrooms.

4. *Building potential trust.* Schools using or attempting to introduce technology need to consider some specific aspects of Kendon technology leadership roles, particularly for pedagogical and organizational management strategies. These include hard work, open-mindedness, commitment, rich ideas, personal assistance, group assistance, professional and self consciousness, confidence, enthusiasm, strong communication skills, and actions accompanied by examples and encouragement, and motivational strategies.

5. *Sustainability of technological innovations.* Over the past five years majority of Kendon teachers continue to receive technical support from Michigan State University. The fear that the departure

or withdrawal of Michigan State University services may likely break down the technological innovations suggests that more teachers need to be trained to assume technical roles. For sustainability of the innovations, the school system need to ensure that technical and pedagogical innovations advance together so as to empower all classroom teachers to take total control of the technological innovations.

Suggestions for Further Research

1. Each classroom at Kendon has two computers in addition to the computer teaching laboratory. After one year of schoolwide adoption of technology, there is a need to conduct a formal experimental or quasi experimental studies to measure the kinds of impacts that the technology has on instruction in terms effectiveness, efficiency, and appeal.

2. All Kendon parents and Community business partners have embraced the schoolwide technology programs. What we do not know at Kendon is the extent to which these instructional tools may promote in and out of school learning. Two studies could be conducted in this regard.

a. Kendon Parent-Teacher-Student Computer Club need to be formally launched so as to provide opportunities for parents to work with their children in the school. My assumption is that, using technology to engage parents in their children's typical school instructional projects would permit educational researchers to measure the extent to which such instructional practice would enhance or motivate students' "in and out" of school learning.

b. Another study could be conducted to measure the extent to which the applications of technology in projects such as Kendon-CASE Credit Union Partnership could contribute to students' understanding of real world problem solving. In connection with this inquiry, it would be important to measure the effects of student-technology (discovery) and teacher-technology-student (guided) interactive processes on instruction.

The first adoption of technological innovations was based on the personal decision, volunteerism, and enthusiasm, i.e., the first adoption was a modest "bottom-up" start which was well publicized within the school. The early technology adoption process at Kendon was "idea sharing" strategy among peers. Team teaching and small group writing projects practiced by the early adopters started to shift the "individual" to "group" instructional processes in some classrooms.

The pace of teachers' adoption of technological innovations was very slow due to limited equipment, teacher's lack of expertise in technology, and student-centered approach to the implementation process. The sustainability of the innovations during this first phase was a major problem.

Emphasis placed on staff development and technical support strategies, the shift from student-centered to teacher-centered approach, and the 40 computers and network management in-service training offered by the School District during 1993/94 school year were greeted with more teacher participation in technology programs and activities. This mass participation and the "bottom-up" approach adopted in the school were clear evidence of sustainability of technology applications in the curriculum.

APPENDICES

APPENDIX A

SELF-ADMINISTERED SURVEY & STRUCTURED INTERVIEW (PARENT & BUSINESS QUESTIONNAIRE)

A. System Influence & Leadership

Very High	(VH) = 5
High	(H) = 4
Moderate	(M) = 3
Low	(L) = 2
Very Low	(VL) = 1
None	(N) = 0

Question 1:
Over the four school years (1989/1990 -1992/1993), what did you see as the degree of influence of the following individuals and group of individuals on Kendon technology programs?

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Lansing School District	5	4	3	2	1	0
ii. University Technology Personnel	5	4	3	2	1	0
iii. Partnership (Business)	5	4	3	2	1	0
iv. Parents	5	4	3	2	1	0
v. Principal	5	4	3	2	1	0
vi. School Network Manager	5	4	3	2	1	0
vi. Teachers	5	4	3	2	1	0

Please, on the next page explain each of your answers in more detail.

i. Lansing School District:
ii. University Technology Personnel
iii. Partnership (Business)
iv. Parents
v. Principal
vi. School Network Managers
vii. Teachers

Question 2
During this current year (1993-1994), what do you see as the degree of influence of the following individuals and group of individuals on Kendon technology programs?

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Lansing School District	5	4	3	2	1	0
ii. University Technology Personnel	5	4	3	2	1	0
iii. Partnership (Business)	5	4	3	2	1	0
iv. Parents	5	4	3	2	1	0
v. Principal	5	4	3	2	1	
vi. School Network Manager	5	4	3	2	1	0
vii. Teachers	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Lansing School District:
ii. University Technology Personnel
iii. Partnership (Business)
iv. Parents
v. Principal
vi. School Network Managers
vii. Teachers

B. Personal Role & Curriculum Demands

Question 3.
Over the four school years (1989/1990 - 1992/1993), to what extent did you play a role in Kendon technology programs during the:

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Planning stage	5	4	3	2	1	0
ii. Development stage	5	4	3	2	1	0
iii. Implementation stage	5	4	3	2	1	0
iv. Evaluation stage	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Planning stage
ii. Development stage
iii. Implementation stage
iv. Evaluation stage

Question 4.
During this school year (1993-1994), to what extent do you play a role in Kendon technology programs:

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Planning stage	5	4	3	2	1	0
ii. Development stage	5	4	3	2	1	0
iii. Implementation stage	5	4	3	2	1	0
iv. Evaluation stage	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Planning stage
ii. Development stage
iii. Implementation stage
iv. Evaluation stage

Question 5.
Over the four school years (1989/1990- 1992/1993), to what extent did teachers' beliefs about technology affect technology implementation in the classroom?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain some specific beliefs in more detail.

Question 6
During this school year (1993-1994), to what extent do teachers' beliefs about technology affect technology implementation in the classroom and in the computer laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain some specific beliefs in more detail.

Question 7.
Over the four school years (1989/1990-1992/1993), to what extent did the school curriculum call for the use of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 8.
During this school year (1993-1994), to what extent does the school curriculum call for the use of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

C. Constraints, incentives & Expectations

Question 9.
Over the four school years (1989/1990 - 1992/1993), to what extent did teachers expect technological support of their own uses of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain the kind of expectations in more detail.

Question 10.
During this school year (1993-1994), to what extent do teachers expect technological support of their own uses of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain the kind of expectations in more detail.

Question 11.
Over the four school years (1989/1990-1992/1993), to what extent did teachers perceive **positive influences** (incentives)on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences were in more detail.

Question 12.
Over the four school years (1989/1990-1992/1993), to what extent did teachers perceive **negative influences** (constraints) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences were in more detail.

Question 13
During this school year (1993-1994), to what extent do teachers perceive **positive influences** (incentives) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences are in more detail.

Question 14
During this school year (1993-1994), to what extent do teachers perceive negative influences (constraints) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences are in more detail.

D. Preservice & Inservice Technology Training

Question 15.
Over the four school years (1989/1990-1992/1993), to what extent did teachers' preservice training in technology, if any, affect their technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 16.
During this school year (1993-1994), to what extent is teachers' preservice training in technology, if any, affecting their technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 17.
Over the four school years (1989/1990-1992/1993), to what extent did teachers' inservice training in technology, if any, affect their technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 18.
During this school year (1993-1994), to what extent is teachers' inservice training in technology, if any, affecting their technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

E. Time Factor

Question 19.
Over the four school years (1989/1990-1992/1993), to what extent did competing demands on time make it difficult for teachers technology assignments at Kendon?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 20.
During this school year (1993-1994), to what extent are competing demands on time making it difficult for teachers' technology assignments at Kendon?

VH	H	N	L	VL	NI
5	4	3	2	1	

(Please, check one only)

Please, explain your answer in more detail.

F. Perceptions

Question 21.
Over the four school years (1989/1990-1992/1993), to what extent did you see technology applications in the classrooms?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 22.
During this school year (1993-1994), to what extent do you see technology applications in the classrooms and in the computer laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 23
Over the four school years (1989/1990-1992/1993), to what extent did teachers integrate technology into **content (subject-matter)** areas?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 24
During this school year (1993-1994), to what extent do teachers integrate technology into **content (subject-matter)** areas?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 25
Over the four school years (1989/1990-1992/1993), to what extent did teachers feel **more comfortable** using computers to teach the subject area in which she/he majors?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 26
During this school year (1993-1994), to what extent do teachers feel more comfortable using computers to teach the subject area in which she/he majors?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 27
Over the four school years (1989/1990-1992/1993), to what extent did technology influence teachers' team or collaborative work?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 28
During this school year (1993-1994), to what extent does technology influence teachers' team or collaborative work?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 29.
Over the four school years (1989/1990-1992/1993), to what extent did you perceive changes in instructional quality over time through technology applications?

		VH	H	M	L	VL	N
		5	4	3	2	1	0
		(Please, check one only)					
i.	1989-1990	5	4	3	2	1	0
ii.	1990-1991	5	4	3	2	1	0
iii.	1991-1992	5	4	3	2	1	0
iv.	1992-1993	5	4	3	2	1	0

Please, explain each of your answers in more detail
i. 1989-1990
ii. 1990-1991
iii. 1991-1992
iv. 1992-1993

Question 30.
During this school year (1993-1994), to what extent do you perceive changes in instructional quality through technology applications?

VF	F	N	S	VS	NC
5	4	3	2	1	0
(Please, check one only)					

Please, explain your answer in more detail.

Question 31.
Over the four school years (1989/1990-1992/1993), to what extent did you consider Kendon Technology Plan as a model for the use of technology in schools?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 32.
During this school year (1993-1994), to what extent do you consider Kendon Technology Plan as a model for the use of technology in schools?

VF	F	N	S	VS	NC
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 33.
To what extent would instruction be affected at Kendon if Lansing School District decides to **withdraw** half of the computers from the classrooms and the laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 34.
To what extent would instruction be affected at Kendon if Lansing School District decides to double (or add more) the number of computers in the classrooms and the computer laboratory?

VH	H	N	L	VL	NI
5	4	3	2	1	

(Please, check one only)

Please, explain your answer in more detail.

-----Question Number: (Please, check one only)
Status: Staff, Parent, Partnership

School Improvement Team/Core Team: Member___
Non Member____

----------THANK YOU FOR YOUR PARTICIPATION----------

APPENDIX B

SELF-ADMINISTERED SURVEY & STRUCTURED INTERVIEW TEACHER QUESTIONNAIRE

A. System Influence & Leadership

Very High	(VH) = 5
High	(H) = 4
Moderate	(M) = 3
Low	(L) = 2
Very Low	(VL) = 1
None	(N) = 0

Question 1:
Over the four school years (1989/1990 -1992/1993), what did you see as the degree of influence of the following individuals and group of individuals on Kendon technology programs?

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Lansing School District	5	4	3	2	1	0
ii. University Technology Personnel	5	4	3	2	1	0
iii. Partnership (Business	5	4	3	2	1	0
iv. Parents	5	4	3	2	1	0
v. Principal	5	4	3	2	1	0
vi. School Network Managers	5	4	3	2	1	0
vii. Teachers	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Lansing School District:
ii. University Technology Personnel
iii. Partnership (Business)
iv. Parents
v. Principal
vi. School Network Managers
vii. Teachers

Question 2
During this school year (1993-1994), what do you see as the degree of influence of the following individuals and group of individuals on Kendon technology programs?

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Lansing School District	5	4	3	2	1	0
ii. University Technology Personnel	5	4	3	2	1	0
iii. Partnership (Business)	5	4	3	2	1	0
iv. Parents	5	4	3	2	1	0
v. Principal	5	4	3	2	1	0
vi. School Network Manager	5	4	3	2	1	0
vi. Teachers	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Lansing School District:
ii. University Technology Personnel
iii. Partnership (Business)
iv. Parents
v. Principal
vi. School Network Managers
vii. Teachers

B. Personal Role & Curriculum Demands

Question 3.
Over the four school years (1989/1990 - 1992/1993), to what extent did you play a role in Kendon technology programs during the:

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Planning stage	5	4	3	2	1	0
ii. Development stage	5	4	3	2	1	0
iii. Implementation stage	5	4	3	2	1	0
iv. Evaluation stage	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Planning stage
ii. Development stage
iii. Implementation stage
iv. Evaluation stage

Question 4.
During this school year (1993-1994), to what extent do you play a role in Kendon technology programs:

	VH	H	M	L	VL	N
	5	4	3	2	1	0
	(Please, check one only)					
i. Planning stage	5	4	3	2	1	0
ii. Development stage	5	4	3	2	1	0
iii. Implementation stage	5	4	3	2	1	0
iv. Evaluation stage	5	4	3	2	1	0

Please, explain each of your answers in more detail.

i. Planning stage
ii. Development stage
iii. Implementation stage
iv. Evaluation stage

Question 5.
Over the four school years (1989/1990- 1992/1993), to what extent did your **beliefs** about technology affect technology implementation in the classroom?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain some specific beliefs in more detail.

Question 6
During this school year (1993-1994), to what extent do your **beliefs** about technology affect technology implementation in the classroom and in the computer laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain some specific beliefs in more detail.

Question 7.
Over the four school years (1989/1990-1992/1993), to what extent did the school **curriculum** call for the use of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 8.
During this school year (1993-1994), to what extent does the school curriculum call for the use of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

C. Constraints, incentives, & Expectations

Question 9.
Over the four school years (1989/1990 - 1992/1993), to what extent did you expect technological support of your own uses of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain the kind of expectations in more detail.

Question 10.
During this school year (1993-1994), to what extent do you expect technological support of your own uses of computers?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain the kind of expectations in more detail.

Question 11.
Over the four school years (1989/1990-1992/1993), to what extent did you perceive **positive influences** (incentives) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences were in more detail.

Question 12.
Over the four school years (1989/1990-1992/1993), to what extent did you perceive **negative influences** (constraints) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences were in more detail.

Question 13
During this school year (1993-1994), to what extent do you perceive **positive influences** (incentives) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences are in more detail.

Question 14

During this school year (1993-1994), to what extent do you perceive negative influences (constraints) on Kendon technology implementation?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain what the influences are in more detail.

D. Preservice & Inservice Technology Training

Question 15.

Over the four school years (1989/1990-1992/1993), to what extent did your **preservice training** in technology, if any, affect your technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 16.

During this school year (1993-1994), to what extent is your **preservice training** in technology, if any, affecting your technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 17.

Over the four school years (1989/1990-1992/1993), to what extent did your **inservice training** in technology, if any, affect your technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 18.

During this school year (1993-1994), to what extent is your **inservice training** in technology, if any, affecting your technology uses for instruction?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

E. Time Factor

Question 19.

Over the four school years (1989/1990-1992/1993), to what extent did competing **demands on time** make it difficult for your technology assignments at Kendon?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 20.
During this school year (1993-1994), to what extent are competing demands on time making it difficult for your technology assignments at Kendon?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

F. Perceptions

Question 21.
Over the four school years (1989/1990-1992/1993), to what extent did you see technology applications in the classrooms?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 22.
During this school year (1993-1994), to what extent do you see technology applications in the classrooms and in the computer laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 23
Over the four school years (1989/1990-1992/1993), to what extent did you integrate technology into **content (subject-matter)** areas?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 24
During this school year (1993-1994), to what extent do you integrate technology into **content (subject-matter)** areas?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 25
Over the four school years (1989/1990-1992/1993), to what extent did you feel **more comfortable** using computers to teach the subject area in which you major?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 26
During this school year (1993-1994), to what extent do you feel more comfortable using computers to teach the subject area in which you major?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 27
Over the four school years (1989/1990-1992/1993), to what extent did technology influence teachers' team or collaborative work?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 28
During this school year (1993-1994), to what extent does technology influence teachers' team or collaborative work?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 29.
Over the four school years (1989/1990-1992/1993), to what extent did you perceive changes in instructional quality over time through technology applications?

		VH	H	M	L	VL	N
		5	4	3	2	1	0
		(Please, check one only)					
i.	1989-1990			5	4	3	2
	1 0						
ii.	1990-1991			5	4	3	2
	1 0						
iii.	1991-1992			5	4	3	2
	1 0						
iv.	1992-1993			5	4	3	2
	1 0						

Please, explain each of your answers in more detail
i. 1989-1990

ii. 1990-1991

iii. 1991-1992

iv. 1992-1993

Question 30.
During this school year (1993-1994), to what extent do you perceive changes in instructional quality through technology applications?

VF	F	N	S	VS	NC
5	4	3	2	1	0
(Please, check one only)					

Please, explain your answer in more detail.

Question 31.
Over the four school years (1989/1990-1992/1993), to what extent did you consider Kendon Technology Plan as a model for the use of technology in schools?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 32.
During this school year (1993-1994), to what extent do you consider Kendon Technology Plan as a model for the use of technology in schools?

VF	F	N	S	VS	NC
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail

Question 33.
To what extent would instruction be affected at Kendon if Lansing School District decides to **withdraw** half of the computers from the classrooms and the laboratory?

VH	H	M	L	VL	N
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

Question 34.
To what extent would instruction be affected at Kendon if Lansing School District decides to double (or add more) the number of computers in the classrooms and the computer laboratory?

VH	H	N	L	VL	NI
5	4	3	2	1	0

(Please, check one only)

Please, explain your answer in more detail.

(Please, check one only)

QUESTION NUMBER: Status: Teacher, Parent, Partnership

School Improvement Team/Core Team: Member___
Non Member____

----------THANK YOU FOR YOUR PARTICIPATION----------

APPENDIX C

Formative Evaluation

March 25, 1994

Dear Colleague,

In an effort to better serve the instructional and personal needs of our teachers and students through computer applications, the Kendon Technology Group requests your strong participation in this "Mini Survey".

Please, feel free to let us know your perceptions, needs, expectations, and recommendations concerning the computer applications, training, and management. This is a cooperative, "Kendon Family", effort and your input is indispensable.

1. Your comments on the current software in the Computer Teaching Lab and in the classrooms?

2. In what disciplines (e.g., Math, Social studies, science, etc.,) do you need more software or technology support?

   Your suggestions of specific software applications preferred:

3. Besides your competency in computers, what other technology help or training do you need (e.g., Software for data analysis and Hypercard)?

4. What type of training and services do you expect from the network managers?

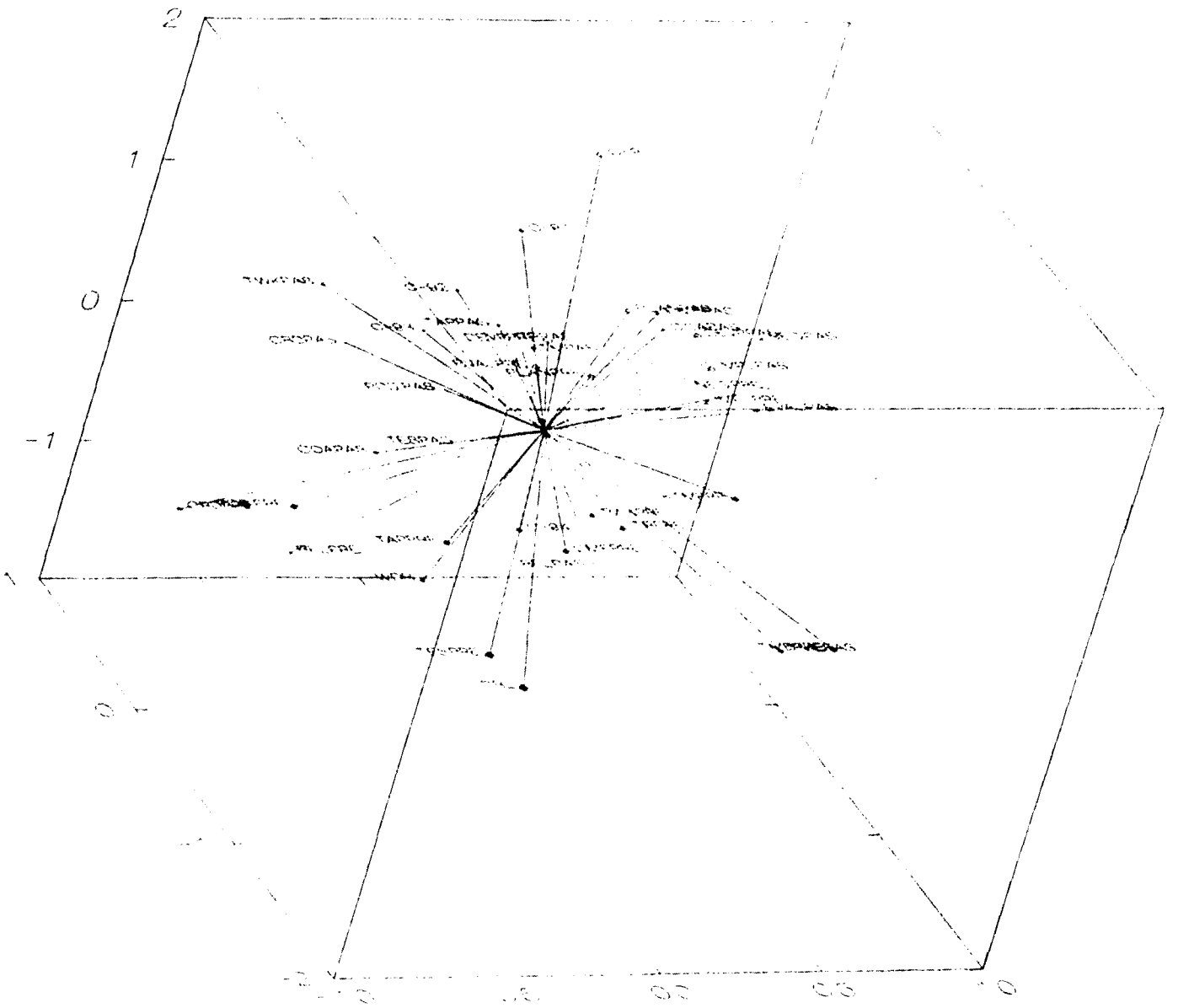
5. What motivations do you anticipate from the administration or the principal with regard to the current uses of computers at Kendon?

APPENDIX D

COORDINATES FOR FIGURE I

VARPAS/PRE	AXE1	AXE2	AXE3
LSDPAS	0.630	0.430	-0.320
MSUPAS	-0.200	-0.520	0.030
BUSPAS	1.080	-O.380	-0.410
PARPAS	1.330	0.530	-0.070
PRPPAS	-0.740	0.160	-0.230
NWMPAS	0.330	-1.110	-0.340
TEAPAS	-0.510	0.150	-0.390
LSDPRE	0.350	0.370	0.220
MSUPRE	-0.520	0.020	0.480
BUSPRE	0.760	-0.140	0.460
PARPRE	0.410	0.440	0.470
PRPPRE	-0.730	-0.150	0.440
NWMPRE	-0.980	-0.730	0.060
TEAPRE	-1.220	0.930	-0.400
	Vertical	Left Horizc	

APPENDIX E



APPENDIX F

COORDINATES FOR FIGURES II, IVA, & IVB

FIGURE II

VARPAS/PRE	AXE1	AXE2	AXE3
PLANPAS	1.120	-0.300	0.020
DEVPPAS	1.040	-0.400	0.210
IMPLPAS	0.980	-0.590	0.320
EVALPAS	0.810	-0.730	0.320
PLANPRE	0.900	-0.560	-0.150
DEVPPRE	1.160	-0.570	-0.320
IMPLPRE	0.850	-0.710	0.170
EVALPRE	0.990	-0.590	-0.340
POSIPAS	-0.110	0.430	-0.160
NEGIPAS	0.380	0.290	0.720
POSIPRE	-0.940	0.420	-0.520
NEGIPRE	0.020	0.300	0.800

FIGURE IVA

BELPAS	-0.040	-1.000	-0.150
BELPRE	-0.340	-0.570	-0.910
CRDPAS	0.310	0.330	-0.550
CRDPRE	-0.690	0.140	-0.990
TESPAS	-0.010	-0.090	-0.280
TESPRE	-1.190	-0.450	-0.150
ITRPAS	0.190	0.490	0.020
ITRPRE	-0.770	0.070	0.370
TMEPAS	-0.740	-0.910	0.550
TMEPRE	-0.980	-0.650	0.830
TAPPAS	0.530	0.230	-0.140
TAPPRE	-0.920	0.120	-0.140
COAPAS	0.410	0.330	0.420
COAPRE	-0.670	0.550	-0.260
CMFPAS	0.500	0.360	0.400
CMFPRE	-0.880	0.010	0.190
TWKPAS	0.480	0.600	-0.560
TWKPRE	-0.650	0.040	0.250
	Vertical	Left Horizontal	Right Horizontal

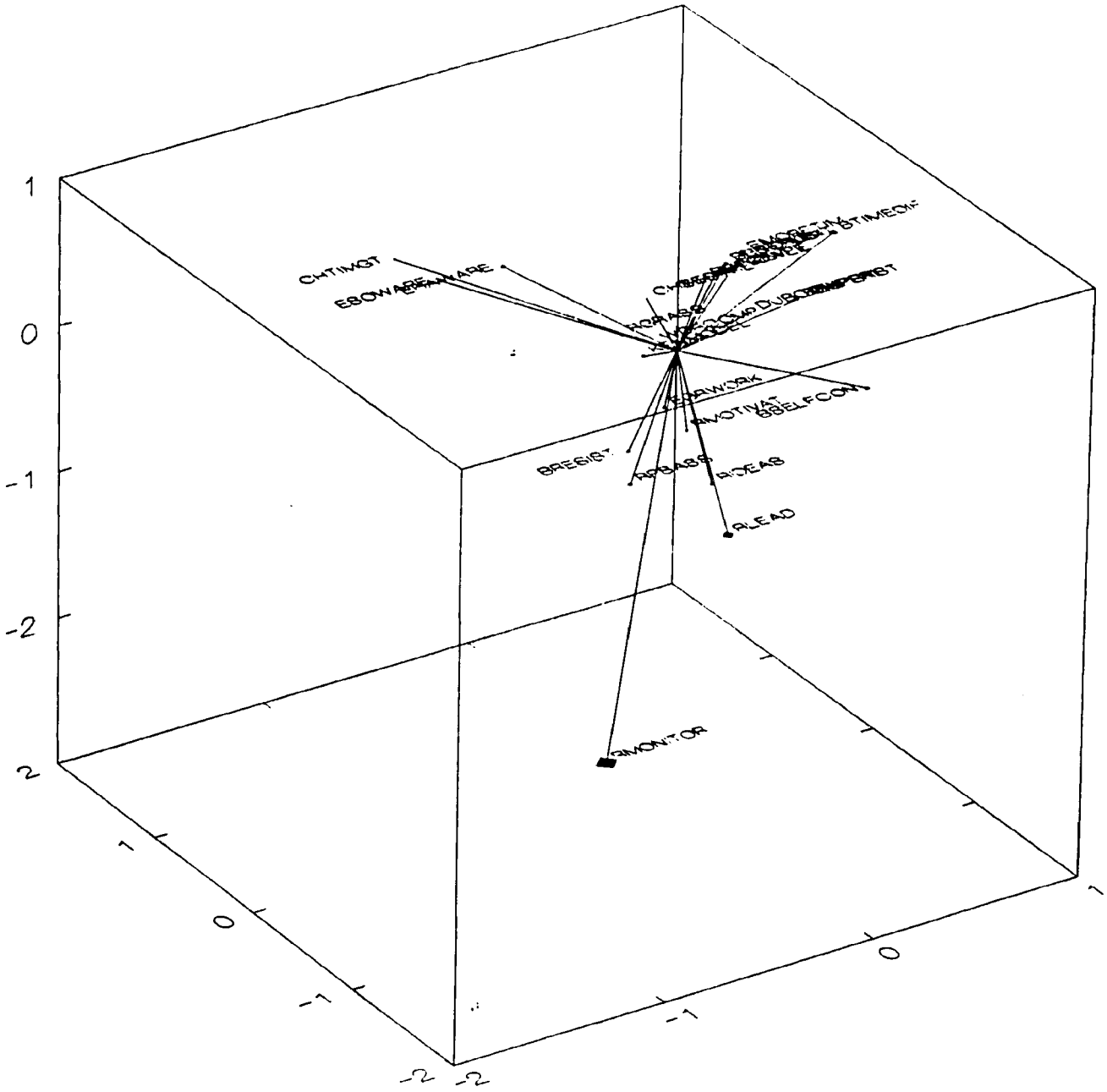
APPENDIX F

FIGURE IVB

VARPAS/PRE	AXE1	AXE2	AXE3
C-90	1.160	0.880	0.300
C-91	0.770	0.710	0.050
C-92	0.420	0.620	-0.130
C-93	0.310	0.430	-0.280
C-94	-0.950	0.250	0.130
KTMPAS	-0.030	0.640	0.140
KTMPRE	-0.910	0.440	0.860
WDR	-0.670	-0.430	-0.420
DBL	-1.220	-0.670	-0.110
	Vertical	Left Horizontal	Right Horizontal

APPENDIX G

Figure III. Full plot representing the attributes of leadership roles.



APPENDIX H

COORDINATES FOR FIGURES IIIA, IIIB, & IIIC

FIGURE IIIA

VARPAS/PRE	AXE1	AXE2	AXE3
RIDEAS	-0.450	-0.760	-0.200
RMOTIVAT	-0.380	-0.270	-0.080
RMONITOR	-2.630	-0.080	-0.340
RLEAD	-1.330	-0.050	0.240
RGRASS	0.170	0.070	-0.230
RPSASS	-0.530	-0.420	-0.420

FIGURE IIIB

VARPAS/PRE	VAR1	VAR2	VAR3
BUSEFUL	0.470	0.050	0.250
BSELFCON	-0.620	-0.020	0.920
BSUPSYST	0.360	-0.350	0.400
BSTDEVPT	0.400	0.060	0.160
BENTHUSI	0.470	0.050	0.250
BEXPERI	0.360	-0.350	0.400
BENCRGMT	0.470	-0.050	0.250
BRESIST	0.410	-1.440	-0.940
BTIMEDIF	0.920	-0.600	0.440

FIGURE IIIC

VARPAS/PRE	VAR1	VAR2	VAR3
EGRWORK	-0.430	0.090	-0.010
EKNOWLE	0.150	0.420	0.380
EMORETIM	0.680	-0.190	0.210
EHAWARE	0.650	0.380	-0.650
ESOWARE	0.760	0.260	-1.010
CHTIMGT	0.070	1.620	-0.570
CHSTDINT	0.130	0.420	0.060
CHTESTYL	0.130	0.420	0.060
KENMODEL	-0.370	0.580	0.130
WDRCOMP	0.060	0.050	-0.080
DUBCOMP	0.100	0.030	0.370
	Vertical	Left Horizontal	Right Horizontal

APPENDIX I

DESCRIPTION OF ACRONYMS & THEMES

QUESTIONNAIRE (SELF-ADMINISTERED SURVEY AND PERSONAL INTERVIEWS

Section A

Questions 1 & 2

LSDPAS: Lansing School District's Past Technology Involvement
LSDPRE: Lansing School District's Present Technology Involvement
UNIPAS: University Collaborators' Past Technology Involvement
UNIPRE: University Collaborators' Present Technology Involvement
BUSPAS: Community Business Partners Past Technology Involvement
BUSPRE: Community Business Partners' Present Technology Involvement
PARPAS: Kendon Parents' Past Technology Involvement
PARPRE: Kendon Parents' Present Technology Involvement
PRPPAS: Kendon School Principal's Past Technology Involvement
PRPPRE: Kendon School Principal's Present Technology Involvement
NWMPAS: Network Managers' Past Technology Involvement
NWMPRE: Network Managers' Present Technology Involvement
TEAPAS: Kendon Teachers' Past Technology Involvement
TEAPRE: Kendon Teachers' Present Technology Involvement

Section B

Questions 3 & 4
PLANPAS: Planning Stage in the Past
PLANPRE: Planning Stage in the Present
DEVPPAST: Development Stage in the Past
DEVPPRE: Development Stage in the Present
IMPLPAS: Implementation Stage in the Past
IMPLPRE: Implementation Stage in the Present
EVALPAS: Evaluation Stage in the Past
EVALPRE: Evaluation Stage in the Present

Questions 5 & 6
BELPAS: Belief in Technology in the Past
BELPRE: Belief in Technology in the Present

Questions 7 & 8
CRDPAS: Uses of Computers in Curriculum in the Past
CRDPRE: Uses of Computers in Curriculum in the Present

Section C

Questions 9-14
TESPAS: Technical Support in the Past
TESPRE: Technical Support in the Present
POSIPAS: Positive Influence in the Past
POSIPRE: Positive Influence in the Present
NEGIPAS: Negative Influence in the Past
NEGIPRE: Negative Influence in the Present

Section D

Questions 15-18
PTRPAS: Impacts of Preservice Technology Training in the Past
PTRPRE: Impacts of Preservice Technology Training in the Present
ITRPAS: Impacts of Inservice Technology Training in the Past
ITRPRE: Impacts of Inservice Technology Training in the Present

Section E

Questions 19 & 20
TMEPAS: Competing Demands on Time in the Past(Time Limitations)
TMEPRE: Competing Demands on Time in the Past (Time Limitations)

Sections F

Questions 19-34
TAPPAS: Technology Applications in the Classrooms in the Past
TAPPRE: Technology Applications in the Classrooms in the Present
COAPAS: Integration of Technology into Content Areas in the Past
COAPRE: Integration of Technology into Content Areas in the Present
CMFPAS: Feeling More Comfortable Using Computers in the Past
CMFPRE: Feeling More Comfortable Using Computers in the Present
TWKPAS: Technology influences on Teachers' Team Work in the Past
TWKPRE: Technology influences on Teachers' Team Work in the Present

C_90: Changes in Instructional Quality in 1989-90 School Year
C_91: Changes in Instructional Quality in 1990-91 School Year
C_92: Changes in Instructional Quality in 1991-92 School Year
C_93: Changes in Instructional Quality in 1992-93 School Year
C_94: Changes in Instructional Quality in 1993-94 School Year

KTMPAS: Kendon Technology as a Model in the Past
KTMPRE: Kendon Technology as a Model in the Present
WDR: Withdrawal of Half of the Computers in the School
DBL: Doubling the Number of Computers in the School

THEMES IDENTIFIED FROM THE QUALITATIVE DATA

Attributes of Technology Leaders' Role

RIDEAS: Using Rich Ideas
RMOTIVAT: Motivational Strategies
RMONITOR: Leading Technology Matters
RGRASS: Active Participation in Group Activities
RPSASS: Personal Assistance Offered to Colleagues (Teachers)
RLEAD: Leaders acting as Leaders or Front-runners

Perceived Beliefs Held by Technology Leaders

BUSEFUL: Technology in Education considered as Useful
BSELFCON: Self Confidence in Technology Applications
BSUPSYST: Importance Attached to Technology Support Systems
BSTDEVPT: Importance Attached to Staff Development
BENTHUSI: Manifestation of Enthusiasm about Technology
BENCRMT: Encouraging Novice Technology Users (Teachers and Students)
BEXPERI: Teachers' Technology Experience or Prior Knowledge
BRESIST: Impacts of Actor's Resistance to Technology
BTIMEDIF: Problems of Time Limitations

Perceived Technology Leaders' Expectations

EGRWORK: Expected More Group Work
EKNOWLE: Users' Prior Knowledge, Experience, or Expertise in Technology
EMORETIM: Expected More Time for Technology Training and Mastery
EHAWARE: Expected More Hardware (Computers) in the Classrooms
ESOWARE: Expected Variety of Software Programs in the Content Areas
CHTIMGT: Changes in Time Management in the Classrooms
CHSTDINT: Changes in Students' Learning Interests
CHTESTYLE: Changes in Teaching Styles
KENMODEL: Kendon Technology Program as a Model
WDRCOMP: Withdrawal of Half of the Computers in the School
DUBCOMP: Doubling the Number of Computers in the School

APPENDIX J

Six Principles for the Design of Professional Development Schools

Principle One	Teaching and learning for understanding. All the school's students participate seriously in the kind of learning that allows you to go on learning for a lifetime. This may well require a radical revision of the school's curriculum and instruction.
Principle Two	Creating a learning community. The ambitious kind of teaching and learning we hope for will take place in a sustained way for large numbers of children only if classrooms and schools are thoughtfully organized as communities of learning.
Principle Three	Teaching and learning for understanding for everybody's children. A major commitment of the Professional Development School will be overcoming the educational and social barriers raised by an unequal society.
Principle Four	Continuing learning by teachers, teacher educators, and administrators. In the Professional Development School, adults are expected to go on learning, too.
Principle Five	Thoughtful long-term inquiry into teaching and learning. This is essential to the professional lives of teachers, administrators, and teacher educators. The Professional Development School faculty working as partners will promote reflection and research on practice as a central aspect of the school.
Principle Six	Inventing a new institution. The foregoing principles call for such profound changes that the Professional Development School will need to devise for itself a different kind of organizational structure, supported over time by enduring alliances of all the institutions with a stake in better professional preparation for school faculty.

Source: Tomorrow's Schools: Principles for the Design of Professional Development Schools. 1990. The Holmes Group, Inc., (p. 7).

APPENDIX K

1994 ANNUAL REPORT

Kendon Elementary School

The Kendon staff is proud to present our annual report which includes our programs, goals, and visions for the future. As we work together to make our school a good place to learn, we invite your participation in all our endeavors because we know "it takes a whole village to raise one child."

School Improvement Process

The Kendon staff in cooperation with the Partnership for New Education established a School Improvement Team to develop policy and programs related to school improvement issues and concerns. Last year its members were Principal Minnie Wheeler-Thomas; staff members Renee Acker, Jan Baker, Nancy Coleman, Bonnie Lacy, Carol Miller, Jo Nelson, David Sauve, Lori Shivley, and Annie Williford; PDS coordinator Tami McGill; and parents Yvonne Hall, Richard Miller, and Kathy Woodman.

The Kendon staff has attempted to build a learning community where all students are taught for understanding, and where the educational faculty progressively assesses its efforts to accomplish this goal. This learning community involves parents, other community members, and educators.

In 1993-94, our work focused on improving the teaching of reading and science and fostering self-esteem. Our efforts also centered on literacy with an emphasis on teaching and learning critical responses that pertain to good children's literature and the development of a computer lab to boost technology skills of students and teachers.

Mission Statement

The mission of Kendon Elementary Professional Development School is to prepare students for the future by working cooperatively with parents, the community, and our educational faculty. Together we will create an organized, supportive learning community. We will accept and accommodate diversity. Our students will become responsible, capable citizens who will use their strong knowledge base to engage in critical thinking and problem-solving for lifelong learning.

Our Goals and Strategies

Reading: Students will be able to read for understanding (inquiry and comprehension). Basal readers, trade books, reading in content areas, Read-A-Thon, and Literature Encounter will all contribute to achieving this goal. We will collect and analyze Curriculum Monitoring System test data for the 1993-94 school year and compare it with results from the 2 previous years. Once that data has been analyzed, we will decide upon a course of action.

Science: Students at all grade levels will have better knowledge of science concepts. They will have opportunities to learn more about science topics of current interest, such as recycling and environmental clean-up programs. In addition, students will participate in an all-school science fair, field trips, hands-on science programs, and other activities that support and enhance our goals in science. Another objective for science instruction will be to familiarize the staff with the State of Michigan science objectives. To meet this goal, we will carefully analyze and discuss ways to implement those objectives. The 1993 MEAP science scores for 5th graders have been collected and will be compared to those achieved on the October 1994 state exams to help us assess our achievement of this goal.

(Continued on page 3)

CASE Credit Union Board Member William Brewer explores real life math applications with Nancy Coleman's 4th graders as part of that agency's partnership with Kendon. Pictured from left to right are Lewis Harrison, Andrew Mecher, Richard Clark, Heather Riojas, Mr. Brewer, Brandi Sterrett, Rolando Gonzales, and Mrs. Coleman.

Core Curriculum

When the State Legislature adopted Public Act 25 in 1990, it stipulated that Michigan school districts would have to make a core curriculum available to all students by the beginning of the 1991-92 academic year.

The State Board of Education (SBE) then distributed a model core curriculum to school systems which defined outcomes to be achieved by students in various content areas.

An analysis of the Lansing School District's curriculum shows it is largely consistent with the SBE recommendations and student outcomes.

However, there are areas within the arts at the elementary level where our system does not address all of the SBE recommendations due to the limited instructional time available to elementary art, music, and physical education specialists. This also is true of the arts at the secondary level where such courses are offered as electives and do not fall within the state's expectation of instruction for all students.

The single area in which Lansing has no current program to meet the SBE core curriculum outcomes is elementary foreign language. The cost of initiating such a program district-wide is prohibitive given the district's current financial status.

Lansing's curricular review plan operates on a 5-year cycle. All district-approved content areas and outcomes recommended by the SBE are reviewed and aligned during that cycle. This process is ongoing and will continue as state requirements and student needs change.

Student Achievement

The academic performance of Kendon students is monitored in a variety of ways throughout the school year. Classwork, homework, and staff-developed tests help teachers, parents, and students check progress on a regular basis.

Frequent reports, staff contacts, and teacher conferences encourage parents to become involved in the evaluation of their child's education.

In addition, the Lansing School District sponsors a testing program designed to provide an annual picture of the academic progress of all students. One part of that program is norm-referenced testing each spring for students in grades 1-11. These results allow us to see how Kendon students perform in comparison to their counterparts in other urban areas across the nation.

In the spring of 1993, the school district replaced the outdated Stanford Achievement Test with the latest version of the Metropolitan Achievement Test in order to better assess today's expectations for student learning. With the change in tests, we began a new data baseline. Historically, math scores of Lansing students have been higher than those for reading. With the change to the Metropolitan, the same pattern has emerged.

On the 1993 Metropolitan exams, Kendon students in grade 2 performed above the national average (50% percentile) in both math and reading, while those in grade 4 scored above the national average in math.

Here at Kendon we study these scores carefully, along with other measures of student progress, as we implement changes in instruction which are necessary to assure that each and every one of the students has a successful school career and is well prepared to become a contributing citizen.

Accreditation Status Report

The Michigan Department of Education has revised the standards by which all public schools can become accredited. These standards should be in place by the spring of 1995. Kendon School will become involved in the state's new accreditation program once it has been finalized.

Extended Learning

There are many activities and programs planned to give students choices, the opportunity to experiences successful learning, and enhance their self concept. Some of them are: **Math-R-Rama, Math Magic, after-school tutorial programs, Fantastic Fun Friday, violin, camp, Calbery Writing Contest, spring art fair/ice cream social, science fair, Literature Encounter, visiting author event, end-of-year award program, book swap, remedial/enrichment programs in math and reading, community partnership with Capital Area School Employees (CASE) Credit Union, Parent Lending Library, Building Libraries Together, Home Outreach Program for Education (HOPE), seasonal musical programs, student/staff softball game, Read-A-Thon, Reading Is Fundamental (RIF), city-wide field day, field trips, multicultural education, the 4-H after-school program, the YWCA program, Kendon's positive behavior assemblies, and honors programs.**

The services of an intervention specialist were provided last year to assist students in the areas of positive self-esteem, conflict resolution, and problem-solving.

Unique Characteristics Of Kendon (A Professional Development School)

As participants in a Professional Development School, the Kendon staff is able to think boldly and sensibly about the future of education and what a school ought to look like to accommodate students as we approach the 21st century. Our participation in the PDS project has brought increased attention, resources, and support for practicing teachers.

A selected group of K-5 teachers and 2 MSU faculty members worked on ways to improve the teaching and learning of literacy in the elementary grades last year. They focused on 3 interrelated and interdependent components which will serve to build a firm foundation for a lifelong habit of critical reading.

Integrated Studies — The fifth grade teachers and selected MSU faculty members collaborated on developing instructional units to integrate social studies and language arts in 1993-94.

Math for Understanding — Five Kendon teachers and several MSU faculty members collaborated to rethink ways of teaching mathematics. Their goal was to help students make a connection between classroom mathematics and mathematics in the real world.

Math Magic—Math Magic is a program to enhance math skills of Chapter I and special education students. The special education teacher consultant, Chapter I reading teacher, and 3 Chapter I instructional assistants met twice weekly with 4th and 5th graders to provide a variety of math experiences.

Technology in the Classroom — All Kendon teachers and selected MSU professors worked with computers throughout the curriculum. A computer lab was established to complement and enhance the use of computers in the classroom.

Inclusion Education — Teams of teachers, support staff, parents, and administrators planned for the full-time inclusion of students with challenging needs into general education classrooms.

An Alternative Curriculum With Special Emphasis On Accommodating Diverse Learners ("At-Risk" Students & High Achievers) — The 4th and 5th grade teachers have been conceptualizing, developing, and designing alternative curriculum and programs to accommodate diverse learners.

Mentorship Program — Our Mentorship Program focused on providing positive role models and building self-esteem for "at-risk" students starting in the early grades.

Electronic Data Systems (EDS) Tutoring Program — Kendon staff members are proud of our association with the tutors from EDS. Several spent 1 hour per week in classrooms last year providing remedial and enrichment support to students. They are positive role models and were very helpful in the classrooms.

Team 1 (MSU Teacher Training Program) — Four post-graduate students served a 1-year internship at Kendon last year to comply with MSU's newly instituted requirements for teaching certification. In addition, a number of MSU seniors were assigned to classrooms for a few hours each week and will continue to work on their teaching certification requirements this year. Those requirements now consist of 4 years of course work and a fifth year assignment in the classroom.

Community Partnership — The staff and students at Kendon School are reaching out for community support. Fourth graders have formed a partnership with the Capital Area School Employees (CASE) Credit Union to help students make a connection between school mathematics and the real world. We have established a mini-credit union with on-line communication with CASE.

Parent Lending Library — Last year, the Parent Lending Library was established to give parents an opportunity to borrow educational games, toys, activities, books, videos, and other academically related materials to help their children at home.

Visiting Author — Award-winning author and illustrator Leonard Everett Fisher visited Kendon last year The program was made possible through the collaborative efforts of Kendon's PTA and the Partnership for New Education.

Parents as Partners in Education

Parents as Partners in Education is a Chapter I program that met monthly with a focused agenda determined by parents' needs and concerns. Child care and transportation were provided for participants. Support from the PTA enabled us to make these meetings available to all parents.

Goals

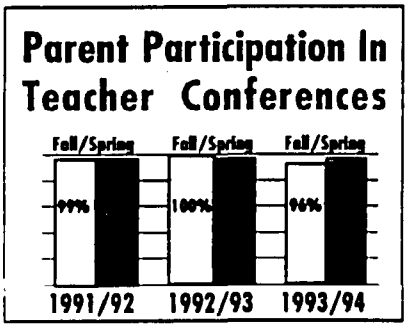
(Continued from page 1)

Self-esteem: Students' positive self-image will be developed through their participation in problem-solving activities. We expect children to engage regularly in problem-solving activities in which they arrive at alternative solutions to academic and social problems. Students' positive self-image also will be developed as they gain awareness of their ability to be constructively self-directed and responsible. We will focus during the 1994-95 school year on Kendon's Code of Conduct, monthly good behavior assemblies and rewards, and recognition of fourth and fifth graders for academic achievement. We have collected data over the past 2 years by counting the number and nature of conduct citations issued. We want to re-evaluate this method of assessment and focus more on specific behaviors that are taught, learned, practiced, and observed. A committee was established in the spring of 1994 to clarify our goals and strategies in self-esteem education.

Kendon School PTA

The Kendon PTA strongly supports the educational efforts of our students and staff. The PTA sponsors the following activities and programs for our students:

- Fall open house
- Fall fund-raiser
- Holiday open house
- Visiting author
- Musicals
- Halloween Parade
- Ice Cream Social and Art Fair
- Field Day
- Reading Is Fundamental (RIF)
- Parent forums
- Book Fair
- Camping program



Parent/Teacher Conferences

Great effort and non-acceptance of routine excuses are the keys to reaching almost each and every parent at Kendon School. Many times we have rescheduled more than 20 conferences, and an additional 20 or more conferences are held in homes of parents or at their place of work.

Parent/teacher conferences are a top priority at Kendon.

Volunteers

Volunteering is one of our most valuable assets. Throughout the 1993-94 school year as in years past, as many as 150 volunteers have supported and coordinated programs, events, and activities for children at all grade levels. Many activities such as field trips, scouting programs, and special projects are made possible because of the efforts of volunteers. The Kendon staff annually sponsors an appreciation luncheon for all parent volunteers who served throughout the school year.

Community Resources

The Lansing School District considers the community as a classroom. We reach out by taking students into the world through field trips, internships, work study opportunities, and technological links. We also invite the community into our schools. There are countless business partnerships, community resources, mentoring programs, pen pal programs with other countries, and speakers and assemblies from which Lansing students benefit each year. We invite you to participate in the education of our future leaders.

History of Our School

Kendon School was built in 1958. An addition was made in 1961, creating a total of 32,000 square feet. Kendon has 14 classrooms, one medium-sized gymnasium, and a library. There are four small conference/storage rooms located at either end of the building.

The Kendon School community brings much diversity to the educational setting. We have neighborhood students who walk to school, while other youngsters are transported by bus from Mill Pond Village and the downtown area. The variables inherent in the Kendon community at-large make it a challenge as well as a rewarding place to teach and learn.

An equal opportunity district

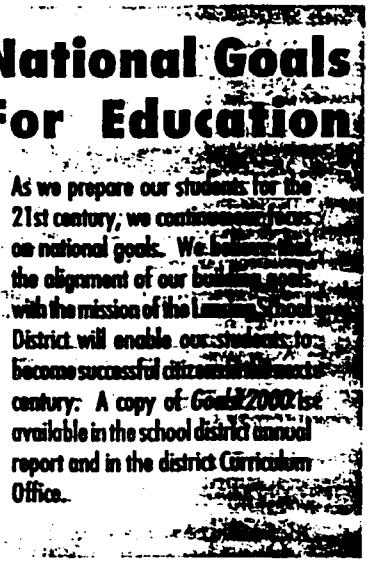
Kendon Facts

Last year, the Kendon staff was comprised of a principal, 13 general education classroom teachers, 4 senior intern student teachers, 1 special education teacher, 1 special education consultant, 1 reading teacher, 1 part-time librarian, a part-time prevention specialist, 3 learning specialists, 6 Michigan State University faculty members, a special education instructional assistant, 3 federally funded instructional assistants, 1 part-time Parent Lending Library coordinator, 1 lunch cashier, 11 lunch assistants, 1 secretary, and 2 custodians.

This staff represents a wide range of people and expertise that provides tremendous support and knowledge for the students they serve.

For the 1993-94 school year, our student enrollment was 333. The breakdown by grade level was as follows:

Kindergarten ... 61	3rd Grade 52
1st Grade 66	4th Grade 55
2nd Grade 47	5th Grade 52



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