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A case study of the diffusion of an electronic mail system in a high school administrative setting

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A CASE STUDY OF THE DIFFUSION OF AN ELECTRONIC MAIL SYSTEM IN A HIGH SCHOOL ADMINISTRATIVE SETTING

by

Richard E. Moore

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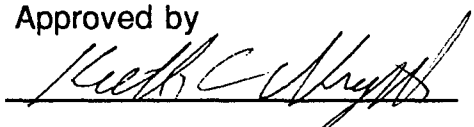

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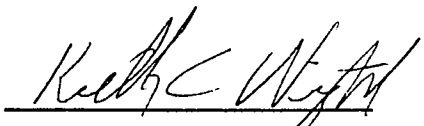
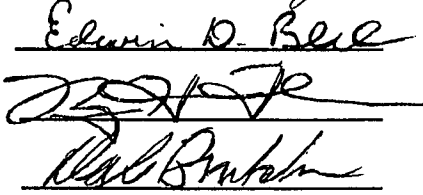
Dissertation Adviser 

Committee Members 

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The objective of this case study was to describe the diffusion of an electronic mail system in a public school administrative setting. The study focused on four variables: 1) principal leadership style, 2) participant readiness for change, 3) rate of adoption, and 4) effectiveness of the system.

The study group was composed of twelve members of a public high school. Perceptions of principal leadership style were assessed for each participant. Readiness levels of change were determined for each individual. The effectiveness of the electronic mail system was rated for various categories by participants. And, the rate of adoption over the span of the study was recorded.

An exploration of these variables in association with the diffusion process was the primary focus. Descriptive data as well as correlation figures were used to describe and discuss the findings.

Findings and Conclusions: A review of the reported findings suggest the following associations resulted among variables during the diffusion process: (1) Leadership style was associated with participant rate of adoption of the electronic mail system. For this study group, the role model and challenging styles of leadership were perceived by the majority of the participants to be the primary style of leadership used by the principal. Users with high adoption rates perceived the role model style of leadership as primary. The participants with the lowest adoption rates perceived the principal to use the challenging style of leadership. (2) High participant readiness for change scores were not associated with high rates of adoption. (4) Participants rated the system as very effective regardless of their readiness for change level. (5) The perception of the electronic mail system's capacity to improve internal communication received the highest rating by the total group. Reducing paper-flow was the only category of effectiveness that resulted in a positive correlation range displayed in any of the figures presented.

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I would like to sincerely thank my adviser, Dr. Kieth Wright, for his guidance, support, and patience during this process. I would also like to thank the other committee members, Dr. Edwin Bell, Dr. Dale Brubaker, and Dr. Roy Forbes for their effort on my behalf.

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TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

> No group can exist without communication. Because we spend nearly 70 percent of our waking hours communicating, it seems reasonable to conclude that one of the most inhibiting forces to successful group performance is the lack of effective communication (Robbins, 1988, p. 98).

The suggestion that a relationship exists between effective communication and group performance is not new. Researchers have spent countless hours investigating the role of communication in organizations. Findings serve to support the notion that effective communication is an important aspect of group performance (Barnett & Goldhaber, 1988). Innovations that address the goal of improving communication are valuable to organizations in their quest to maximize performance.

From a historical perspective, the evolution of communication innovations can be associated with specific stages of societal development. According to Daniel Bell of Harvard University, these stages may be identified as follows:

> Human societies have seen four distinct revolutions in the character of social interchange: speech, writing, printing, and now, telecommunications. Each revolution is associated with a distinctive, technologically-based way of life. Speech was central to the hunting and gathering bands-the signals that allowed men to act together in common pursuits. Writing was the foundation of the first urban settlements in agricultural society-the basis of recordkeeping and the codified transmission of knowledge and skills. Printing was the thread of the industrial society-the basis of widespread literacy and the foundation of mass education. Telecommunications (from the Greek tele, "over a distance")-the ties of cable, radio, telegraph, telephone, television, and newer technologies-is the basis of an information society (Salvaggio, 1989, p. 89).

The advent of an information-based society provides the impetus for a major shift toward the development of a new communication infrastructure. Telecommunications will serve as the central structure that ties such a society together. The consolidation and merging of devices such as computers, telephones, copiers, printers, and television offers an unlimited range of possibilities. The integration of these technologies produces an unprecedented opportunity to create an electronic foundation that will profoundly impact modern communication systems (Salvaggio, 1989; Tennant & Heilmeier, 1991).

Microcomputers and Communications

One particular innovation, the microcomputer, has made a substantial contribution to the development of modern communications technology (Rogers, 1982). Recent strides in microchip technology have enabled the microcomputer to become a powerful communication tool. The capability currently available to personal computer users is astounding. Computing tasks that previously required mainframe computing power are now being performed by desktop machines. Add to this the development of connectivity technology, hardware and software, which allows computers to interact with other computers and you have a structure ideally suited for a range of applications (Stallings, 1987). These networks range from personal computer based "local area networks" to more sophisticated systems forming "wide area networks". Both offer tremendous capabilities for advancing communication (Wright, 1990).

These networks are paving the way for interactive, on-line systems of communication. No longer speculation or fantasy, this kind of technology is becoming central to many organizations. The communication capability provided through the use of this

technology provides an attractive alternative to traditional means of communication.

Diffusion of Technology

The widespread diffusion of microcomputer networks and communications technology in the world of business can be attributed to several factors. Corporate leaders envision the use of technology as a means of helping them remain competitive in a global marketplace. Also, microcomputer technology is becoming increasingly more affordable. Prices of personal computers have decreased dramatically in recent years while computing power has increased. Technology use in industry and business has not been viewed as an option but rather as a tool necessary to compete in a high-tech world (Jackson, 1986; Leebaert, 1991).

Not all organizations, however, view the use of technology from this perspective. Non-profit organizations still lag behind their business counterparts in the use of technological innovations (Perelman, 1992). Yet, performance and effective means of communicating are just as important to these entities.

One such organization that falls far behind in the use of technology is the public school. Many of the tasks performed in schools today are executed using the same technology that was in place twenty years ago. This is true both instructionally and administratively (Becker, 1990). Can schools continue to operate in this manner and meet the increasing demands they are facing?

Futurist, Lewis Perelman (1989), thinks not. He proposes the following: "Confronted with a technological revolution transforming the rest of society, schools can cling to traditional ways of operating-but only at the cost of becoming ever more alienated, obsolete, and ultimately irrelevant to that society" (Lewis, p. 207). Business as usual will not meet the demands that schools are now facing or those that lie ahead.

Schools and Technology

The use of technology, or lack thereof, in schools today can be attributed to a number of variables. First and foremost, limited economic resources have much to do with the current state of technology in schools. Funding can be related to the current economic conditions and the interests of those in leadership

positions. Tight budget times are requiring school systems to operate with very lean budgets. Money for programs not considered essential to basic operations is severely limited. Investment in technology is often viewed from this perspective.

A lack of investment in technology by educational organizations was highlighted in a four-year study of knowledge age economy by the U.S. Congress's Office of Technology Assessment. This study revealed that education had by far the "lowest level of capital investment", another name for "buying technology". Approximately one thousand dollars per employee was invested. The average for the U.S. economy as a whole is about fifty thousand dollars of capital investment per job. (Perelman, 1992, 215-216).

A third factor for consideration is the reputation associated with schools regarding change. Schools have been viewed as organizations that are unwilling to invite or embrace change (Cuban, 1990). This has become evident through a number of unsuccessful attempts to diffuse computer technology in a variety of educational settings (Becker 1990; Clerc, 1985). If school personnel are reluctant to face change when we live in a society that is constantly changing, how can the challenges that lie ahead for schools be met? Discovering

and understanding the forces associated with the process of successfully introducing change in educational institutions may prove to be useful information. Identification of any factors associated with successful diffusion efforts related to technological innovation in a school could shed some light on the dynamics of the adoption cycle. This type of discovery might prove to be beneficial to other settings attempting to introduce an innovation or change.

Schools cannot continue to operate using technologies that were developed to meet the needs of a past era. While this is true for both administrative and instructional applications, administrative uses of state of the art technology seem to be losing the most ground. The use of technology to address the demands of an information-based, service-oriented society is a must if schools hope to meet the challenges that lie ahead.

Purpose and Objectives of the Study

With those thoughts in mind, this study examined several factors related to the diffusion of electronic mail, a technology based communication system, in a school administrative environment.

Twelve staff members of a public high school agreed to participate in the study. Specifically, this group was composed of five administrators, five counselors, and two secretaries. Each participant had a personal computer in their office operating as a part of a local area network. Full access to electronic mail was offered through this system. Each individual was provided staff development with regard to the use of the system to communicate internally.

The specific purpose of this investigation was to describe any association that may exist between a principal's leadership style and a participant's readiness for change and adoption or non -adoption of the electronic mail system. Adoption of the technology was measured by the frequency of use of the system by the participants as a means of communication.

In addition, the effectiveness of the communication system as it related to several aspects of employee performance was also reported. This rating examined participants' perceptions of the system's ability to; improve communication, reduce paper-flow, expedite decision-making, provide time for other tasks, and improve personal productivity.

An assessment of the principal's leadership style was provided from both the principal's perspective as well as the participants' perspective. Each individuals' readiness level for change was also assessed in this study.

An exploratory case study such as this one may provide insight into relationships that exist among the identified variables and the diffusion process. The knowledge gained could benefit other educators in their attempt to implement technology projects in school administrative settings.

Research Questions

In this exploratory case study, various tools were used to gather data with respect to the following variables: principal leadership style, participant readiness for change, rate of adoption of the technology, and effectiveness rating of the technology. This data collection and analysis provided the basis for responding to the following research questions:

Question 1: For this study group, how are perceived principal leadership style and rate of adoption associated?

Question 2: How do participants perceive the effectiveness of the electronic mail system and how does this vary among participants?

Question 3: How are participant readiness levels for change associated with rate of adoption?

Question 4: How are participant readiness levels for change and effectiveness ratings associated?

Question 5: How are participant ratings of effectiveness associated with rate of adoption of the electronic mail system?

Significance of the Study

Research related to the diffusion of technology in organizations encompasses a wide range of innovations in a number of settings. In education, studies that address diffusion, particularly those related to the use of computer technology are limited. The majority of those available for review tend to focus upon the diffusion of instructional technologies. Studies related to administrative

applications of computers are even more limited. Look further for studies that focus on the diffusion of a computer based communication system in a school and you find that they are virtually non-existent.

The significance of this case study lies in its attempt to explore the use of technology in a school administrative environment. The examination of factors associated with the diffusion and adoption of communication technology may reveal a means of enhancing performance in an educational setting.

This study also provides insight into factors that may influence adoption or non-adoption of an innovation. Exploring the relationship that exists between a principal's leadership style and use of technology in an organization may be useful to other practitioners. Understanding how an individual's "readiness level for change" relates to adoption of the technology may yield a better understanding of the diffusion process. Reports from participants regarding the effectiveness of the communications technology as a tool to assist them with their daily responsibilities is also valuable information.

Definition of Terms

The technical nature of many terms related to microcomputer and communication technology is accompanied by a new vocabulary. The following definitions will serve to clarify terminology that will be used in this study. *Microcomputers in Education Today* (1989) served as the source of the following definitions.

Application Software - software that is used to operate specific tasks such as wordprocessing, spreadsheets, databases, and communications (p.10).

Electronic Mail - (also referred to as E-Mail) an electronic communication system that allows personal computer users to send and receive messages (p. 220).

Hardware - the physical components that make up the computer system (p. 52).

Local Area Network - several computers linked together in a network and housed in one building or at least in a relatively small area (p. 220).

Microchip - a small piece of silicon consisting of many small transistors (p. 38).

Microcomputer - a machine that takes in and processes information called data (p. 5).

Software - programs that consist of a set of instructions to operate the computer (p. 5).

Telecommunication - the process of transferring data from one point to another without changing the data as it travels (p. 212).

Scope and Limitations

This case study provided descriptive information with respect to the diffusion of a communication technology in a single educational setting. An exploration of the association that developed among the variables of leadership style, readiness for change, rate of adoption, and effectiveness was the primary objective.

The nature of this study, a single site with a small population, limits the significance of the findings. The time frame during which data was collected for frequency of use and rate of adoption was three months. The data collected to assess the effectiveness of the electronic mail system resulted from the use of an opinion survey

developed specifically for this study. This administration served as a field test for this survey form. The results cannot be considered definitive due to their descriptive nature. To replicate this study, the effectiveness rating survey would need to be validated through further field testing and refinement.

Literature reviews of technological diffusion efforts in the education arena, particularly in the area of administration are limited. Studies that explore the diffusion of communication technologies in school administrative offices are limited. Additional studies of technology diffusion in school administrative environments merit consideration. The need to further understand the process of introducing innovations to organizations and the related factors that influence adoption or non-adoption is of value to other educational organizations.

Summary

The development of microcomputer technology and systems of communication is providing organizations with expanded opportunities for addressing the goal of improving performance. Limited financial resources and increased demands for higher levels

of service are providing the impetus for schools to find new ways of operating. The use of electronic mail in an educational setting may serve as a vehicle to enhance performance and productivity.

The successful diffusion of an innovation in an organization is a mix of many forces. Understanding how various factors influence the adoption or rejection of the innovation can assist in the development of diffusion strategies. This case study will explore and describe several of those forces. Perceptions of leadership style in conjunction with adoption of an innovation will be described. An individual's disposition with respect to change will be explored. The effectiveness of the technology to enhance performance and productivity will also be addressed.

Barriers to educational implementation are being reduced. The current relative affordability of microcomputers is making the use of technology in schools much more possible. Demands for improved service will have to be addressed. Improving communication and performance in schools are valid objectives. If technology can assist with this endeavor, then school administrators should pursue the diffusion of appropriate innovations in educational settings to help meet those objectives.

CHAPTER II

REVIEW OF THE LITERATURE

Technological innovation is a fact of life. Rapid technological change has become a permanent feature of our existence. The extent that researchers are able to understand the mix of forces that both generate new developments and influence the rate and extensiveness of the spread of these technologies is important (Sankar, 1991).

The intent of this chapter will be to review literature related to these forces. When an innovation, such as electronic mail, is introduced to individuals or organizations, many factors contribute to and influence the acceptance or rejection of the innovation. This review will focus upon three distinct but interrelated areas of research relevant to this topic: diffusion of innovation, change and resistance to change, and leadership. Each of these will be reviewed independently, but attention will also be directed toward any relationships that may exist commonly among these areas.

Diffusion of Innovation

Literature related to the diffusion of innovations examines various aspects of the diffusion process. A number of studies attempt to identify stages in the process of diffusion. Some focus on diffusion at the individual level while others examine the process of diffusion from an organizational perspective. A third aspect examines the characteristics surrounding the innovation itself in relation to adoption or rejection. Each perspective will be presented in this review.

Diffusion and innovation will be referred to a number of times in this study. The following definitions provided by Everett Rogers (1983) will serve to explain these terms for the purpose of this research effort.

Innovation - an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.

Diffusion - is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented,

diffused, and are adopted or rejected, leading to certain consequences, social change occurs.

Stages in the Process of Diffusion

Numerous attempts have been made to determine a sequence of stages that occur during the diffusion process. The identification of such stages may prove to be beneficial in the development of diffusion strategies. One model for consideration is offered by diffusion expert, Everett Rogers.

Everett Rogers (1983) has identified a process of diffusion titled, The Innovation-Decision Process. Emphasis is placed on diffusion directed toward individuals in this model. The five proposed stages are: 1) knowledge 2) persuasion 3) decision 4) implementation 5) confirmation.

Knowledge occurs when an individual is exposed to an innovations existence and develops some understanding of how it functions. At this stage, an individual seeks information that reduces uncertainty about an innovation. What is the innovation and why does it work are primary questions during this stage.

Persuasion occurs when an individual forms a favorable or unfavorable attitude toward the innovation. It is at this stage that the individual seeks innovation-evaluation information to reduce any concerns about the innovation's expected consequences. The individual is also interested in knowing the innovation's advantages and disadvantages with respect to them personally.

Decision occurs when an individual engages in activities that lead to a choice to adopt or reject the innovation. Such decisions can be reversed at a later point. An individual may become dissatisfied with the innovation and choose to discontinue use. It is also possible for one to adopt an innovation that they had previously chosen to reject. Later adoption and discontinuance generally occur at the confirmation stage of the process.

Implementation occurs when an individual puts an innovation into use. It is at this stage that an overt behavior change takes place. The innovation is actually put into practice at this point in the process.

Confirmation occurs when an individual seeks reinforcement of an adoption decision that has already been made. But, he or she may reverse the previous decision if exposed to conflicting messages about the innovation. At this stage, the change agent has a special

role. Even though the decision to adopt has been made, it is imperative that support continues to be offered to individuals to insure continued use of the innovation.

Adoption decisions are influenced by the organizational social system. Innovations can be adopted or rejected by either the individual or by the entire organization. Rogers' (1983) identifies four categories of adoption decisions.

1. Optional innovation decisions - choices to adopt or reject an innovation are made by an individual independent of the decisions of other members of a system (p. 29).
2. Collective innovation decisions - choices to adopt or reject an innovation that are made by a consensus among the members of a system (p. 29).
3. Authority innovation decisions - choices to adopt or reject an innovation are made by a relatively few individuals in a system who possess power, status, and technical expertise (p. 30).
4. Contingent innovation decisions - choices to adopt or reject that can be made only after a prior innovation decision. For example, an individual may be free to adopt a new idea only

after his system's innovation decision (p. 30).

An organizational diffusion effort is constituted by a different series of stages in the process of diffusion.

Organizational Diffusion of Innovation

Rogers (1983) further differentiated diffusion by examining the process from the organizational perspective. The innovation process in an organization consists of a sequence of five stages: agenda setting, matching, redefining/restructuring, clarifying, and routinizing.

1. Agenda setting - one or more of the individuals in an organization identify a problem and seek an innovation as a means of coping with the problem. Organizations constantly scan for innovations and try to match the innovation with the particular need. The idea that awareness of an innovation serves to launch the innovation process has been supported through the research efforts of Eveland in 1977 and Rogers in 1976 (pp. 362-363).
2. Matching - at this stage, conceptual matching of the problem with the innovation occurs to determine how well they are

likely to fit. Anticipated problems are identified and if the organization's decision makers conclude that there is a mismatch of the innovation and need, the innovation may be rejected (p. 364).

3. Redefining / Restructuring - at this stage, the innovation may be modified to meet the needs of the organization. Sometimes the structure of the organization may have to be modified as well to make the fit (pp. 364-365).

4. Clarifying - the innovation is put into wider use in the organization. It becomes imbedded in the organizational structure(p. 365).

5. Routinizing - at this point the innovation loses its separate identity. It becomes incorporated into the regular activities of the organization (p. 365).

Stages in the diffusion process are delineated into two phases: initiation or implementation. The initiation stages are viewed as those that identify the need and the innovation. The implementation stages are those that facilitate the full implementation of the innovation. The locus of the decision to implement an innovation and the intended target group determines whether the diffusion effort is

aimed at the individual level or the organizational level.

While Rogers' work with diffusion is very well known and well respected, many other research efforts have addressed the same objectives. A brief review of some additional models of diffusion offers a generally consistent theme in the process.

Arthur Levine's (1980) model identified four stages associated with the diffusion process. They are as follows:

1. Recognition of need.
2. Planning and formulating a decision.
3. Initiation and implementation of a plan.
4. Institutionalization or termination.

Stage one, requires a need to change. Members of the organization must feel that a need is not being met for a change to be necessary. Stage two requires input from those that will be affected by the change. This will aid the planning and decision processes. In stage three, the innovation is introduced to the organization and use begins. In stage four, the success or failure of the innovation is determined. In this stage the innovation will either become institutionalized and a vital part of the organization or it will be terminated.

Hage and Aiken (1970) also used a four step model to discuss diffusion.

1. Evaluation
2. Initiation
3. Implementation
4. Routinization

Stage one requires evaluating the need for a change in the current organizational environment or structure. In stage two, either someone from within the organization or outside takes the initiative to offer an innovative solution to the organizational need that has been determined. Stage three is the implementation phase. The innovation is introduced to the users and a trial use begins. During stage four, if the innovation is successfully adopted, it will become routinized into the day to day operations of the organization.

The similarity between these and the model presented by Rogers is evident. According to Michael Fullan (1982) most researchers now see three broad phases in the diffusion process.

> Phase I - variously labeled initiation, mobilization or adoption, consists of the process which leads up to and includes the decision to adopt.

Phase II - implementation or initial use and involves the first experiences of attempting to put an idea or program into practice.

Phase III - called continuation, incorporation, routinization, or institutionalization and refers to whether an innovation gets built in as an ongoing part of the system or disappears by way of decision to discard or through attrition.

Another explanation of diffusion centers upon the characteristics of the innovation. It is believed that various characteristics of the innovation itself influence the potential acceptance or rejection.

Characteristics of Innovations

In what manner do characteristics of innovations contribute to the varying adoption rates within an organization? Rogers (1983) offers the following categories of characteristics that potentially influence the diffusion process.

1. Relative Advantage - the degree to which an innovation is perceived as better than the idea it supercedes. The degree of advantage may be measured in economic terms, but social prestige factors, convenience, and satisfaction are also often

important components. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is going to be (p. 15).

2. Compatibility - the degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters. An idea that is not compatible will not be adopted as rapidly as an innovation that is compatible (p. 15).

3. Complexity - the degree to which an innovation is perceived as difficult to understand and use. In general, new ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understanding (p. 15).

4. Trialability - the degree to which an innovation may be experimented with on a limited basis. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing (p. 15).

5. Observability - is the degree to which the results of an innovation are visible to others. The easier it is for individuals

to see the results of an innovation, the more likely they are to adopt (p. 16).

"In general, innovations that are perceived by receivers as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations" (Rogers, 1983, p. 16).

Zaltman, Duncan, and Holbek (1973) noted that the following characteristics of an innovation make them more or less attractive and thus more likely to be adopted by individuals of an organization.

1. Cost - two types of cost are identified, economic and social. Economic costs involve initial startup costs and continuing costs. Social costs involve the status arrangements in an organization, the shift of power bases.
2. Return on investment - innovations will be selected that have high return.
3. Efficiency - the more efficient, the more likely to be adopted.
4. Risk and uncertainty - low risk and uncertainty are desirable.
5. Communicability - clarity of results.
6. Compatibility - high compatibility with the existing structure is attractive.

7. Complexity - the less complex, the more likely to be adopted.

8. Scientific status - needs to be sound scientifically.

9. Perceived relative advantage - needs to be perceived as offering a significant advantage.

10. Point of origin - more likely to be adopted if they originate within the organization.

11. Terminality - timing of the innovation is important.

12. Status Quo Ante - can the decision to innovate be reversed?

13. Commitment - involves behaviors and attitude towards the innovation.

14. Interpersonal relations - will the innovation disrupt interpersonal relationships?

15. Publicness versus privateness - how large is the public being affected by the innovation?

16. Gatekeepers - the number of steps to approval.

17. Susceptibility to successive modification - can the innovation be modified to fit the organization?

18. Gateway capacity - the adoption of the innovation may increase the capacity to involve the organization in additional such actions.

19. Gateway innovations - innovations can pave the way for additional innovations.

(Hall, 1987, pp. 206-208)

What characteristics of an electronic mail system have the capacity to contribute to the diffusion / adoption cycle? Electronic mail has been found to solve several problems related to communication. Rather than playing "telephone tag", a full message can be sent and left the first time, whatever the hour or locale. The recipient does not have to be there to get the message or deal with it until it is convenient for them to do so. When a response is ready, the original sender does not have to be available.

After the initial expense, electronic mail becomes very cost effective. The speed of the transmission can result in a savings of time to take care of communications in a very efficient fashion. If the electronic mail system is a part of a wide area network system, the costs in comparison to traditional mailing systems, postage and paper, are less expensive.

An electronic mail system is also convenient. Mail is sent at the sender's convenience. And it is read at the receiver's convenience. Many different kinds of mail can be sent. Messages, letters, and

memos are examples of communication that can take place through an e-mail system. These can be sent to multiple parties simultaneously and instantaneously without having to retype each individually. Messages can be forwarded and filed for future reference (Mayer, 1985)

Technology such as electronic mail has the potential to alter relationships among employees. "Short-circuiting" the hierarchy may have an impact upon decision-making. Flow of information and the organizational structure may be re-defined (Barnett & Goldhaber, 1988).

These are several of the characteristics of an electronic mail system that may contribute to the adoption of such an innovation in an organization.

"Innovations do not just arrive at an organization's doorstep with adoption automatic; instead, innovation characteristics interact with organizational characteristics" (Hall, 1987, p. 208) creating conditions that lead to adoption or rejection.

Innovations are catalysts for change. And, like diffusion, change is a process, not an event. The change process starts to unfold when an innovation is introduced. With change comes resistance.

Understanding the dynamics of the change process and the factors that influence it, both positively and negatively, may facilitate diffusion efforts.

Types of Change

At least three types of change can be distinguished in the literature: planned change, spontaneous change, and evolutionary change.

Planned change is "a conscious and deliberate attempt to manage events so that the outcome is redirected by design to some predetermined end" (Hanson, 1991, p. 298).

Spontaneous change is "an alteration that emerges in a short time frame as a result of natural circumstances and random occurrences. No deliberate attempt is made to bring about this type of change; it happens" (Hanson, 1991, p. 299).

Evolutionary change is "a long-range, cumulative consequence of major and minor alterations in the organization. The idea of evolutionary change is often associated with the idea that as organizations evolve through time, people, conditions, and events improve" (Hanson, 1991, p. 299).

The type of change associated with this particular study is planned change. According to Hanson (1991), "planned change requires three basic cornerstones that must be built into the foundation of the change design: (1) a full understanding of the technology of an innovation (2) a comprehensive knowledge of the environmental constraints operating within and around the organization (3) a strategy of change" (p. 300).

Researchers, Levine and Cooper (1989), further identify what they call the prerequisites to successful planned change. Key elements that foster the change effort are: site-level emphasis, continuing training and staff development, incentives, clear goals and objectives, and strong leadership.

Much of the research associated with change has been directed toward the identification of stages in the change process. Understanding these stages may lead to more successful efforts of planned change in organizations and combatting resistance to change at all levels.

Stages of Change

Typically, change will go through several stages. According to Reavis and Griffith (1992), the following stages are likely to be experienced in one fashion or another.

1. Planning and initiation - in this stage beliefs have been established and concrete actions are being planned to meet those beliefs. This stage represents clarification of goals, the relation of the goals to local needs and beliefs, and the identification of material and human resources that can aid in the change. First steps are planned and responsibilities are assigned and accepted.
2. Momentum - in this stage goal directed activities begin to accelerate.
3. Problems - as the change effort continues, problems will develop. Anxiety may increase as individuals have to break away from traditional means of doing things.
4. Turning point - at this stage, problems continue to mount or they have been dealt with in such a way that the change initiative proceeds. Doubts at this point are either that the individual does not have the ability to make the change or that

the change is not worth the effort.

5. Institutionalization or termination - at this stage the change becomes institutionalized or it is terminated.

Kurt Lewin argued that the forces supporting change and the forces resisting change converge in what he calls "quasi-stationary equilibrium". He further recommends conducting a force-field analysis to determine these forces. Change requires finding a strategy that will best facilitate the shifting of the field of forces to achieve a new equilibrium. From this perspective, he sees the change process consisting of three stages: unfreezing, changing, and refreezing.

1. Unfreezing - creates the awareness of the need to change.
2. Changing - the action-oriented stage. Specific changes are brought about through the development of new values, attitudes, or behaviors.
3. Refreezing - stabilizes the change that has been brought about. The new state becomes the status quo and must be sustained.

(Hanson, 1991, pp. 318-319)

Efforts to bring about change will usually meet with resistance. Change increases uncertainty and uncertainty creates anxiety. As a

result, barriers develop and impede the progress of change.

Resistance to Change at the Organizational Level

"Goodson Watson argues that during the life of an innovation, perceived resistance moves through a four-stage cycle. In the early stage, when only a few take the reform seriously, resistance appears massive and undifferentiated.

In the second stage some support becomes evident. The pro and con forces become visible and the lines of battle are drawn.

In the third stage, the battle is engaged as resistance becomes mobilized to crush the upstart proposal. Survival of the innovation is dependent upon developing a base of power to overcome the opposition.

If the supporters of change are victorious, the fourth stage will be characterized by support flowing to the newly arrived innovation. Any persisting resistance at this point is basically minor in nature. At times, the danger of a counter-swing of the change effort seems real" (Hanson, 1991, p. 311).

Katz and Kahn (1964) approach resistance to change in organizations from the following perspective. They identify six

factors that contribute to change resistance.

1. Organizations are overdetermined. There are multiple mechanisms in place to ensure stability. Personnel selection, training, and reward systems are examples of elements that lead to stability.
2. Organizations commit the error of assuming local determinism, or believing that a change in one location will not have organization-wide impacts.
3. There is individual and group inertia. The force of habit is hard to overcome.
4. Organizational change can threaten the established power system. The fear of loss of power serves to provide a source of resistance.
5. Organizational change can threaten occupational groups within the organization. Some fear loss of job.
6. Organizational change can threaten those who presently benefit from the current reward and resource allocation system.

(Hall, 1987, p. 200)

Resistance to change also occurs at the individual level. Some of the forces that contribute to resistance at this level are as follows:

1. Vested interests - individuals have a vested interest in the program or function that they are a part of. Even of the program is of no use, there is an extreme effort to see that it continues. Fear of losing one's job is a critical factor.
2. Mobility expectations - an individual's personal expectation of mobility in an organization will influence their resistance to change. If they are upwardly mobile, they will seek to adapt to the change more readily. If they are indifferent, they are generally more resistant to change. If they are ambivalent, they may seek change but not necessarily the same change that is desired by the organization.
3. Search behavior - the need to change must be a product of dissatisfaction with current means of operating. Need is a critical element if resistance is to be minimized.
4. Psychological systems - the following are rooted in the psychological systems of the individual.

   a. Habit - repetition of a specific behavior is satisfying. The behavior becomes routinized and is difficult to change.

   b. Primary - the first time an individual copes successfully with a task, a persistent pattern of behavior is established.

c. Selective perception and retention - once a belief has been established within an individual, the belief tends to be reinforced.

d. Dependence - dependent relationships support certain beliefs and constrain independent thought.

e. Insecurity and regression - insecurity and uncertainty leads to individuals holding fast to the familiar and less risky.

(Hanson, 1991, pp. 313-314)

Overcoming resistance to change and removal of barriers that restrict change is a complex process. Understanding the dynamics of change at both the individual and organizational level can lead to more control over social change.

Individuals respond to change in different ways. Some invite change readily while others resist change from its initial inception. Understanding an individual's disposition with respect to change of any order may be useful. Knowing the point along the continuum of the change process that an individual falls can help determine strategies for implementing change. Strategies may be developed to fit the needs of the individual in relation to their readiness for change.

Earlier it was noted by researchers Levine and Cooper that several key factors are necessary to foster the change process. Strong leadership was one such component. The role that leadership plays with respect to diffusion and change continues to attract a significant amount of attention from researchers.

A review of the literature regarding leadership provides an interesting perspective for those facilitating change in organizations.

Leadership and Change

> Leadership is an interaction between two or more members of a group that often involves a structuring or restructuring of the situation and the perceptions and expectations of the members. Leaders are agents of change - persons whose acts affect other people more than other people's acts affect them. Leadership occurs when one group member modifies the motivations or competencies of others in the group (Bass, 1990, pp. 19-20).

Emergent views of leadership see leaders less in terms of skills and functions and more as human resource developers. Rather than pushing, telling, and driving individuals, emergent leadership gets commitment, expects the best from each person, takes time to learn the drives and ambitions of each individual, develops goals with

individuals, holds them accountable for results, and rewards them for performance that contributes to goals (Reavis & Griffith, 1992).

What constitutes good leadership has long been a subject of debate. Generally, "good or effective" leadership moves people to a place in which they and those who depend upon them are better off. According to John Kotter (1990) leadership within a complex organization achieves this function through three subprocesses.

1. Establishing direction - developing a vision of the future, often the distant future, along with the strategies for producing the changes needed to achieve this vision.
2. Aligning people - communicating to those whose cooperation may be needed so as to create coalitions that understand the vision and are committed to its achievement.
3. Motivating and inspiring - keeping people moving in the right direction despite major political, bureaucratic, and resource barriers to change by appealing to very basic, but often untapped, human needs, values, and emotions.

(Kotter, 1990, p. 5)

Hersey and Blanchard (1982) examined a number of leadership theories and asked the question, "Is there a best style of

leadership?". The fact that leadership is a function of the leader, the follower, and other situational variables suggests that a single ideal type of leader behavior seems unrealistic. Hersey and Blanchard explains leadership from the following perspective.

Situational Leadership

According to the Situational Leadership theory, there is no one best way to influence people. A person's leadership style involves some combination of task behavior or relationship behavior and the individual's maturity level. Task behavior refers to the extent that roles of the followers are defined by the leaders. What, when, where, and how tasks are to be accomplished is a function of this behavior. Relationship behavior is the extent to which leaders maintain personal relationships between themselves and members of the group. Maturity level is the ability and willingness of people to take responsibility for directing their own behavior in relation to a specific task.

Four leadership styles are proposed in this theory: telling, selling, participating, and delegating. Each style is a combination of task and relationship behavior. Maturity level is a matter of degree,

from a low of M1 to a high of M4.

"Telling" is for low maturity. People unable and unwilling to take the responsibility to do something need a leadership style that tells them or provides clear, specific directions and supervision. This style involves high task behavior and low relationship behavior.

"Selling" is for low to moderate maturity. These are people who are unable but willing to take responsibility, are confident but lack the skills to perform the task. The "selling" style provides directive behavior due to lack of ability, but also supportive behavior to reinforce their enthusiasm and willingness. This style involves high task behavior and high relationship behavior.

"Participating" is for moderate to high maturity. People at this level are able but unwilling to do what the leader wants. Their unwillingness is often a lack of confidence or insecurity. If they are competent but unwilling, the problem may be motivational. A supportive, non-directive, participating style has the highest probability of being effective at this level. This style involves high relationship and low task behavior.

"Delegating" is for high maturity. People at this level are both able, willing, or confident to take responsibility. Little direction or

support is needed for this individual. Give them the task and they will see that it is accomplished. This style involves low relationship and low task behavior.

The key to using Situational Leadership is to assess the maturity level of the follower and to behave as the model prescribes. The appropriate leadership style, matched with the maturity level or needs of the individual has the potential to achieve the desired results. Followers have different needs and are at different levels relative to the task being assigned. Leaders need to help followers grow in maturity as far as they are willing and able to go.

Kouzes and Posner Model

James Kouzes and Barry Posner (1990) offer an additional perspective on leadership in organizations. This model is more transformational than situational. Their studies identified five categories of leadership behaviors that leaders practice to get things done in organizations: (1) challenging the process (2) inspiring a shared vision (3) enabling others to act (4) modeling the way (5) encouraging the heart.

1. Challenging the process - leadership is an active, not a passive process. Leaders viewed as practicing this style of leadership are pioneers. They are willing to take risks, to innovate, and experiment to find new and better ways of doing things. They recognize good ideas and support those ideas. They challenge the system to get new products or processes or services adopted.

2. Inspiring a shared vision - leaders inspire a shared vision. Leaders get others to buy into their dreams. People must believe that you understand their needs and have their interests at heart. The leader's own belief in and enthusiasm for the vision are the spark that ignites the flame of inspiration.

3. Enabling others to act - leaders enlist the support and assistance of all those who must make the project work. They encourage collaborations, build teams, and empower others. They enable others to act.

4. Modeling the way - the leader must model the way. Does the leader practice what he preaches? Leaders act in a way that is consistent with their beliefs.

5. Encouraging the heart - leaders must encourage the heart of followers to carry on. Celebrations of accomplishments are important. Genuine acts of caring draw people forward.

(Kouzes and Posner, 1990)

The preceding models of leadership and leadership behaviors emphasize the need to pay attention to the human dimension of leadership. Skills and functions of leaders are de-emphasized. The appropriate leadership behavior when matched with the needs of the follower has tremendous potential toward the achievements of goals.

The body of literature related to leadership is vast and expansive. Many additional theories and models of leadership exist. For example, the "great man" theories attempted to explain leadership on the basis of inheritance and traits of the individual. Some of the early theorists advanced the view that leadership was a result of time, place, and circumstance. Personal-situational theories viewed leadership as a combination of these factors. Interaction-action theories evolved in the fifties and were advanced in the seventies. Evan's path-goal theory and Fiedler's contingency theory were examples of such models of leadership. Humanistic theories, such as

those advanced by Argyris, Blake and Mouton, Likert, and McGregor looked at the development of the organization. The function of the leader was to modify the organization to assist the individual in meeting their needs as well as organizational needs (Bass, 1990)

The Kouzes and Posner theory of leadership will provide the basis of discussion in the following chapters of this study. This theory perceives leaders as human resource developers. James MacGregor Burns refers to this as transformational leadership. "Such leadership occurs when one or more persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation" (Kouzes & Posner, 1990, p. 118).

Diffusion of innovation, change, and leadership have been discussed to this point in the review from a generic perspective. The models and theories presented have not focused upon any particular type of innovation, organization, or individual. The final section of this review will be more specific. It will focus on factors that affect the diffusion of microcomputer technology in schools and examine the process of change and role of leadership associated with diffusion.

Diffusion of Microcomputers in School

> Few innovations have impacted society as greatly as computing technologies. Computers have permeated virtually all aspects of our culture and society. Yet, their impact on daily educational practice has been relatively minor. Certainly, there is nothing magical about computers per se. The pattern of diffusion currently occurring with computers is similar to that witnessed for programmed instruction, film, and a variety of other innovations. (Dalton, 1989, p. 20)

What factors have contributed to this situation? In a paper presented by Donald Ely (1990) at the International Meeting of the Association for the Development of Computer-Based Instructional Systems, he identifies a set of conditions that may facilitate the implementation of innovations in general and computers specifically. The opposite of these conditions serve as barriers to the diffusion of computer technology. He recommends to those attempting to introduce computers to educational settings the following factors for consideration:

1. Dissatisfaction with the status quo - one of the first steps to initiate change in an education environment is a dissatisfaction with the way things are.

2. Knowledge and skills - the people that will implement the innovation must possess sufficient knowledge and skills to do so.
3. Resources are available - the necessary hardware and software must be available. It is impossible to implement changes without adequate support materials.
4. Time is available - time must be made available for the implementation to occur.
5. Commitment by those who are involved - commitment communicates support and any individual who is about to try to use a new material or procedure wants to know that there is support from a higher level.
6. Leadership is evident - individuals need the inspiration and support of persons they respect.
7. Rewards or incentives exist for participants - for some it may mean satisfaction for a job well done; for others it may mean more help, more or better resources and, in some cases, increased salaries and professional opportunities.
8. Participation is expected and encourages - shared decision making and communication among all parties. (Ely, 1990, p. 11)

A 1985 study by Everett Rogers examined the diffusion of computer technology in nine California high schools. Using his model of the innovation process in organizations, (agenda setting, matching, redefining/restructuring, clarifying, routinizing), a case study was done in each school to determine factors that contributed to the adoption or rejection of the computers by teachers and administrators. The findings of the study are presented below.

1. About one half of the schools studied acquired computers due to external pressure from corporations, parents, or students, not because educators decided that new machines represented a better way of doing things.
2. The usual level of school planning is insufficient to adapt microcomputers. The most successful implementations occurred when administrators, faculty, parents, and students were involved in the innovation process.
3. Although the computer may be introduced to a school by an innovative teacher, the principal must take responsibility for applying the new technology.
4. The educational microcomputer is still a "fragile" innovation, but it is probably not a fad that will pass from the school scene.

5. None of the nine high schools studied purchased more than a small fraction of their microcomputers from the regular budget.
6. The purchase of computers is just a small part of the budget needed to support and maintain the system.
7. Applications of computers have not become routinized in schools as of yet. It will likely be several more years before applications are likely to stabilize.
8. The microcomputer introduces a great deal of uncertainty and anxiety into schools that adopt it.
9. The computerized school envisioned by many is very distant from the day to day realities in the schools studied.

The diffusion of technology in schools, like any other organization, is a product of many factors. The preceding studies emphasize the importance of strong leadership in the process. The role of the principal is viewed as critical. Finding ways to reduce anxiety and uncertainty generated from the diffusion of technology is part of the challenge in the process. Providing the inspiration and support for those affected by the change is a key role of the principal.

Summary

Diffusion of innovation and change in organizations are generally viewed as processes closely related. Innovation brings about change. Understanding the inter-related dynamics of these processes can be useful to those facilitating change. The need for strong leadership from those responsible for implementing change is critical for success.

In schools, the chief facilitator of change is the principal. The principal is responsible for providing vision and leadership for the school staff. The promise of technological innovation is providing a challenge for those principals striving to move schools from traditional organizations to those prepared to meet the needs of the twenty-first century.

Moving people through the change process is not easy. Removing barriers and reducing anxiety and uncertainty is difficult. If one can determine the appropriate leadership style to use with individuals facing technological change, the chance for adoption may be increased.

In light of the continued move toward a high-tech, information driven society, principals as leaders of schools must make a choice.

They can continue to operate using outdated technologies that were developed to meet the needs of a past era, or they can begin to lead their followers on a journey to meet the needs of a current and future society.

CHAPTER III

METHOD OF STUDY

As presented in the preceding chapter, the mix of forces that influence diffusion of innovation and change in organizations and among individuals are many. Prior studies have examined the diffusion of a wide range of innovations in a variety of settings.

The microcomputer and associated hardware and software have evolved as major catalysts for change. The diffusion of computer technology offers new challenges to leaders striving to prepare organizations and individuals for the twenty-first century and an information society. The capability to understand the extent that various factors influence the adoption or rejection of an innovation is valuable information for leaders of those organizations.

Based on this assumption, this study was designed to describe several factors associated with the diffusion of a technological innovation in an educational setting. Specifically, the diffusion of an electronic mail system of communication in a high school administrative environment is investigated.

The case study focuses on four specific variables; 1) the leadership style of the principal, 2) participant's readiness level for change, 3) rating of effectiveness of the E-mail system, and 4) rate of adoption. These variables were examined to see if any association surfaced that might help explain either adoption or rejection of the innovation.

The research questions presented in the first chapter provide the framework for this task. This case study will describe associations that surface among the listed variables identified above with respect to the diffusion of the electronic mail system over the course of the study.

Research Design

The structure for this case study involved three categories of staff members: administrators, guidance counselors, and clerical staff. The study group included five administrators, five counselors, and two secretaries. All participants had access to a microcomputer workstation attached to a local area network of computers. An electronic mail system for communication was available to all users as a part of the network. All staff members received training which

taught them how to use the system properly to send messages electronically.

The study lasted for a period of three months. During that time frame, each participant kept a log sheet that detailed their daily electronic mail communication activity. (see Appendix A) Participants were also asked to complete an assessment instrument titled, Readiness for Change, to determine their readiness level for change as it related to the use of an electronic mail system. (see Appendix B) At the conclusion of the study, participants completed a survey designed to rate the effectiveness of the system as it related to five specific areas related to their daily functions. (see Appendix C) Participants also completed an instrument titled, Human Patterns, which was intended to provide an assessment of their perception of the principal's leadership style. (see Appendix D)

The ways that participants differ in terms of rate of adoption over the test period, readiness for change, perceptions of electronic mail effectiveness and perceptions of principal leadership style were described in terms of central tendency and variability.

For each category, means, ranges, and standard deviations were calculated. Participant scores and ratings were then discussed.

Description of the Site and Case Study Population

The site selected for this study is a public high school located in a consolidated school system in Piedmont North Carolina. There are 57 schools in the system with a current population of approximately 38,000 students. With a budget of 165 million dollars and an above average tax base, it is considered to be one of the more affluent public school systems in the state. The particular high school chosen for this study has 1478 students in grades nine through twelve. There are 88.4 full-time professional staff members on the faculty. Including the support staff, clerical, housekeeping, and part-time, and the total staff exceeds 100 members.

Five administrators, five guidance counselors, and two secretaries agreed to participate in the study. A descriptive profile of each of these participants will be included in chapter four. The primary reasons for choosing this site were: availability of the technology to support a study of this nature and the willingness of the staff to participate.

Configuration of the Electronic Mail System

The hardware and software used to operate this electronic mail

system are components of a local area network of computers. There are 15 IBM computers operating as workstations attached to the network. The computing power of the workstations vary according to the needs of the staff member. The more powerful machines are assigned to those users that have more demanding computing requirements. The file server is also an IBM machine with sufficient memory, disk storage capacity, and processing speed to adequately support a network of this size. It is configured as a dedicated file server.

The operating system software for the local area network is version 2.12 of Novell Netware. Novell provides an industry standard for network operating systems. The cabling system is a token-ring platform and network interface cards are installed in each of the workstations.

The software configuration available to those participating in this study is two-fold. Participants have access to SIMS (Student Information Management System) software as well as application software offered through the Wordperfect Office module. The SIMS software offers a complete database of information for students and staff members of the school. Users have access to demographic

information as well as attendance, academic progress, and discipline data for all students.

The Wordperfect Office software offer participants a user-friendly interface to access features such as: appointment calendaring, electronic mail, file maintenance, and resource scheduling. Wordless software, Wordperfect 5.1, is also available to users of the system. It is the electronic mail component of this system that is the basis of this study.

The electronic mail feature of the system offers any member of the network the capability to send and receive messages to any other member of the network. User groups can be created providing the capability to broadcast a message to multiple members of the system easily. The system also allows the user to check the status of a message once it has been sent. One can easily determine if the receiver has opened the message, the time sent and received, and if it has been deleted from the system.

Two levels of security are featured in the system. First, there is an entry level of security required to log onto the network itself. A second level of security provides access to the SIMS system or the Wordperfect Office module. This permits users to feel secure in the

confidentiality of information available and stored on the system. These levels of security are provided through the use of passwords and user IDs. The system operator must assign these to network users. Individuals are granted different levels of access within the system, depending on their needs in relation to their job. Some features of the system may be made available to users on an information only basis, while others may be accessed to allow modifications to be made.

Wordperfect 5.1, wordprocessing software, offers a full-featured wordprocessing program to all users. Documents can be created, edited, stored and printed on this system. Three printers are available for participants. A Hewlitt-Packard laser printer and two Okidata 2410 dot matrix printers are at their disposal.

Data Collection

Four data collection tools were used to provide the information used in this study. A brief description of each will detail the intended use of the various tools.

Electronic Mail Log Sheet

Using this sheet, participants recorded their daily electronic

mail activities. The date, and to whom the message was sent was recorded on this instrument. These logs were kept for a period of three months. A rate of adoption value was calculated for each participant using the data recorded on this log.

Readiness for Change Instrument

The Readiness for Change instrument is a relatively new instrument developed to assess an individual's readiness level to accept change. The developer of the instrument involved school superintendents, principals and teachers in establishing content validity for the test. Using a variation of the Delphi Approach, the panel of reactors evaluated the items in the inventory as well as the stages of change. After consensus was obtained on content items and scoring interpretation procedures from the advisory panel, a reliability test was conducted by testing a group on a test/retest basis. A correlation of .872 was obtained from the pre and post test scores. Additional external validity and reliability studies are currently underway. This inventory is being made available to individuals who wish to participate in such studies.

Participants were asked to respond to a series of questions in

this instrument with a specific change in mind. In this case, the change was the electronic mail system. Participant responses were then scored and interpreted to categorize individuals in relation to stages of change: denial, resistance, exploration, and commitment. High scores in a particular stage indicate an individual's disposition with respect to change. A copy of the instrument is included in Appendix B.

Effectiveness Rating Survey

This survey was used to assess each participants' opinion of the effectiveness of the electronic mail system. As discussed in chapter two, electronic mail is a communication tool that promises several advantages. The potential to improve efficiency and convenience in organizational communication is advantageous. The ability to communicate quickly to individuals or large groups instantaneously may enhance productivity and be less expensive. A paperless means of transmitting messages, memos, or letters can be cost effective. Flow of information and the potential to "short-circuit" organizational hierarchy may impact the decision-making process. With those thoughts in mind, this survey was developed

by the author of this case study to gather responses from participants regarding their experience in the use of electronic mail. The categories selected for rating stem from the discussion of advantages of electronic mail presented above.

Participants were asked to rate on a scale of one to five, with five being the highest, the effectiveness of the system to: 1) improve internal communication, 2) reduce paper-flow, 3) improve decision-making, 4)increase time for other tasks, and 5) increase personal productivity.

This administration of the survey served as a field test and no accompanying validity or reliability data is available. The use of this survey in future studies would address the validation process required to produce statistically acceptable data. .

Human Patterns Instrument

Human Patterns is a published, copyrighted assessment instrument designed to assist agencies in areas such as leadership, team building, and organizational development. It consists of 248 groups of four words or statements from which responses are analyzed to provide a wide range of information regarding the

individual being assessed. For the purpose of this study, the results of the section which assesses leadership style was of primary interest. Each participant completed the instrument to assess the principal's leadership style and scores were determined for each of the following categories of leadership: (1) inspiring other (2) challenging the process (3) appreciating and recognizing others (4) coaching and enabling others (5) serving as a role model.

These categories of leadership style are explained in detail in *The Leadership Style* (1990), authored by James Kouzes and Barry Posner. The characteristics of these leadership styles are also discussed in the literature review chapter of this study. A copy of the report resulting from the use of this instrument is provided in Appendix D.

Analysis of Data

The findings that result from the tools discussed in the preceding section will serve as the basis of a descriptive analysis of the variables being explored in this case study.

Summary

The method of study in this project was designed to explore the diffusion of a technological innovation in an education setting. Specific variables examined were: 1) principal leadership style, 2) participant readiness level for change, 3) rate of adoption, and 4) effectiveness rating. Descriptive data were used to examine associations among variables. Such information may be helpful to those attempting to introduce innovations to organizations.

The ability to identify potential relationships that may exist among leadership style, diffusion, change, and adoption is useful information. This kind of information would be of interest to those facing the challenges associated with diffusion of innovation and change in organizations.

The potential of technology as a tool to enhance performance in schools is promising. Identifying ways to foster the diffusion of technology in schools is a step toward tapping this potential.

CHAPTER IV

REPORT OF THE FINDINGS

Twelve individuals participated in this exploratory case study which described the diffusion of an electronic mail system in a high school administrative setting. The composition of the group includes five administrators, five counselors, and two secretaries. A more detailed description of these participants will be provided in a later section.

The focus of the study centered around four variables: 1) principal leadership style, 2) participant readiness for change, 3) rate of adoption, and 4) effectiveness rating. Several assessment and rating tools were completed by participants to provide data for each of these variables.

This chapter will report the results and findings related to each of the variables under exploration for individual participants and the group as a whole. Two reporting formats will be used to accomplish this objective.

An individual narrative profile will be presented for each participant describing the results of each variable under exploration. Following these profiles will be a series of tables and figures presenting the data reported for each variable. Prior to these presentations, a brief discussion of each variable is presented.

Description of Variables

Leadership Style Scores

Five leadership style scores were assessed:

1. LS1 - Inspiring style
2. LS2 - Challenging style
3. LS3 - Appreciating style
4. LS4 - Coaching style
5. LS5 - Role Model style

Scores reported in this category represent an assessment of the principal's leadership style as perceived by participants. This data is provided through the use of the Human Patterns instrument described in chapter three. Each participant completed this instrument and scores were determined for each of the five leadership styles. Scores may be either positive or negative,

indicating a strong use of a style or weak use. The style with the largest positive value represents the strongest perceived leadership style used by the principal from that participants' perspective.

Readiness for Change Scores

Six readiness for change scores were determined:

1. RFC1 - Denial stage
2. RFC2 - Resistance stage
3. RFC3 - Exploration stage
4. RFC4 - Commitment stage
5. RFCNEG - Sum of the RFC1 score and the RFC2 score
6. RFCPOS - Sum of the RFC3 score and the RFC4 score

Participants completed an instrument titled "Readiness for Change" to provide this data. Scores may range from a minimum of four to a maximum of twelve for the first four scores. The RFCNEG score is determined by adding the denial and resistance scores together. Values may range from a minimum of eight to a maximum of twenty-four. These stages of change are generally perceived as more negative with respect to readiness for change. The RFPOS scores result from summing the commitment and exploration values. They have the same minimum and maximum as the RFCNEG. These

stages of change are normally perceived as more positive with respect to readiness for change.

Rate of Adoption Scores

Four rate of adoption scores were calculated:

1. ROAM1 - average number of messages per day for month one.
2. ROAM2 - average number of messages per day for month two.
3. ROAM3 - average number of messages per day for month three.
4. ROATOT - average number of messages per day for total time.

Participants provided this data by recording the messages sent each day on the e-mail log sheet. These logs were kept for a three month period of time. The rate of adoption scores were then calculated by computing the average number of messages per day for each of the three months and then an average for the total three month period.

Effectiveness Rating Values

Six effectiveness rating scores were determined:

1. ER1 - improves internal communication.
2. ER2 - reduces paper-flow.
3. ER3 - improves the decision-making process.
4. ER4 - increases time to perform other tasks.

5. ER5 - increases personal productivity.

6. ERAVG - the average score for ER1 through ER5.

Each participant completed a survey designed to assess the effectiveness of the electronic mail system. A rating was assigned to each of the first five categories by the participants ranging from a low of 1 (not effective) to a high of 5 (very effective). The ERAVG value was determined by calculating an average of the five individual effectiveness ratings for each participant.

Reporting Formats

Two formats will be used to report and discuss the findings in this chapter. First, an individual, narrative profile will be presented for each participant in the study. This profile will consist of the following types of information: current position or role, years of experience, other roles prior to the current one, and age range. Also, anything unique regarding the participant's role or position in the organization that may influence potential use of the e-mail system will be included.

In addition, numerical data reported from the ratings and assessment instruments for that particular participant will also be

displayed. This data will list the individual participant's scores and ratings in conjunction with group descriptive data reported for several measures of central tendency and variability.

The second format will incorporate the use of tables and figures to present the findings. Tables will list the descriptive data pertinent to this study resulting from the data collection tools and instruments. Individual data and group data is included in these tables.

Figures illustrating correlation values calculated for specific pairings of variables will also be included in this section. This information will assist in describing mathematical patterns and associations that surface among variables but is not intended to provide or suggest any statistically significant evidence due to the exploratory nature of this study.

The data will be used to address the research questions identified in chapter one. This will serve as the basis of discussion when describing variances among individual participants and the group for each variable under exploration.

Participant Profiles

Participant One (P1)
Individual Profile Data

N=12

Variable Name	Participant 1	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-1.67	-0.5	0.6	-1.67	0.17
LS2 Challenging	-1.87	0.22	1.01	-1.87	1.63
LS3 Appreciating	0.54	-0.45	0.88	-1.95	0.75
LS4 Coaching	0.31	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.82	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	5	5.7	2.31	4	12
RFCNEG	11	12.2	3.59	10	23
RFC3 Exploration	10	9.3	1.37	7	11
RFC4 Commitment	12	10	2.49	5	12
RFCPOS	22	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	5.35	2.37	1.14	0.9	5.35
ROAM2 Month 2	6.45	3.01	1.33	1.2	6.45
ROAM3 Month 3	7.1	3.94	1.47	2.15	7.1
ROATOTAVG Total	6.3	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	4	4.67	0.49	4	5
ER3 Decision-making	4	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	4.6	4.57	0.44	3	5

Participant one is the principal of the school and has been in this position for the past three years. This individual falls into the 35-40 age range and has sixteen years of experience in the field of education. Prior roles include those of high school teacher, high school assistant principal, central office instructional specialist, and middle school principal. The central office instructional specialist role included responsibilities in the area of computer assisted instruction. The prior experience as a high school assistant principal included responsibility for all scheduling aspects of the school. This was completed using a microcomputer and the SIMS (Student Information Management System) software used for the management of student data.

Leadership style scores for participant one range from a high of 0.82 (role model) to a low of -1.87 (challenging). The high score indicates that participant one perceives himself primarily functioning as a leader using the "role model" style. The low score indicates that he sees himself least using the "challenging" style.

The change assessment data clearly identifies participant one as an individual that confronts change in the stages of "exploration and commitment. A combined score of 22 for these two stages support

this position. This contrasts with participant one's RFCNEG score of 11.

Participant one had the highest rate of use of the system of all participants. During the three month period, he sent a total of 378 messages. Each month's activity increased from the prior month. The average number of messages sent for the entire period was 6.3 per day. This ranged from a 5.35 average during month one to a 7.1 average daily rate during month three.

Participant one had an average effectiveness rating of 4.6 for the system. Ratings of 5, the maximum, were given for effectiveness in the categories of improving internal communication, increasing time to perform other tasks, and increasing personal productivity. A rating of 4 was assigned to reducing paper-flow and improving decision-making. These scores indicate that participant one rated the system overall as very effective.

In summary, participant one viewed himself as a leader that serves as a "role model" for his colleagues. Evidence supporting this belief is the fact that he personally used the system as a means of communication more frequently than any of the participants. He perceives himself to function with a positive attitude toward

change. And he rated the system as an effective tool in the categories assessed.

Participant Two (P2)
Individual Profile Data

N=12

Variable Name	Participant 2	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.53	-0.5	0.6	-1.67	0.17
LS2 Challenging	-1.24	0.22	1.01	-1.87	1.63
LS3 Appreciating	-0.5	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.86	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.84	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	4	5.7	2.31	4	12
RFCNEG	10	12.2	3.59	10	23
RFC3 Exploration	9	9.3	1.37	7	11
RFC4 Commitment	8	10	2.49	5	12
RFCPOS	17	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	2.85	2.37	1.14	0.9	5.35
ROAM2 Month 2	4	3.01	1.33	1.2	6.45
ROAM3 Month 3	5.6	3.94	1.47	2.15	7.1
ROATOTAVG Total	4.15	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	3	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	4.6	4.57	0.44	3	5

Participant two is an assistant principal in the school. This individual is in the 35-40 age range and has been an assistant principal for eight years. Prior experience included teaching at the high school level. This participant currently serves as a grade level administrator for the school. This includes administrative responsibility for all aspects of one of the four grade levels of students housed in the school.

A major area of responsibility for this participant includes preparation and refinement of student and teacher schedules for the school. This responsibility is shared with the principal providing a substantial amount of input into the process.

Participant two's assessment of the principal's leadership style ranged from a high score of 0.84 (role model) to a low score of -1.24 (challenging). These leadership style perceptions are the same as the principal viewed himself.

Readiness for change scores for participant two are high in the stages of exploration and commitment, a total rating of 17 from a possible 24. Combined scores for denial and resistance total 10 out of 24.

The total number of messages sent by participant two was 249. This was the second highest use of the system among participants. This resulted in a total average of 4.15 messages per day. Scores increased throughout the three month period from an average of 2.85 messages per day to 5.6 messages per day.

Participant two had an average effectiveness rating of 4.6 for the system. Ratings of 5 were given for the areas of communication, paper-flow, increasing time, and improving personal productivity. A rating of 3 was assigned to the category of decision-making.

In summary, participant two used the system at a high rate to communicate during the three month period. The attitude toward change was positive, and effectiveness ratings were high for four of the five categories.

Participant Three (P3)
Individual Profile Data

N=12

Variable Name	Participant 3	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.13	-0.5	0.6	-1.67	0.17
LS2 Challenging	1.63	0.22	1.01	-1.87	1.63
LS3 Appreciating	-0.66	-0.45	0.88	-1.95	0.75
LS4 Coaching	-1.76	-0.57	1.18	-3.24	0.89
LS5 Role Model	-0.09	0.42	0.48	-0.58	0.85

Variable Name	Participant 3	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Readiness for Change					
RFC1 Denial	5	6.5	1.57	5	11
RFC2 Resistance	8	5.7	2.31	4	12
RFCNEG	13	12.2	3.59	10	23
RFC3 Exploration	9	9.3	1.37	7	11
RFC4 Commitment	6	10	2.49	5	12
RFCPOS	15	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	2.25	2.37	1.14	0.9	5.35
ROAM2 Month 2	2.8	3.01	1.33	1.2	6.45
ROAM3 Month 3	4.35	3.94	1.47	2.15	7.1
ROATOTAVG Total	3.13	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	4	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	3	4.42	0.79	3	5
ER4 Increase time	3	4.42	0.79	3	5
ER5 Productivity	4	4.58	0.67	3	5
ERAVG	3.8	4.57	0.44	3	5

Participant three is currently serving as an assistant principal in the school. This is his fourth year as an administrator. This participant is in the 40-45 age range and has 22 years of experience in education. Prior roles include that of high school teacher.

Participant three's responsibilities include that of grade level administrator. Any aspect of administration that arises for the assigned grade level is this individual's responsibility. Other major areas of responsibility for this individual includes management of

transportation for extracurricular activities. All field trips and all athletic team transportation must be scheduled through this administrator. This is a major undertaking for a high school of this size with the range of extracurricular activities that are on-going.

Participant three's assessment of principal leadership style produced a high score of 1.63 (challenging) to a low of -1.76 (coaching).

Total readiness for change scores are similar for this individual. The RFCPOS score is 15 while the RFCNEG score is 13. This individual falls into the middle stages of change as assessed by this instrument.

A total of 188 messages were sent electronically by this participant. This ranked fifth in use. This resulted in an average daily rate of 3.13 messages. Rate of use increased over the three month period from a rate of 2.25 messages for month one to 4.35 messages during month three.

Participant three had a total average effectiveness rating of 3.8. This is the lowest rating reported for overall effectiveness of the system. The only category receiving a 5 was the reduction of paper-flow.

Summarizing, participant three viewed the principal's leadership style much differently from the way the principal viewed himself. Readiness for change for this individual is in the middle stages. While use of the system did increase over the three month period, this participant viewed it to be the least effective of any of the participants.

Participant Four (P4)
Individual Profile Data

N=12

Variable Name	Participant 4	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.28	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.94	0.22	1.01	-1.87	1.63
LS3 Appreciating	-1.4	-0.45	0.88	-1.95	0.75
LS4 Coaching	-3.24	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.28	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	4	5.7	2.31	4	12
RFCNEG	10	12.2	3.59	10	23
RFC3 Exploration	8	9.3	1.37	7	11
RFC4 Commitment	9	10	2.49	5	12
RFCPOS	17	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	1.45	2.37	1.14	0.9	5.35
ROAM2 Month 2	2	3.01	1.33	1.2	6.45
ROAM3 Month 3	2.6	3.94	1.47	2.15	7.1
ROATOTAVG Total	2.02	3.11	1.29	1.42	6.3

Variable Name	Participant 4	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	5	4.57	0.44	3	5

Participant four is an assistant principal. He has served as an administrator for the past four years, but in different schools. Prior to this position, he served as a guidance counselor. He is in the 45-50 age range and has 26 years of experience in education.

Participant four is also responsible for all aspects of the administration for one of the four grade levels housed in the school. Other responsibilities include management of the daily yellow bus transportation program, cafeteria supervision, and field trip approval. This individual is also responsible for all fund-raising activities that occur at the school.

From this participant's perspective, the principal's primary style of leadership was that of challenging. The style perceived least likely to be used was that of coaching.

Readiness for change scores for this individual are higher in the stages of exploration and commitment , a total of 17. A total score of 10 resulted for the denial and resistance stages.

Participant four sent a total of 121 messages for the three month period. Of the twelve participants included in this study, this rate ranked eleventh. The rate of use did increase from month to month, beginning at an average of 1.45 messages per day and finishing at 2.6 messages per day.

A rating of 5 was given for each of the five categories of effectiveness. This was the maximum score possible.

Summarizing, participant four did demonstrate an increase in use of the system over the course of the study. The increase demonstrated was one of the smallest gains recorded for the three month span of the study. And, this individual did perceive the system to be very effective in the categories rated. All categories rated received the maximum score possible for effectiveness.

But, this participants' rate of use was one of the lowest in the study group.

Participant Five (P5)
Individual Profile Data

N=12

Variable Name	Participant 5	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.49	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.03	0.22	1.01	-1.87	1.63
LS3 Appreciating	-1	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.18	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.66	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	6	5.7	2.31	4	12
RFCNEG	12	12.2	3.59	10	23
RFC3 Exploration	10	9.3	1.37	7	11
RFC4 Commitment	12	10	2.49	5	12
RFCPOS	22	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	1.8	2.37	1.14	0.9	5.35
ROAM2 Month 2	2.5	3.01	1.33	1.2	6.45
ROAM3 Month 3	3.65	3.94	1.47	2.15	7.1
ROATOTAVG Total	2.65	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	4	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	4	4.42	0.79	3	5
ER5 Productivity	4	4.58	0.67	3	5
ERAVG	4.4	4.57	0.44	3	5

Participant five is an assistant principal and has functioned in this role for the past four years. Prior experience includes that of a high school teacher. This individual is in the 40-45 age range and

has 21 years of service in the education profession.

Also a grade level administrator, other major responsibilities include management of the buildings and grounds of the total facility. This includes supervision of all housekeeping staff which totals eight full time adults. This individual has also been responsible for administering the summer school program offered at the school.

From this participants' perspective, the principal's primary leadership style is that of role model. The least likely style to be used was the appreciating style. This did coincide with the principal's perspective of himself for the strongest style identified.

This participants' readiness for change scores clearly indicate a readiness for change disposition in the positive stages of change, exploration and commitment. A score of 22 for the RFCPOS value supports this observation.

Participant five sent a total of 159 messages during the course of the study. This ranked eighth in use among participants. The average daily rate for the total period was 2.65 messages per day. An increase from a rate of 1.8 messages per day for month one to a 3.65 rate for month three occurred during the three month span.

Ratings of 5 for effectiveness were given for the areas of improving communication, and improving decision-making. The capacity to reduce paper-flow, increase time for other tasks, and increasing personal productivity were assigned ratings of 4.

In summary, this participant's rate of use of the system increased during the study. The system received a high rating of effectiveness from this participant as well. And, this individual had a very high score for the positive stages of change

Participant Six (P6)
Individual Profile Data

N=12

Variable Name	Participant 6	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.17	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.4	0.22	1.01	-1.87	1.63
LS3 Appreciating	-1.02	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.14	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.72	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	8	6.5	1.57	5	11
RFC2 Resistance	5	5.7	2.31	4	12
RFCNEG	13	12.2	3.59	10	23
RFC3 Exploration	8	9.3	1.37	7	11
RFC4 Commitment	11	10	2.49	5	12
RFCPOS	19	19.3	3.42	12	23

Variable Name	Participant 6	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Rate of Adoption					
ROAM1 Month 1	2.2	2.37	1.14	0.9	5.35
ROAM2 Month 2	3	3.01	1.33	1.2	6.45
ROAM3 Month 3	3.9	3.94	1.47	2.15	7.1
ROATOTAVG Total	3.03	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	4	4.67	0.49	4	5
ER3 Decision-making	4	4.42	0.79	3	5
ER4 Increase time	4	4.42	0.79	3	5
ER5 Productivity	4	4.58	0.67	3	5
ERAVG	4.2	4.57	0.44	3	5

Participant six currently serves as the director of guidance for this high school. This individual has 37 years of experience in the field of education. This individual has served in the current role for the past 14 years. Prior to this, other roles include, a junior high counselor, junior high teacher, and high school teacher. The age range of this individual falls in the 60-65 category.

As the director of guidance, this participant is responsible for the total guidance program. Supervision of four counselors and two clerical staff members is included. Students are assigned counselors on the basis of an alphabetical division of the student body by last name. Students enrolled in vocational programs, are assigned a

vocational counselor. Maintaining student records, registration of new students, filing reports, aiding students in scholarship competition and transcripts for graduation are several key areas of responsibility for this individual, not to forget, counseling students on an individual basis.

Participant six' assessment of principal leadership style ranged from a high score of 0.72, role model, to a low score of -1.02, the appreciating style.

Readiness for change scores were higher for the positive stages of change than for the negative. The stages of denial and resistance each received scores of 8.

During the three month span, participant six sent a total of 182 messages. This resulted in a rate of 3.03 messages per day. The rate of use increased from month one, 2.2 messages per day, to a rate of 3.9 messages per day for month three.

Participant six rated the system with an overall effectiveness of 4.2. Four of the five categories received ratings of 4. The only one receiving a 5 was the effectiveness of the system to improve internal communication.

Summarizing, participant six ranked sixth in frequency of use of the system. This individual also perceived the system to have a high effectiveness rating in the categories assessed. A review of the scores for readiness for change found equal scores for the stages of denial and resistance.

Participant Seven (P7)
Individual Profile Data

N=12

Variable Name	Participant 7	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-1.57	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.86	0.22	1.01	-1.87	1.63
LS3 Appreciating	0.39	-0.45	0.88	-1.95	0.75
LS4 Coaching	0.31	-0.57	1.18	-3.24	0.89
LS5 Role Model	-0.15	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	5	5.7	2.31	4	12
RFCNEG	11	12.2	3.59	10	23
RFC3 Exploration	11	9.3	1.37	7	11
RFC4 Commitment	11	10	2.49	5	12
RFCPOS	22	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	0.9	2.37	1.14	0.9	5.35
ROAM2 Month 2	1.2	3.01	1.33	1.2	6.45
ROAM3 Month 3	2.15	3.94	1.47	2.15	7.1
ROATOTAVG Total	1.42	3.11	1.29	1.42	6.3

Variable Name	Participant 7	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	5	4.57	0.44	3	5

This participant is a guidance counselor and has served in this role for the past fifteen years. Prior to this, this individual was a high school teacher. This participant is in the 55-60 age range with 30 years of experience in education.

This individual is responsible for the counseling of all students enrolled in vocational programs either on the main campus or those that are enrolled in a program at the Career Center. The Career Center is a centrally located facility that serves the entire county through a number of vocational offerings. Assisting students with part-time employment is also a function of this individual.

Principal leadership style scores from this participant ranged from a high or 0.86, the challenging style, to a low of -1.57, the inspiring style.

Readiness for change scores for this individual are positive. A combined score of 22 for the stages of exploration and commitment supports this observation. Scores for the stages of denial and resistance totaled 11.

The total number of messages sent by this participant over the course of the study was 85. This was the least number of messages sent by any participant in the study. But, an increase in average daily use did occur over the span of the study. Month one had a rate of 0.9 messages per day and month three increased to a rate of 2.15 messages per day. The overall average for this participant was 1.42 messages per day.

A rating of 5 for all categories assessed in effectiveness was assigned by this individual. This was the maximum score that could be obtained.

In summary, this individual increased their rate of use over the course of the study, but sent the fewest messages of any participant. This participant rated the system at the maximum level for all 5 categories of effectiveness assessed.

Participant Eight (P8)
Individual Profile Data

N=12

Variable Name	Participant 8	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.03	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.57	0.22	1.01	-1.87	1.63
LS3 Appreciating	-1.05	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.18	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.8	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	6	5.7	2.31	4	12
RFCNEG	12	12.2	3.59	10	23
RFC3 Exploration	11	9.3	1.37	7	11
RFC4 Commitment	12	10	2.49	5	12
RFCPOS	23	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	1.9	2.37	1.14	0.9	5.35
ROAM2 Month 2	2.1	3.01	1.33	1.2	6.45
ROAM3 Month 3	2.6	3.94	1.47	2.15	7.1
ROATOTAVG Total	2.2	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	4	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	4.8	4.57	0.44	3	5

Participant eight is a guidance counselor with 28 years of service in the field of education. Prior experience includes teaching at the high school level in several schools. This individual is in the 50-55

age range. This individual is responsible for all counseling needs required for a portion of the student body assigned by the method described in an earlier section. The organization of the graduation ceremony is a major function of this individual as well.

Participant eight's assessment of principal leadership style ranged from a high score of 0.57, the challenging style, to a low of -1.05 for the appreciating style.

Readiness for change scores are highest in the stages of exploration and commitment, 23 from a possible 24. This compares with a total score of 12 for the stages of denial and resistance.

Participant eight sent 132 messages electronically during the span of the study. This resulted in an overall daily average of 2.2 messages per day. This ranked ninth among the participants in use of the system. The average number of messages sent per day increased from 1.9 during month one to a 2.6 rate during month three.

The average effectiveness rating by this participant was 4.8. A maximum score of 5 was given for all categories except reduction of paper-flow.

In summary, this individual perceived the system to be a highly effective tool. There was a positive increase in use of the system

and this individual scored very high in the positive stages of change.

Participant Nine (P9)
Individual Profile Data

N=12

Variable Name	Participant 9	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	0.07	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.83	0.22	1.01	-1.87	1.63
LS3 Appreciating	-1.95	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.77	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.85	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	11	6.5	1.57	5	11
RFC2 Resistance	12	5.7	2.31	4	12
RFCNEG	23	12.2	3.59	10	23
RFC3 Exploration	7	9.3	1.37	7	11
RFC4 Commitment	5	10	2.49	5	12
RFCPOS	12	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	2.1	2.37	1.14	0.9	5.35
ROAM2 Month 2	3.25	3.01	1.33	1.2	6.45
ROAM3 Month 3	4.25	3.94	1.47	2.15	7.1
ROATOTAVG Total	3.2	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	5	4.57	0.44	3	5

This participant is a guidance counselor in the school and has served in that capacity for the past eight years. Years of experience

in the field of education total 18. Prior experience was that of a classroom teacher at the high school level. The age range of this participant is in the 35-40 span.

While counseling a portion of the student body is a primary function, this individual is also responsible for the management of the student scholarship program as well. This requires much contact with students, teachers, and parents to meet deadlines and assist in the process of application.

Principal leadership style from this individual's perspective ranged from a high score of 0.85, the role model style, to a low of -1.95, the appreciating style. Note that this participant's second ranked leadership style score had a value of 0.83 for the challenging style.

This participant was the only member of the study population that had an extremely high score for readiness for change in the more negative stages. A combined score of 23 for the RFCNEG score contrasts with a score of 12 for the RFCPOS score.

Participant nine sent a total of 192 messages during the three months. This ranked fourth in use of the system. This converts to a 3.2 daily average for the total period of time. There was an increase

in the rate of use for this participant from month one, 2.1 messages per day, to month three, 4.25 messages per day.

All five categories rated for effectiveness received scores of 5 from this participant, the highest possible.

Summarizing, this participant used the system at one of the highest rates recorded. This is interesting since their readiness for change scores were high for the stages of denial and resistance. The system was rated as very effective in every category assessed in this study.

Participant Ten (P10)
Individual Profile Data

N=12

Variable Name	Participant 10	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.96	-0.5	0.6	-1.67	0.17
LS2 Challenging	-0.51	0.22	1.01	-1.87	1.63
LS3 Appreciating	0.61	-0.45	0.88	-1.95	0.75
LS4 Coaching	0.89	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.2	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	4	5.7	2.31	4	12
RFCNEG	10	12.2	3.59	10	23
RFC3 Exploration	11	9.3	1.37	7	11
RFC4 Commitment	10	10	2.49	5	12
RFCPOS	21	19.3	3.42	12	23

Variable Name	Participant 10	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Rate of Adoption					
ROAM1 Month 1	2.3	2.37	1.14	0.9	5.35
ROAM2 Month 2	2.95	3.01	1.33	1.2	6.45
ROAM3 Month 3	3.55	3.94	1.47	2.15	7.1
ROATOTAVG Total	2.93	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	4	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	4	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	4.6	4.57	0.44	3	5

Participant ten serves as a guidance counselor in the school. With 16 years of experience, this individual falls in the 35-40 age range. Prior experience includes junior high teaching, junior high counseling, and counseling at the community college level.

This individual is responsible for all aspects of counseling for a portion of the student body. Involvement in the scheduling process is evolving for this individual. This participant is also responsible for all aspects of standardized testing of students for the school.

Participant ten's assessment of principal leadership style ranged from a high of 0.89, coaching style, to a low of -0.96 for the inspiring style of leadership.

Readiness for change scores are high for exploration and commitment and low for denial and resistance.

A total of 176 messages were sent by this participant during the three month span of the study for a 2.93 average per day. The month one average of 2.3 messages per day increased to 3.55 messages per day during month three.

The overall effectiveness calculation resulted in an average rating of 4.6 of a possible 5. This was a very high rating.

In summary, this participant showed a steady increase in the use of the system over the three month period. They perceived themself as an individual that has a high readiness level for change. Their rate of use of the system ranked seventh among the group.

Participant Eleven (P11)
Individual Profile Data

N=12

Variable Name	Participant 11	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	-0.46	-0.5	0.6	-1.67	0.17
LS2 Challenging	1.02	0.22	1.01	-1.87	1.63
LS3 Appreciating	-0.16	-0.45	0.88	-1.95	0.75
LS4 Coaching	-1.72	-0.57	1.18	-3.24	0.89
LS5 Role Model	-0.58	0.42	0.48	-0.58	0.85

Variable Name	Participant 11	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	5	5.7	2.31	4	12
RFCNEG	11	12.2	3.59	10	23
RFC3 Exploration	8	9.3	1.37	7	11
RFC4 Commitment	12	10	2.49	5	12
RFCPOS	20	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	3.5	2.37	1.14	0.9	5.35
ROAM2 Month 2	3.75	3.01	1.33	1.2	6.45
ROAM3 Month 3	5.15	3.94	1.47	2.15	7.1
ROATOTAVG Total	4.13	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	4	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	4	4.42	0.79	3	5
ER4 Increase time	3	4.42	0.79	3	5
ER5 Productivity	3	4.58	0.67	3	5
ERAVG	3.8	4.57	0.44	3	5

Participant eleven's role is that of front office secretary. Years of experience total 10 and age range is in the 30-35 span. All work experience has been of this nature. This individual's responsibilities include working primarily with the principal and assistant principals. Answering the phone, greeting visitors, written correspondence, filing, and scheduling appointments are a few of the functions of this individual. Maintaining instructional supply allotments and placing requisitions for instructional orders are

also a function of this position.

This individual perceives the principal to use a primary leadership style of challenging and the least likely style is that of coaching.

A score of 20 for the stages of exploration and commitment rates this individual as one that welcomes change. This compares with a score of 11 for the denial and resistance stages.

This participant ranked third highest in the use of the system. During the three month period, 248 messages were sent. This was an average of 4.13 messages per day. Month one had a rate of 3.5 messages per day and month three increased to a rate of 5.15 per day.

The overall effectiveness rating calculated was 3.8. Reducing paper-flow received a rating of 5. Increasing time and increasing personal productivity received ratings of 3. The remaining categories received ratings of 4.

This participant was one of the highest users but did not rate the system nearly as high in effectiveness as other members did. Note that this individual did begin the study with one of the highest rates of use during the first month of the study.

Participant Twelve (P12)
Individual Profile Data

N=12

Variable Name	Participant 12	Group Mean	Standard Deviation	Group Minimum	Group Maximum
Leadership Style					
LS1 Inspiring	0.17	-0.5	0.6	-1.67	0.17
LS2 Challenging	-0.07	0.22	1.01	-1.87	1.63
LS3 Appreciating	0.75	-0.45	0.88	-1.95	0.75
LS4 Coaching	0.47	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.72	0.42	0.48	-0.58	0.85
Readiness for Change					
RFC1 Denial	6	6.5	1.57	5	11
RFC2 Resistance	4	5.7	2.31	4	12
RFCNEG	10	12.2	3.59	10	23
RFC3 Exploration	10	9.3	1.37	7	11
RFC4 Commitment	12	10	2.49	5	12
RFCPOS	22	19.3	3.42	12	23
Rate of Adoption					
ROAM1 Month 1	1.85	2.37	1.14	0.9	5.35
ROAM2 Month 2	2.2	3.01	1.33	1.2	6.45
ROAM3 Month 3	2.4	3.94	1.47	2.15	7.1
ROATOTAVG Total	2.15	3.11	1.29	1.42	6.3
Effectiveness Rating					
ER1 Communication	5	4.75	0.45	4	5
ER2 Paper-flow	5	4.67	0.49	4	5
ER3 Decision-making	5	4.42	0.79	3	5
ER4 Increase time	5	4.42	0.79	3	5
ER5 Productivity	5	4.58	0.67	3	5
ERAVG	5	4.57	0.44	3	5

Participant twelve is also a secretary in the school. During 15 years of experience, clerical responsibilities have changed as needed. They have become more technical and technological in

nature during the past five years. The age range of this participant is 40-45 years. This individual is currently responsible for the management of the SIMS (Student Information Management System) functions that pertain to daily attendance of students. Some functions related to data entry and report card processing are also included.

Scores for principal leadership style range from a high of 0.75, the appreciating style, to a low of -0.07 for the challenging style. This participant also had a very close second score of 0.72 for the role model style of leadership.

Readiness for change scores were high in the stages of exploration and commitment. A total score of 22 of a possible 24 supports this observation.

Participant twelve sent 129 messages during the span of the study for an average of 2.15 messages per day. An increase in use did occur from 1.85 messages per day during month one to 2.4 per day during month three.

All five categories of effectiveness received ratings of 5 from this participant.

In summary, this participant viewed the system as very effective. Their use of the system was one of the lowest and they perceived themself as a person that is ready for change.

Summary of Profiles

A review of the twelve individual profiles offers some interesting insight with respect to the four variables under exploration. For example, ten of twelve participants perceived the principal's primary leadership style as falling into one of two categories. Six perceived him to use the "role model" style while four classified him to function primarily using the "challenging" style.

The group as a whole perceived themselves as individuals that faced change in a positive manner. Eleven of the twelve had higher total scores for the sum of exploration and commitment stages than for the sum of the denial and resistance stages. Individually, the commitment stage received the high score for eight of the twelve participants.

All participants increased their rate of use of the system over the three month period. Participant one had the highest rate of use

while participant seven had the lowest rate of use. Effectiveness ratings as a group were high. The effectiveness of the system to improve communication received the highest average rating for a single category. With a maximum rating of 5, all five categories had average ratings of effectiveness greater than 4.

Tables and Figures

The format for reporting the findings will now change. The findings will be displayed using tables and figures. These will include both individual and group data. The first five tables displayed will contain descriptive data for each variable under examination. Those tables are titled as follows:

Table 1 Leadership Style Scores

Table 2 Readiness for Change Scores

Table 3 Rate of Adoption Values

Table 4 Effectiveness Ratings

Table 5 Descriptive Statistics for Each Variable

Each table will now be presented and a brief discussion of the findings presented for the variable or correlation calculated will be included.

Table 1
Leadership Style Scores

Participant	Leadership Style Inspiring LS1 Score	Leadership Style Challenging LS2 Score	Leadership Style Appreciating LS3 Score	Leadership Style Coaching LS4 Score	Leadership Style Role Model LS5 Score
P1	-1.67	-1.87	0.54	0.31	0.82
P2	-0.53	-1.24	-0.5	-0.86	0.84
P3	-0.13	1.63	-0.66	-1.76	-0.09
P4	-0.28	0.94	-1.4	-3.24	0.28
P5	-0.49	0.03	-1	-0.18	0.66
P6	-0.17	0.4	-1.02	-0.14	0.72
P7	-1.57	0.86	0.39	0.31	-0.15
P8	-0.03	0.57	-1.05	-0.18	0.8
P9	0.07	0.83	-1.95	-0.77	0.85
P10	-0.96	-0.51	0.61	0.89	0.2
P11	-0.46	1.02	-0.16	-1.72	-0.58
P12	0.17	-0.07	0.75	0.47	0.72
Group Avg.	-0.50	0.22	-0.45	-0.57	0.42

The data reported in Table 1 represents the leadership style values reported from the Human Patterns instrument for each participant. This instrument provided an assessment of the principal's leadership style from each individual including the principal himself. The group average is also included. Note that the group average resulted in a primary leadership style of "role model". The second ranked leadership style was that of "challenging". From the group's perspective, the least likely style used by the principal was that of "coaching".

Table 2
Readiness for Change Scores

	Readiness for Change	Readiness for Change	Sum	Readiness for Change	Readiness for Change	Sum
	Denial RFC1	Resistance RFC2	RFC1+RFC2 RFCNEG	Exploration RFC3	Commitment RFC4	RFC3+RFC4 RFCPOS
Part.						
P1	6	5	11	10	12	22
P2	6	4	10	9	8	17
P3	5	8	13	9	6	15
P4	6	4	10	8	9	17
P5	6	6	12	10	12	22
P6	8	5	13	8	11	19
P7	6	5	11	11	11	22
P8	6	6	12	11	12	23
P9	11	12	23	7	5	12
P10	6	4	10	11	10	21
P11	6	5	11	8	12	20
P12	6	4	10	10	12	22
Group Avg.	6.50	5.67	12.17	9.33	10.00	19.33

The data reported in Table 2 results from the "Readiness for Change" instrument. Four stages of change, denial, resistance, exploration, and commitment are identified through this process. All participants are assigned a score for each stage. The higher scores indicate the stage or stages of change that an individual perceives themself to be operating within. Scores for each stage may range from a minimum of 4 to a maximum of 12. The scores are then further classified into two additional categories, RFCNEG and RFCPOS. RFCNEG is the sum of the denial and resistance stages. RFCPOS is the sum of the exploration and commitment stages. Note that the group RFCPOS score is much higher than the RFCNEG score.

Table 3
Rate of Adoption

	Average Messages Per Day	Average Messages Per Day	Average Messages Per Day	Average Messages Per Day
	Month 1 ROAM1	Month 2 ROAM2	Month 3 ROAM3	Total ROATOT
Participant				
P1	5.35	6.45	7.1	6.3
P2	2.85	4	5.6	4.15
P3	2.25	2.8	4.35	3.13
P4	1.45	2	2.6	2.02
P5	1.8	2.5	3.65	2.65
P6	2.2	3	3.9	3.03
P7	0.9	1.2	2.15	1.42
P8	1.9	2.1	2.6	2.2
P9	2.1	3.25	4.25	3.2
P10	2.3	2.95	3.55	2.93
P11	3.5	3.75	5.15	4.13
P12	1.85	2.2	2.4	2.15
Group Avg.	2.37	3.02	3.94	3.11

Table 3 displays data regarding the rate of adoption of the electronic mail system. This is defined as the average number of messages sent per day by participants. Rates of adoption for four time periods is calculated, the three individual months, and the average for the total period. A group average has also been calculated for all members of the study. Participant one had the highest rate of use and participant seven had the lowest rate of use of the electronic mail system.

Table 4
Effectiveness Rating

	Improves Internal Communication	Reduces Paper Flow	Improves Decision Making	Increases Time for Other Tasks	Increases Personal Productivity	Average
	ER1	ER2	ER3	ER4	ER5	ERAVG
Participant						
P1	5	4	4	5	5	4.6
P2	5	5	3	5	5	4.6
P3	4	5	3	3	4	3.8
P4	5	5	5	5	5	5
P5	5	4	5	4	4	4.4
P6	5	4	4	4	4	4.2
P7	5	5	5	5	5	5
P8	5	4	5	5	5	4.8
P9	5	5	5	5	5	5
P10	4	5	5	4	5	4.6
P11	4	5	4	3	3	3.8
P12	5	5	5	5	5	5
Group Avg.	4.75	4.67	4.42	4.42	4.58	4.57

Table 4 consists of ratings assigned for each category of effectiveness by participants. A group average of effectiveness is also calculated for each measure of effectiveness. The effectiveness of the system to improve internal communication received the highest rating. As a group, the system received high ratings overall for each category assessed.

Table 5
Descriptive Statistics

N=12

Variable Name	Group Mean	Standard Deviation	Minimum	Maximum
Leadership Style				
LS1 Inspiring	-0.5	0.6	-1.67	0.17
LS2 Challenging	0.22	1.01	-1.87	1.63
LS3 Appreciating	-0.45	0.88	-1.95	0.75
LS4 Coaching	-0.57	1.18	-3.24	0.89
LS5 Role Model	0.42	0.48	-0.58	0.85
Readiness for Change				
RFC1 Denial	6.5	1.57	5	11
RFC2 Resistance	5.7	2.31	4	12
RFCNEG	12.2	3.59	10	23
RFC3 Exploration	9.3	1.37	7	11
RFC4 Commitment	10	2.49	5	12
RFCPOS	19.3	3.42	12	23
Rate of Adoption				
ROAM1 Month 1	2.37	1.14	0.9	5.35
ROAM2 Month 2	3.01	1.33	1.2	6.45
ROAM3 Month 3	3.94	1.47	2.15	7.1
ROATOTAVG Total	3.11	1.29	1.42	6.3
Effectiveness Rating				
ER1 Communication	4.75	0.45	4	5
ER2 Paper-flow	4.67	0.49	4	5
ER3 Decision-making	4.42	0.79	3	5
ER4 Increase time	4.42	0.79	3	5
ER5 Productivity	4.58	0.67	3	5
ERAVG	4.57	0.44	3	5

Table 5 is a list of descriptive statistics for all variables being investigated. Included are means, standard deviations, and maximum and minimums for each variable. This data serves as a point of reference for comparison among the data collected.

Correlation Figures

In addition to the descriptive data provided in the tables, a series of correlation figures have been developed to illustrate associations that may exist among specific pairings of variables. These figures are not intended to display results that would be considered statistically significant. In an exploratory case study such as this, the study population is too small to realize any statistical values that would be acceptable. Rather they are intended to offer insight into possible patterns that may exist among the variables that may not be observed or considered through descriptive data alone.

List of Figures

Leadership Styles and Rates of Adoption

Figures 1 through 5 illustrate the correlations calculated for each leadership style and each rate of adoption period. Note that the inspiring style of leadership was the only style that produced positive correlation values for all rate of adoption periods.

Figure 1. Inspiring leadership style and rate of adoption

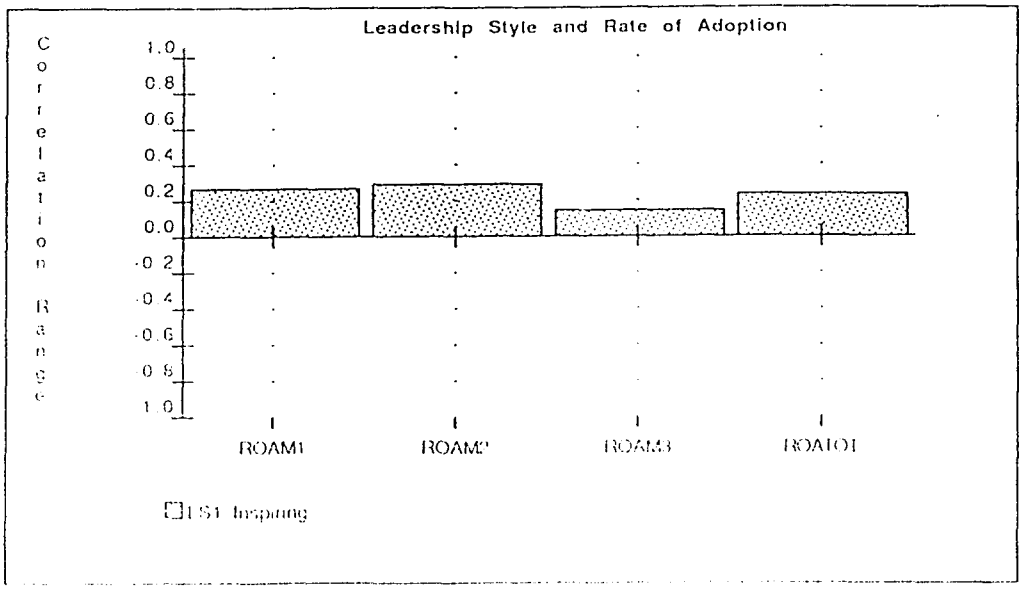


Figure 2. Challenging leadership style and rate of adoption

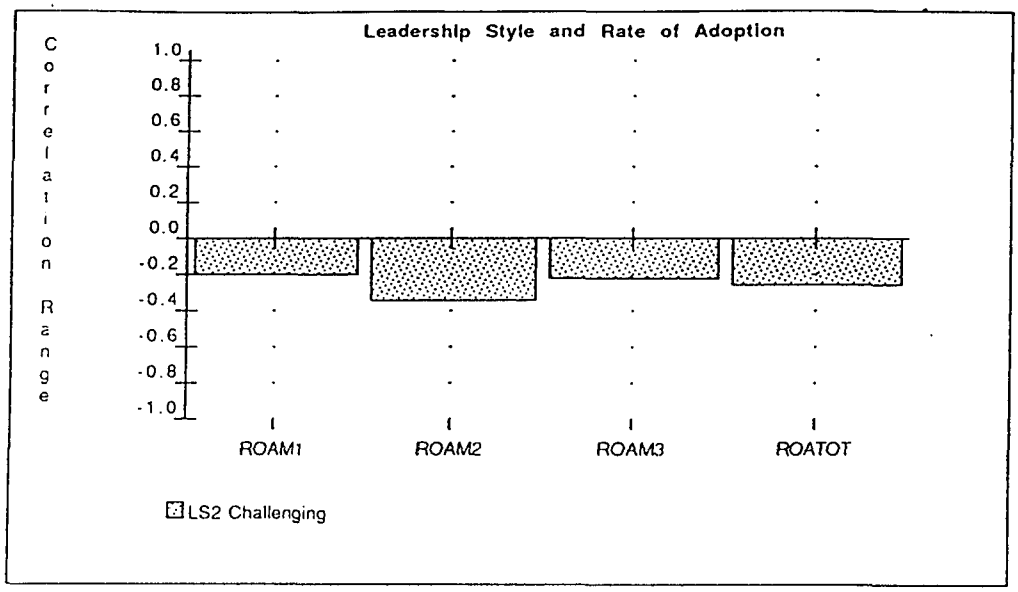


Figure 3. Appreciating leadership style and rate of adoption

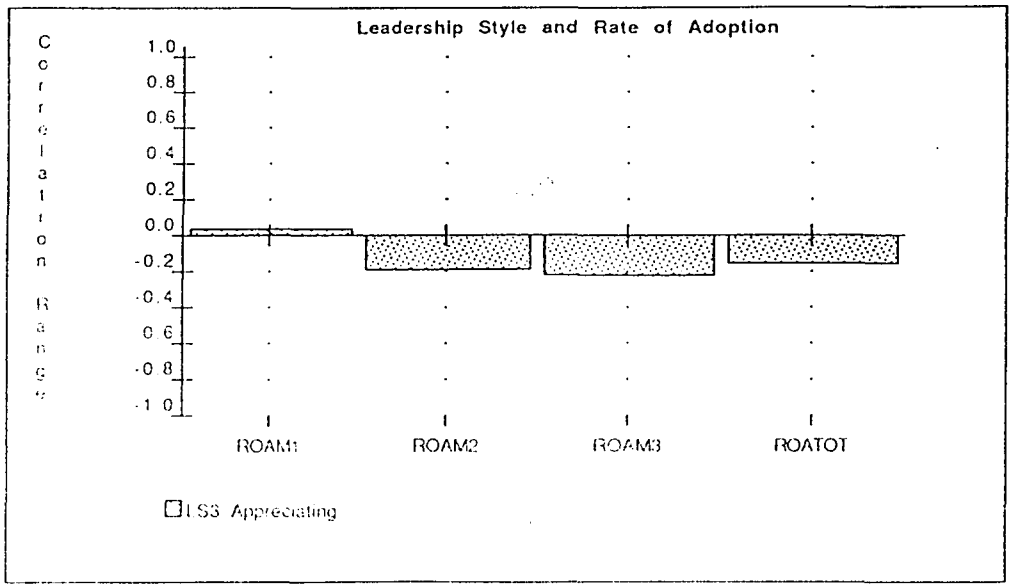


Figure 4. Coaching leadership style and rate of adoption

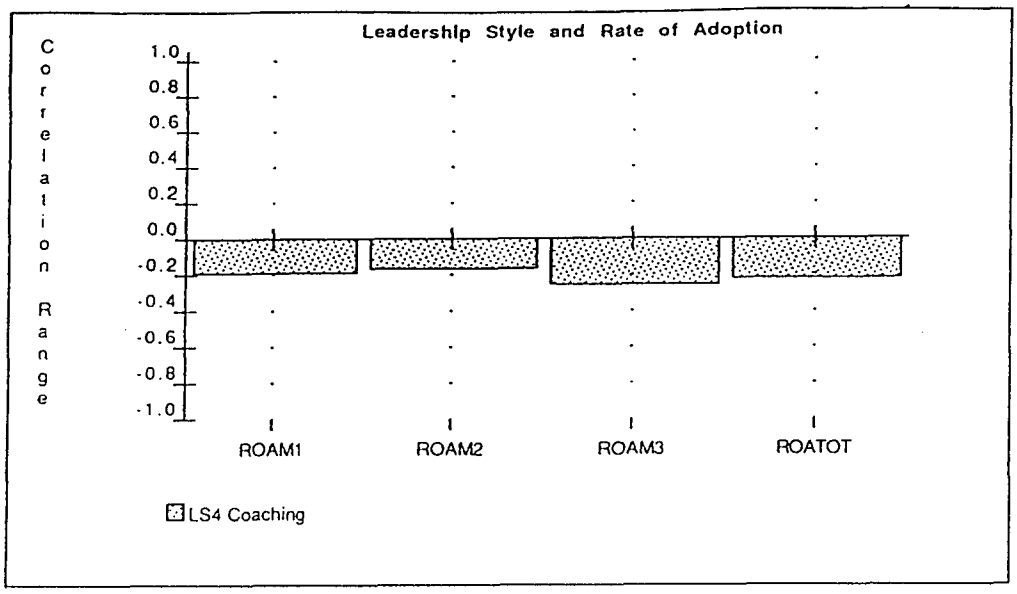
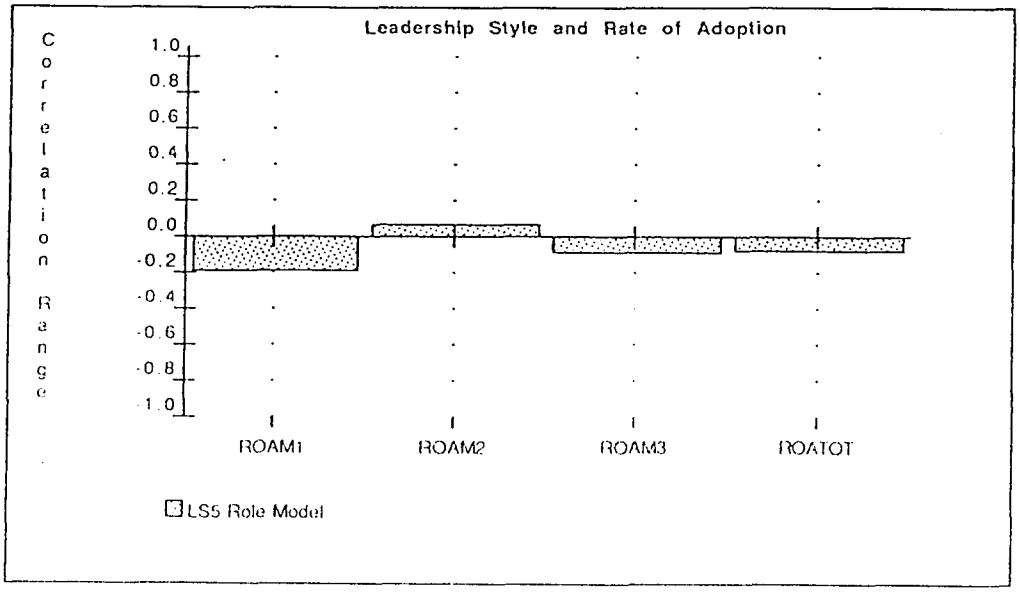


Figure 5. Role model leadership style and rate of adoption



Effectiveness Ratings and Rates of Adoption

Figures 6 through 11 illustrate correlation ranges for effectiveness ratings paired with rates of adoption. Note that the only category of effectiveness that resulted in positive values was the perception of the electronic mail system to reduce paper-flow. For all other categories of effectiveness surveyed, the results illustrated are negative.

Figure 6. ER1 (Communication)and rate of adoption

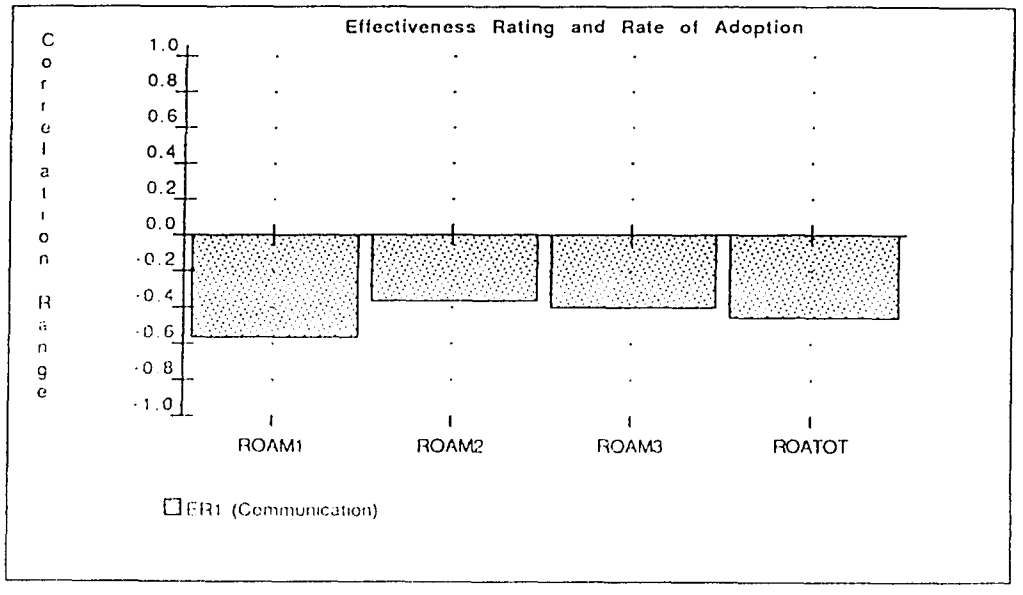


Figure 7. ER2 (Paper-flow) and rate of adoption

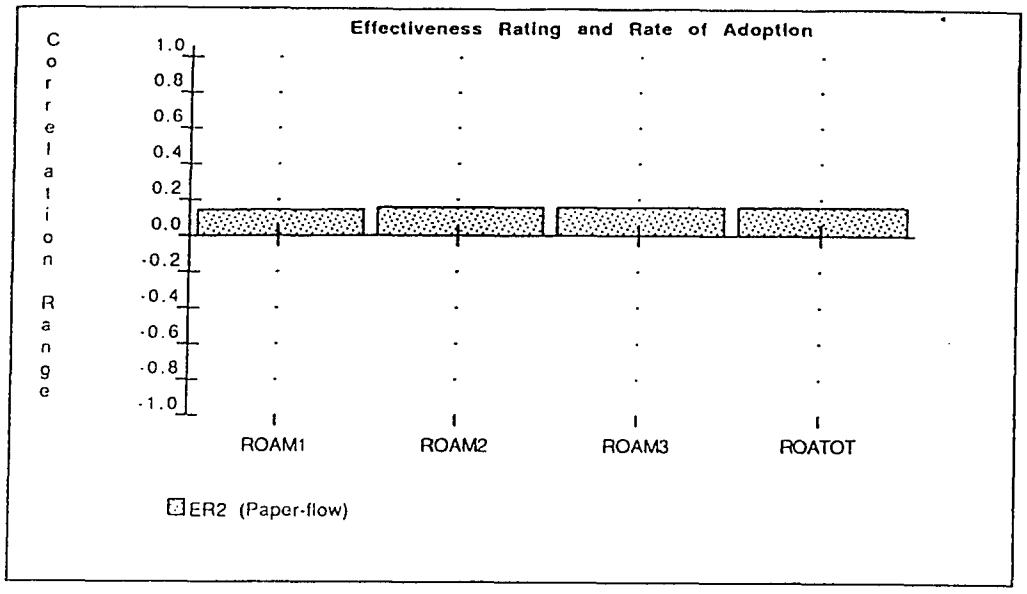


Figure 8. ER3 (Decision-making) and rate of adoption

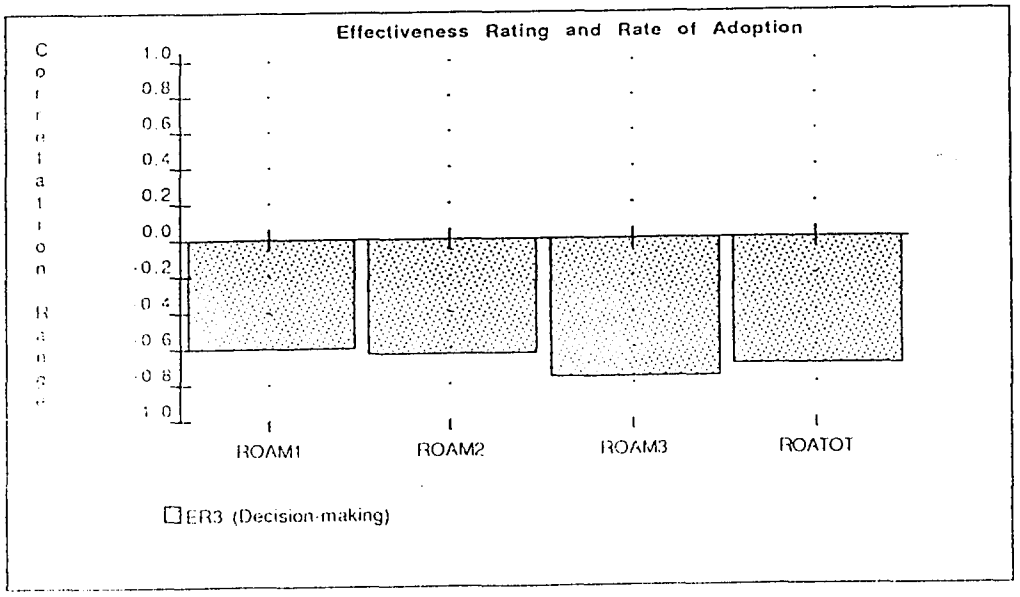


Figure 9. ER4 (Increases time) and rate of adoption

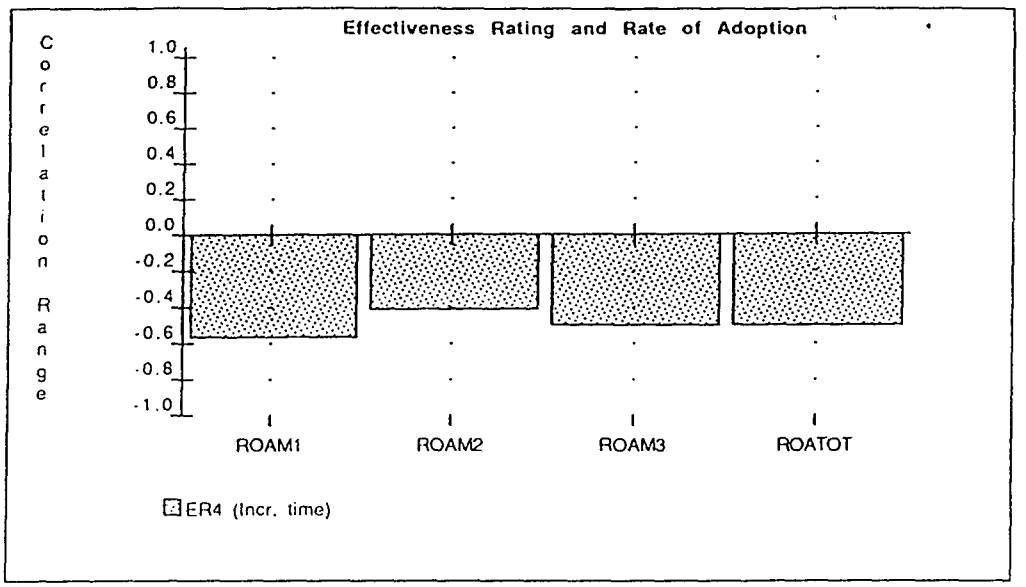


Figure 10. ER5 (Increases productivity) and rate of adoption

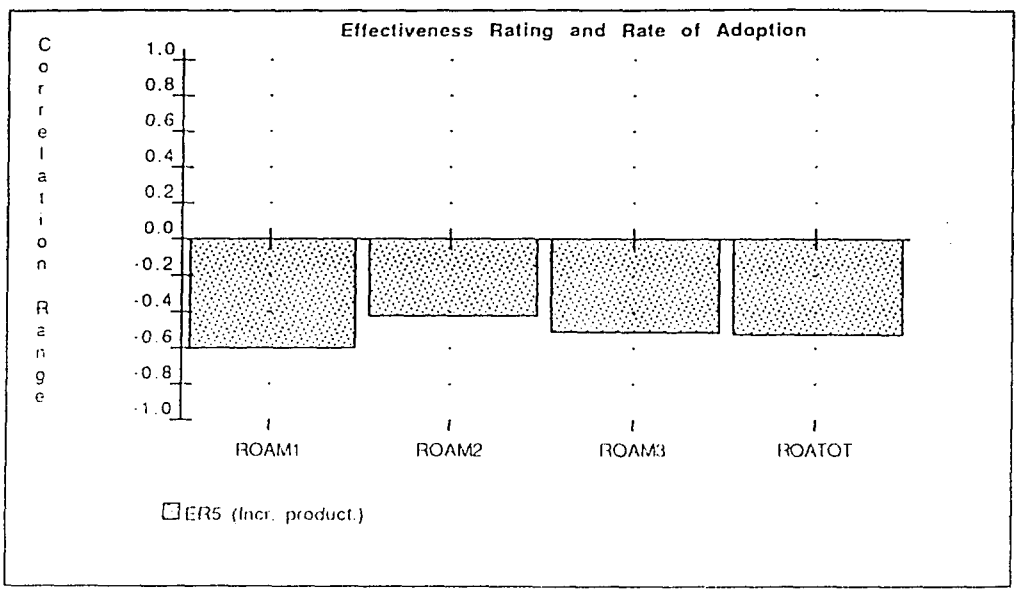
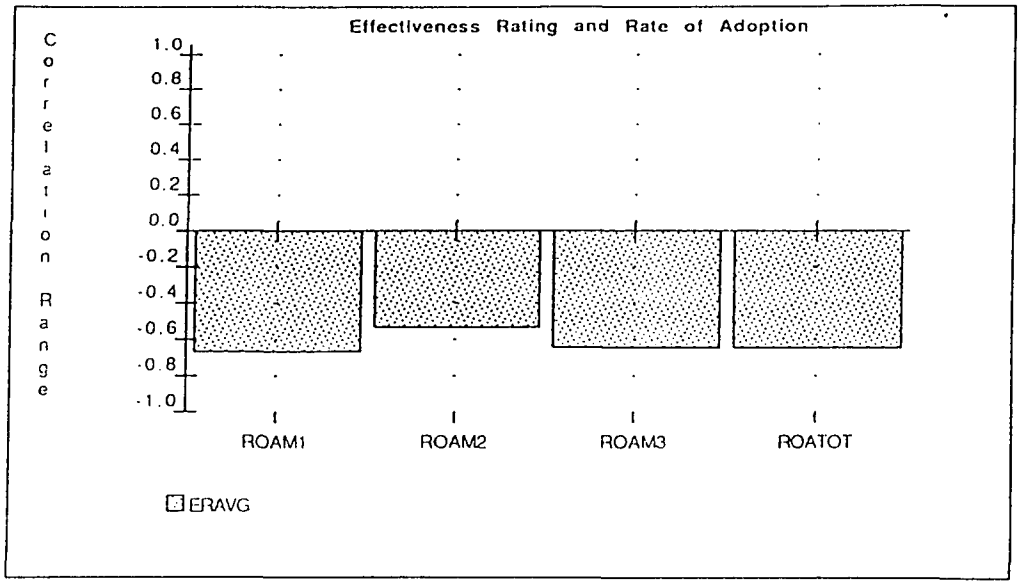


Figure 11. ERAVG (Average) and rate of adoption



Figures 12 and 13 illustrate correlation ranges calculated for readiness for change paired with rate of adoption and readiness for change paired with effectiveness rating. Note that the correlation range illustrated in table 12 displays positive values for the RFCNEG scores and rate of adoption. The RFCPOS correlation values are negative for each rate of adoption.

Figure 13 displays the correlation range calculated for readiness for change and effectiveness rating. Eleven of the twelve pairings produced positive correlation values. The RFCPOS pairing with the ER2 (paper-flow) effectiveness rating produced the only negative value.

Figure 12. Readiness for change and rate of adoption

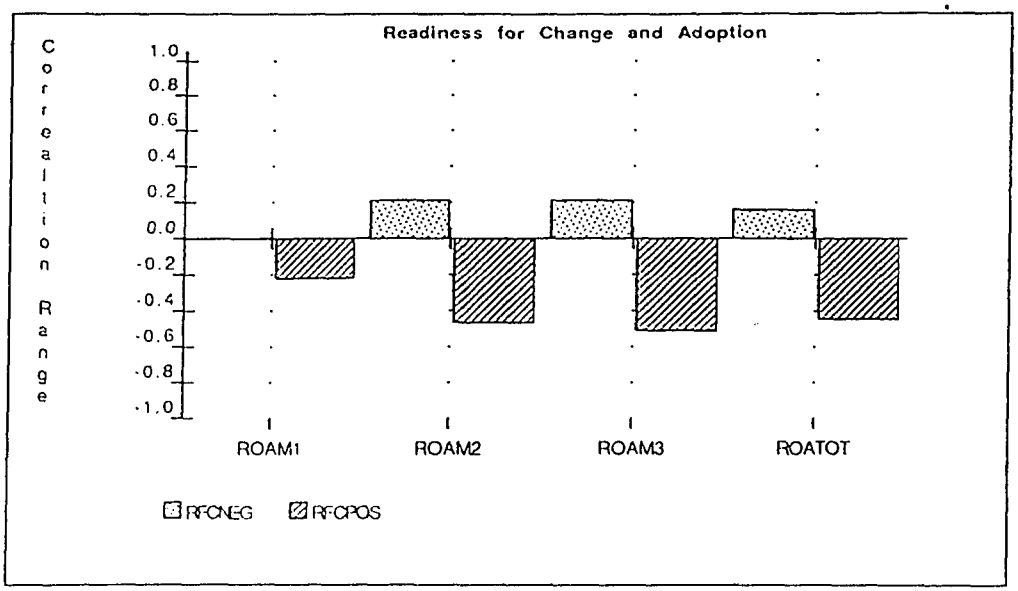
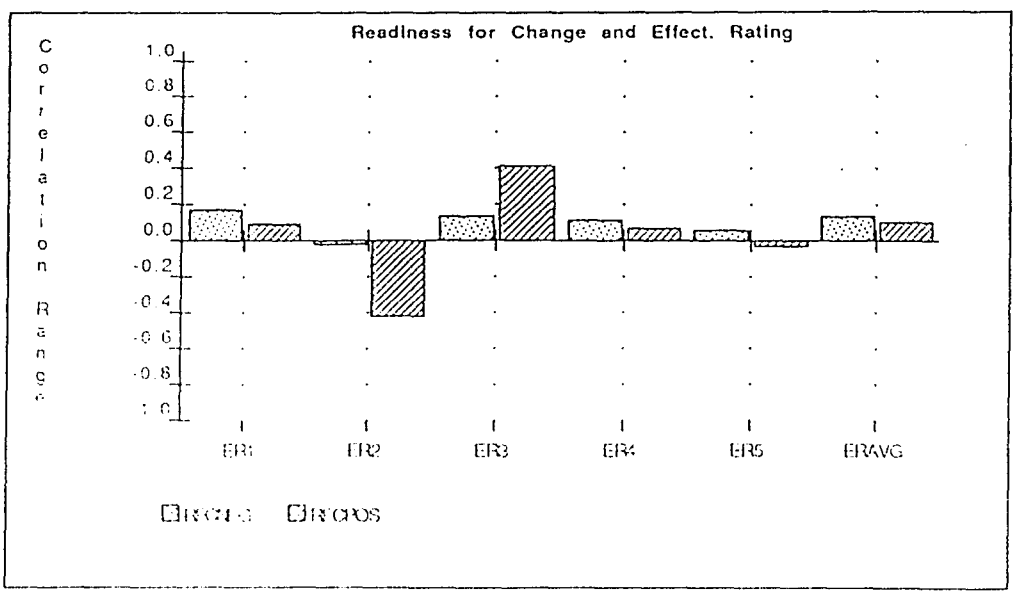


Figure 13. Readiness for change and effectiveness rating



Summary

The purpose of this chapter was to report the findings related to the variables under investigation in this exploratory case study. Two formats were used to achieve this effort: individual participant profiles, and data tables and figures.

The narrative profiles were intended to present a brief description of each participant in the study. Professional experience, current roles and positions, age range, and prior experiences were included. Also, ratings and scores were presented and discussed for the individual in conjunction with related measures of central tendency and variability for each variable.

The tables provided descriptive data for both individuals and the group for each of the variables being explored. The correlation figures were presented to assist in the observation of patterns that may exist among the specific variables under scrutiny.

Conclusions and recommendations offered in the fifth chapter result from a thorough analyses of the findings reported in this chapter.

CHAPTER V

DISCUSSION OF THE RESULTS

Summary

The objective of this study was to describe the diffusion of an electronic mail system in a public school administrative setting. The study focused on four variables: 1) principal leadership style, 2) participant readiness for change, 3) rate of adoption, and 4) effectiveness of the electronic mail system.

Five research questions were identified in the first chapter. Those questions provided the framework used to explore and describe the process of diffusion that occurred during the course of this study.

The purpose of this chapter will be to discuss each of those questions using the results reported in the preceding chapter. An analyses of the data will be used to offer conclusions and findings relevant to the variables identified above with respect to diffusion of electronic mail in a high school administrative setting.

Analyses of Research Questions

The following sections will address each research question individually. Data reported in the preceding chapter will be referred to in each discussion. Observations made with respect to variance among individual and group ratings and scores will be explained primarily using measures of central tendency and variability. The correlation figures presented in chapter four will also be used to describe any patterns among variables that surface that may not be noted by a review of the descriptive data alone.

Research Questions

Question 1: For this study group, how were perceived principal leadership style and rate of adoption associated?

All participants increased their rate of adoption over the three month time span of the study. An examination of Table 1, Leadership Style Scores, found on page 103 indicates that ten of twelve individuals participating in this study, perceived the principal to function using a primary leadership style in one of two categories: "role model" style or "challenging" style. The role model style had

the greatest mean value and the challenging style ranked second. Consider this information with each participant's rank in overall rate of adoption score, and it is observed that four of the top six users of the system perceived the primary leadership style of the principal to be the role model style. Six of the top nine perceived the role model style as primary. Note that this does include the principal's ratings as well in the observation. The principal did have the highest adoption rate of any of the participants. He also perceived himself to lead using the role model style.

The two participants that had the lowest adoption rates perceived the principal as a leader that uses the "challenging" style. This does not imply, as a general rule, that this style of leadership produces lower rates of adoption. Participant eleven and participant three perceived the principal as this type of leader and their adoption rates were in the top half of the group.

A review of Figures 1 through 5, which illustrate correlation ranges for leadership styles and rates of adoption, on pages 109 through 111 suggests an interesting relationship. Mathematically, the correlations that result from the pairing of the "inspiring" style of leadership and each adoption rate produces all positive values.

This was the only case in which this occurred. None of the participants perceived the principal using this style as a primary style of leadership. For the overall adoption rate, all other styles of leadership resulted in negative values for correlations. Two other cases resulted in positive values for leadership style other than inspiring.

The challenging style did produce the largest negative correlation range illustrated for participants and the overall total adoption rate.

Question 2: How did participants perceive the effectiveness of the electronic mail system and how did this vary among participants?

Table 4, Effectiveness Ratings, found on page 106 lists all of the participants ratings for each of the five categories of effectiveness under consideration. Using a rating scale ranging from 1, the least effective, to 5, the most effective, it is obvious from this data that all participants perceived the system to be very effective. An overall average effectiveness rating of 4.57 for the whole group was reported. The lowest score reported for any category was 3. The

effectiveness of the system to improve internal communication had the highest overall average rating (4.75) among participants. Two categories tied for the lowest average rating of effectiveness: improves decision-making and increases time for other tasks. They both had average rating scores of 4.42.

Individual participants had average overall effectiveness ratings ranging from a low of 3.8 to a high of 5. Participant three and participant eleven had the lowest average ratings. Participants four, seven, nine and twelve rated the system in every category of effectiveness at the maximum score possible, a 5.

Question 3: How were participant readiness levels for change associated with rates of adoption?

An analysis of readiness for change scores reported in Table 2 on page 104 indicate that the majority of the participants perceived themselves to face change from a positive perspective. Eleven of the twelve participants received scores higher for the stages of exploration and commitment than for the stages of denial and resistance. This is supported by an average group score for the

positive categories of change of 19.33 compared with an average for the negative stages of 12.17. How do these readiness for change scores relate to participants' rate of adoption of the electronic mail system?

All participants had rates of adoption that increased over the course of the study. All participants except for one had readiness for change scores higher in the positive stages of change. Participant nine had a much higher score for the negative stages of change, but had one of the higher rates of adoption. Therefore, it is not evident from reviewing this data that a higher score for readiness for change influences a higher rate of adoption. It appears that several participants that had lower rates of adoption had some of the higher scores for readiness for change.

A review of Figure 12 on page 116 seems to support this observation. This figure illustrates the correlation range calculated for the RFCNEG scores and RFCPOS scores with each rate of adoption. The scores for the positive stages of change, when correlated with the overall rate of adoption produced a negative range. The negative scores produced a positive correlation range for overall rates of adoption.

Question 4: How were participant readiness levels for change and effectiveness ratings associated?

As reported in the discussion of question three, a review of the readiness for change values indicates all participants except for one perceived themselves to have a positive disposition with respect to change. The average total effectiveness rating for the group was a 4.57 out of a possible maximum score of 5. Therefore, no clear relationship surfaced among these variables. Regardless of the readiness for change score, individuals perceived the system to be effective.

A review of Figure 13 on page 116 supports this observation. The range of correlation values illustrated in this figure were positive regardless of the stages of change. Therefore, no pattern could be determined for this pairing of variables.

The perception of the effectiveness of the electronic mail system was high among all participants. This was true for all five categories of effectiveness surveyed.

Question 5: How were participant ratings of effectiveness associated with rate of adoption of the electronic mail system?

All participants increased their rate of adoption over the span of the study. All participants rated the system at a relatively high total average rate of effectiveness. Ranking each participants' overall average effectiveness rating and comparing this with each individuals' overall rate of adoption ranking offers an interesting observation. It appears that participants that had the highest ratings of effectiveness did not necessarily have the highest rates of adoption. Rather the opposite seemed to be true. For example, the participant with the lowest rate of adoption, participant seven, had the highest possible rating of effectiveness. The individual with the highest rate of adoption, participant one, had an overall effectiveness rating that ranked third.

A review of Figures 6 through 11 on pages 112 through 115 offers the following insight. The only category that produced positive values was the effectiveness of the system to reduce paper-flow. All other categories of effectiveness, when paired with

adoption rates, resulted in a negative correlation.

Conclusions

The diffusion of an innovation in any organization is a product and mix of many different forces. This exploratory case study focused on some specific variables that are a part of that mix. Principal leadership style, an individual's readiness for change, the rate of adoption of the technology, and the perceived effectiveness of the innovation served as focal points of this study.

Developing a better understanding of associations that may exist between these variables and the diffusion process was a primary objective. Using the data reported in chapter four and the research questions as the framework of exploration, the following conclusions and observations can be made.

An innovation, electronic mail, was introduced to participants in a public high school and over the course of the study, adoption rates did increase.

Participants did perceive the electronic mail system to be very effective. In all effectiveness categories assessed, each one received a score that was above the average rating of effectiveness

that was possible to achieve. The literature discussed in chapter two (Mayer, 1985) suggests that electronic mail has the potential to improve efficiency of communication. The effectiveness of the system to improve internal communication was rated highest among participants. Electronic mail is viewed as a convenient means of communication. Messages can be delivered to individuals or groups very quickly, potentially saving time and expense. While decision-making may be influenced through the use of electronic mail and hierarchy restructure, these participants rated this as one of the lowest categories with respect to effectiveness.

As a group, these individuals did perceive themselves as people that address change from a positive perspective. A review of the scores for participants in each stage of change supports this observation.

The participants perceived the principal to function with a primary leadership style in one of two categories: role model or challenging.

The descriptive statistics presented in the fourth chapter support these observations and conclusions.

Can any conclusions or observations be made regarding associations that surfaced among variables during the course of this study? The research questions discussed in the previous section addressed these possibilities. Using the data reported in chapter four, the observations and conclusions formulated from this discussion will now follow.

Ten of twelve participants perceived the principal to function using one of two styles of leadership: role model or challenging. The literature reviewed in chapter two suggests that leadership is a key component of the diffusion of technology. The findings reported from the case studies of nine high schools directed by Rogers (1985) suggested that the principal must play a key role in technology advancement. Donald Ely's (1990) findings agree with the need for strong principal leadership during the diffusion of technology.

Participants that perceived the principal using the "role model" style of leadership had higher adoption rates. Recall that this style of leadership is characterized by a leader that "models the way". They lead by example. The principal of this school did have the highest rate of adoption of all of the participants.

The challenging style of leadership was perceived by the two participants with the lowest rate of adoption. Also note that two of the top six adopters perceived the principal to use this style as well. This style of leadership "challenges the process". The status quo is not acceptable. The leader will strive to get new products, processes, and services adopted. Those with low adoption rates may have perceived this style to be pushy. This style may have been uncomfortable for those participants. Those that were higher adopters that perceived the principal as this style of leader may be more comfortable with the strategies used by this style of leader.

The correlation figures displayed a positive pattern among the scores reported for the inspiring style of leadership and rates of adoption among participants. The inspiring style of leadership as described by Kouzes and Posner (1990) is characterized by an individual that can inspire a shared vision. Followers will come to accept the vision as their own. All of the leadership styles discussed above involve the need for a leader that can develop human resources. This is supported by the emerging leadership theories that were discussed in the literature chapter. It is not just a matter of skills or traits possessed by a leader, but rather the capacity to

develop those human resources through a style of leadership that can move people forward.

Participant readiness for change scores were very high in the areas of exploration and commitment. But, the relationship between these scores and adoption rates does not support the concept that individuals that face change and innovation in a positive manner will adopt the innovation at a faster rate. A close analysis of the descriptive statistics reported in this study suggest the opposite. Many of the participants that had high scores for readiness for change had low adoption rates.

Readiness for change had little impact upon effectiveness ratings as well. Regardless of an individuals' readiness for change score, they rated the system as effective. High effectiveness ratings may have resulted from the characteristics of the electronic mail system to meet certain needs of the organization. The recognition of a need and an innovation that can match the need will influence the diffusion process. This is consistent with Rogers' (1983) and Levine's (1980) research on the process of diffusion.

The relationship between effectiveness rating and rate of adoption was interesting. In a number of cases, the higher the

effectiveness rating assigned by a participant, the lower their rate of adoption. Reviewing the correlation figures that illustrate these pairings, the only category to have a positive relationship with rate of adoption was the effectiveness of the system to reduce paper-flow.

These observations and conclusions are a result of an analysis of the data presented in chapter four. The nature of this case study limits the statistical significance of these observations. But, they do begin to lay the groundwork for others interested in technological diffusion in educational settings.

Those seeking to develop effective diffusion strategies and facilitate change may benefit from the findings and conclusions formulated through this case study.

Implications for Practitioners

Studies which address the use of computer technology in public school administrative settings are limited. Look further for research efforts that investigate the use of electronic mail as a means of communication in schools and one finds that they are virtually non-existent.

The absence of technological innovation in school administrative offices is disturbing. Inadequate funding deserves much of the credit for the current status of technology in schools. Lack of effective leadership for technological innovation has also served as a barrier to progress. As studies by Rogers suggest, leadership for innovation and change is critical. A deeper understanding of how various factors work together to facilitate or impede the diffusion process may lead to strategies for the progress and advancement of technology.

This study attempted to explore and describe some of those factors. For practitioners in the field of educational leadership, this study may provide insight into the dynamics of leadership and technological diffusion. A better understanding of associations that exists between a principal's leadership style and the diffusion process is useful.

An actual case study, such as this one, provides practitioners with a concrete example of the diffusion of a technology in an educational setting. The use of electronic mail as a communication tool in school administrative settings is relatively new.

Insight gained from this study may be helpful to others striving to lead schools forward to meet the needs of a high-tech, information-based society.

Recommendations for Continued Research

Research that examines the relationships that exist among leadership, change, and technological advancement is needed. The diffusion of any technological innovation into an educational setting offers researchers an opportunity to increase their understanding of the variables that influence the diffusion process.

A study such as the current one is a step in this direction. With the experience gained from this case study, recommendations for future studies of this nature will now be offered.

A longer span of time for data collection should be considered. A time frame of six months to one year might offer more insight into rates of adoption and frequency of use. In conjunction with this, the collection of more detailed data regarding actual communication activity could be beneficial. A knowledge of specific uses of the system by participants could provide a clearer understanding of electronic mail as a communication tool. A thorough study of

communication patterns in an organization could also be conducted with more detailed data.

A larger sample size would provide a greater statistical base for the analyses of various relationships. The small number of participants in this study limited the statistical significance of any findings that may be reported.

An assessment of an individual's technological experience and expertise would also be useful information. For example, one of the things that might have been done was to use the principal's perceptions of each participant's technological experience and conject how this may have influenced adoption.

Using this study group and the knowledge of the principal regarding each individual's experience and expertise the following insight would have been offered. Participant one, two, eleven, and twelve had the most experience with computer technology. All were comfortable with wordprocessing, spreadsheets, databases, and the SIMS software. Participants three, eight, nine and ten had some limited experience with word processing and some beginning experience with the SIMS software. Participants four, five, six, and seven had virtually no experience with using computers. From this

data, one might expect the rates of adoption of the electronic mail to correspond to an individual's experience. While this was true at the very top and at the very bottom of ranked use, those that fell in the middle varied. Participant six had no experience with computers but ended up ranking in the middle in terms of use. Participant twelve had a lot of experience with technology and would have been expected to use the system at a high rate but ranked ninth in use of the system. These examples illustrate possible conjectures that may be made using this type of data.

This kind of information may add a valuable dimension toward understanding the diffusion and adoption of an innovation. It may be obtained easily through some type of structured interview format as well, but it should be considered. The quantity and quality of staff development needs can be more accurately assessed if this information is considered.

One final recommendation centers around site selection. If possible, future studies of this nature should be conducted in several sites. The availability of technological resources and willing participants makes this a difficult goal to achieve. But, implementing a technological innovation, such as electronic mail in

several sites offers the opportunity to more thoroughly analyze variables associated with diffusion such as those investigated in this study.

These suggestions provide a basis of consideration for future research of this nature. The opportunity to investigate and develop deeper understandings of the diffusion of technology into educational settings must be pursued.

Concluding Statement

In his book, *School's Out,* Lewis Perelman (1992) speaks of the technology gap that exists between the school environment and the "real world". He further states that "schools are almost totally isolated from the information revolution that is explosively transforming every other venue of human affair" (p. 215).

Much work lies ahead for those that believe technology must be diffused in the educational setting. This is true for both instructional and administrative applications.

What can be done to facilitate the advancement of technological innovation in our schools? Discovering how various forces influence diffusion is a start. The purpose of this study was to address this

issue. Understanding relationships such as leadership style and adoption of technology can help others in the pursuit of technological transformation in organizations. Developing a deeper understanding of individuals and change is needed. Examining the effectiveness of a technology to enhance performance may lead to better and more efficient means of achieving individual and organizational objectives.

Technologies that were developed to meet the needs of a past era are still the norm. The gap that exists in schools is real. Schools can no longer afford to continue to do business as usual. A thorough body of research related to addressing this condition can serve as a vehicle to facilitate the progress of technological advancement. Studies of this nature begin to address this need.

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APPENDIX A

ELECTRONIC MAIL LOG SHEET

User Name	Date	Sent To:	

APPENDIX B

READINESS FOR CHANGE INSTRUMENT

Participant ID_____

Instructions: Please indicate how you would react to the proposed change identified below by circling a rating for each behavior as follows: 3 = the behavior describes how I would react; 2 = the behavior somewhat describes how I would react; 1 = the behavior does not describe how I would react.

Type of Change: Technological Change - Use of Electronic Mail

Behavior Toward Change	**Rating**		
1. I'm eager to begin.	1	2	3
2. I won't worry; it'll be over soon.	1	2	3
3. Let's explore the possibilities.	1	2	3
4. I can find ways to make it fail.	1	2	3
5. It could prove to be beneficial.	1	2	3
6. Don't fix it if it ain't broke.	1	2	3
7. Let's sell our colleagues on the idea.	1	2	3
8. So what, it won't affect me.	1	2	3
9. I won't take the blame when it fails.	1	2	3
10. Wonder how our clients would react.	1	2	3
11. The cost in money and time will kill it.	1	2	3
12. Let's develop a plan to evaluate outcomes.	1	2	3
13. I'd like to take it under consideration.	1	2	3
14. How can we best train our people?	1	2	3
15. Could we consider it on a trial basis?	1	2	3
16. Let's figure out ways we can improve what we're doing now rather than change.	1	2	3

Scoring Procedures

Transfer (circle) the ratings you assign to the 16 behaviors to the scoring grid below and obtain a total for each level of change.

Stages of Change

Denial →		Resistance →		Exploration →		Commitment	
Item	Rating	Item	Rating	Item	Rating	Item	Rating
2.	1 2 3	4.	1 2 3	3.	1 2 3	1.	1 2 3
8.	1 2 3	6.	1 2 3	5.	1 2 3	7.	1 2 3
11.	1 2 3	9.	1 2 3	10.	1 2 3	12.	1 2 3
13.	1 2 3	16.	1 2 3	15.	1 2 3	14.	1 2 3
Total	_____	Total	_____	Total	_____	Total	_____

Interpretation of Readiness Scores

Stages of Change

Denial → Resistance → Exploration → Commitment

- Total between 4 - 6 for any of the four stages indicates that you are not currently within this stage in regard to the proposed change.
- Total between 7 - 9 for any of the four stages indicates that you are somewhere within this stage in regard to the proposed change.
- Total between 10 - 12 for any of the four stages indicates that you are within this stage in regard to the proposed change.

If you have total scores at or about 7 in two consecutive stages (i.e., exploration and commitment) there is a possibility you are moving from one stage to another. On the other hand, if you have scores at or above 7 in two non-consecutive stages, there is a possibility that you are ambivalent about the value of proposed change. Finally, if you have scores below 7 in all of the four stages, there is an indication that you don't understand the nature of or oppose change altogether.

APPENDIX C

EFFECTIVENESS RATING SURVEY

Effectiveness Rating

Participant ID_____

Directions: In your opinion, please rate the effectiveness of the electronic mail system with respect to each item presented below as it relates to your daily work activities and responsibilities.

Use the following scale to rate the effectiveness of each item.

Effectiveness Rating: 1 2 3 4 5

Not Effective — Very Effective

The "electronic mail communication system":

1. Improves internal communication.	1	2	3	4	5
2. Reduces paper-flow.	1	2	3	4	5
3. Expedites the decision making process.	1	2	3	4	5
4. Increases time to perform other tasks.	1	2	3	4	5
5. Increases personal productivity.	1	2	3	4	5

APPENDIX D

HUMAN PATTERNS REPORT SAMPLE

CONTACT NAME: RESEARCH

WORK TASKS PREFERRED	PROACTIVE	REACTIVE	AVERAGE	PROACTIVE	REACTIVE	AVERAGE
Mechanics or fine motor	0.25	0.77	0.51	2.03	1.15	1.59
Physical or gross motor	0.55	-0.26	0.14	-0.17	0.11	-0.03
Aesthetic or design	-0.75	-3.09	-1.92	-1.10	-2.43	-1.77
Service or support	0.19	0.51	0.35	-1.38	-0.92	-1.15
Clerical or specific	2.56	0.75	1.66	1.48	0.97	1.23
Sales or communicative	-1.41	-1.46	-1.44	-0.26	-0.27	-0.27
Leadership or management	-0.10	0.33	0.12	0.76	0.33	0.55
Literary composition or writing	0.33	0.36	0.35	-0.41	-1.01	-0.71
Science or technical areas	1.09	1.28	1.19	1.09	1.28	1.19
Creative or innovative areas	-1.03	-1.95	-1.49	-1.32	-1.95	-1.64
WORLD VIEW						
Practical and hands-on experience	-0.71	-0.01	-0.36	-0.02	-0.01	-0.02
Traditional values and structures	1.42	1.59	1.51	0.97	0.84	0.91
Ideas and theories	0.89	-0.67	0.11	0.89	-0.27	0.31
Personal growth opportunities	-1.06	-0.86	-0.96	-1.06	-1.96	-1.51
LEADERSHIP BEHAVIORS						
Inspiring others	-1.65	-1.68	-1.67	-0.84	-0.22	-0.53
Challenging and pushing others	-1.47	-2.27	-1.87	-0.95	-1.52	-1.24
Serving as a role model	1.64	0.00	0.82	0.54	1.13	0.84
Coaching and enabling others	0.11	0.50	0.31	-1.19	-0.53	-0.86
Appreciating and recognizing others	1.09	-0.02	0.54	-0.58	-0.41	-0.50
KEYS TO PERSONALITY						
Guarded and questioning	0.50	1.45	0.98	1.10	1.45	1.28
Openness to others	0.07	0.95	0.51	0.40	-0.83	-0.22
Impulsiveness and spontaneity	-1.46	-1.83	-1.65	-1.85	-1.66	-1.76
Second-guessing self/worry	-0.01	-0.82	-0.42	-0.29	0.06	-0.12
LEADERSHIP MOTIVATIONS						
Maintaining organizational structures	1.62	1.30	1.46	1.22	0.68	0.95
Developing new processes	-1.08	-1.43	-1.25	-0.63	-1.12	-0.87
Delegating and developing others	-0.20	-0.34	-0.27	-0.51	-0.40	-0.46
Exercising authority	-0.83	-0.94	-0.89	-0.05	-0.42	-0.23
Conserving assets and resources	1.35	1.06	1.20	1.28	0.69	0.98
EDUCATION AND TRAINING						
Discontinuous conceptual	-0.27	0.19	-0.04	-0.13	-1.07	-0.60
Continuous didactic	-0.52	-1.22	-0.87	-0.77	-0.89	-0.83
Sporadic experiential	-0.14	0.18	0.02	-0.29	0.45	0.08
Behavioral	1.45	0.86	1.16	0.67	0.44	0.55
DISLIKES AND REACTS STRONGLY TO						
Being taken advantage of	0.41	-0.03	0.19	0.23	1.30	0.76
Being humiliated or embarrassed	-0.98	-1.56	-1.27	-0.30	-0.33	-0.32
Ground rules changing arbitrarily	1.02	1.75	1.39	1.06	0.98	1.02
Being unskilled or uninformed	0.10	-0.96	-0.43	0.18	0.91	0.54
Being in situations requiring risk	1.36	3.20	2.28	1.43	1.19	1.31
Boredom and redundancy	-1.46	-1.67	-1.56	-1.56	-1.46	-1.51
PATH TO ACHIEVEMENT						
Conforming	0.20	-0.70	0.45	-0.61	-0.59	-0.60
Independence	-0.72	-1.11	-0.91	0.34	-0.55	-0.10
Intellect	-0.05	-1.52	-0.78	-0.25	-0.90	-0.57
Intuition	-1.33	-2.08	-1.70	-1.05	-1.25	-1.15
Adapting	-0.97	0.91	-0.03	-0.46	-1.90	-1.18