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Effects of electronic mail on staff communication satisfaction and computer anxiety

Luck, Donald D., Ed.D.

University of Northern Iowa, 1992

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Ann Arbor, MI 48106

EFFECTS OF ELECTRONIC MAIL

ON

STAFF COMMUNICATION SATISFACTION

AND

COMPUTER ANXIETY

A Dissertation

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

_____
Dr. Sharon Smaldino

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Dr. Greg Stefanich

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Donald D. Luck

University of Northern Iowa

December 1992

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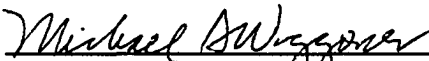
ON

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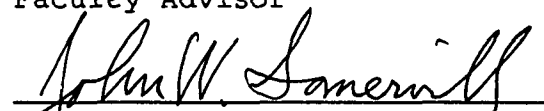
COMPUTER ANXIETY

An Abstract of a Dissertation

Submitted

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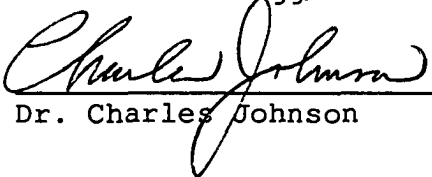
of the Requirments fo the Degree

Doctor of Education

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Dean of the Graduate College

Donald D. Luck

University of Northern Iowa

December 1992

ABSTRACT

Research indicates teacher isolation and computer anxiety are significant problems effecting teachers. This study examined the influence of electronic mail on these two problems. The research hypotheses questioned whether electronic mail installation positively effected a staff's level of communication satisfaction and/or lowered their level of computer anxiety.

Three sites were used in the study. Site One had electronic mail at the time of both measurements, Site Two implemented electronic mail immediately following the first measurement, and Site Three never used electronic mail. Ten months separated the measurements.

The study used the Computer Satisfaction Questionnaire to measure eight components of communication satisfaction, and the Computer Anxiety Index to measure computer anxiety levels. The research followed a design developed by the researcher and based upon the Recurrent Institutional Cycle Design.

A discriminant analysis technique was used to determine if a function existed which discriminated between sites at the time of the measurements and at the same site over the course of the research. Where a function was developed, t-tests were used to determine if individual components differed significantly. Computer anxiety between sites and between measurements at each site were compared using a t-test procedure.

No function was found which could discriminate between Site One and Site Two before or after installation of electronic mail at Site Two. A discriminant function was developed which could identify a significant change in communication satisfaction between the first and second measurements at Site Two. This function was composed of a perceived improvement in satisfaction with General Organizational Perspective and small perceived decreases in satisfaction with Media Quality and Organizational Integration.

A discriminant function, composed of a significant improvement in Media Quality and a small decrease in satisfaction with Horizontal Communication Satisfaction, was identified at Site Three between first and second applications of the questionnaire. A discriminant function was also found which identified significant differences between Site One and Site Three, and Site Two and Site Three. This function was composed of significant differences on seven of the eight variables of Communication Satisfaction including General Organizational Perspective, Personal Feedback, Organizational Integration, Communication With Superior, Communication Climate, Horizontal Communication, and Media Quality.

No change was found between sites, or within sites between pre and post measures of computer anxiety. There does not appear to be a relationship between the use of electronic mail and level of computer anxiety.

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INTRODUCTION

Background

Research by Rothberg (1984) indicated over 80% of
teachers viewed the classroom as an isolated world populated
by themselves and their students. This isolation allows
teachers to exercise high levels of control over their
classrooms but also results in teachers being isolated from
peers and supervisors. The classroom can become a lonely
place for teachers. Bayer (1983) reported that teachers
perceived the teaching climate as being characterized by
loneliness and powerlessness. Driscoll (1983) identified
isolation as one of the inhibiting characteristics of the
teaching profession. Jackson and Boles (1982) named teacher
isolation as the most important cause of job dissatisfaction
among teachers. Engelking, in 1986, found that a poor
relationship existed between teachers and administrators and
between teachers and their peers due to a communication
deficit. In settings where there is a lack of communication,
research indicates there is greater perceived teacher
isolation and a decline in enthusiasm for teaching.

Hunter (1990) states:

Teacher collaboration with other teachers and with other
people both inside and outside of the school community
is increasingly recognized as necessary for achieving
such important and urgent goals as increased
professionalism and continuing education of teachers,
school restructuring, and reform of curricula,
instructional strategies, and assessment methods. A
rapidly growing number of teachers are using computer-
based communications networks--both local and remote--to
access information, facilitate such collaborations, and

to build new local, regional, national, and international communities. (p. 46)

Teacher-teacher, teacher-administrator, or teacher-support staff communication generally occurs through face to face interaction, announcements broadcast over an intercom, or by written documents. Teachers can initiate communication during out-of-classroom times, but are limited receivers of information during the majority of the day, their in-class time being spent working with students.

The teacher has little choice concerning when to receive communication and less choice when to initiate communication. Written communications are often placed in teacher mailboxes accessible only during the rare times when instructors can leave their classrooms. Other forms of classroom communication, broadcast and face-to-face, interrupt immediately with no choice given the teacher concerning when to receive the information.

Local area network based electronic mail systems may provide a solution to some communication problems discussed above. Electronic mail systems allow teachers to send messages to other teachers, administrators, or support people without leaving the classroom, thereby allowing instructors greater freedom in choosing times to receive or initiate communications. Communications can be left in an electronic mail box for collection at times most convenient for the teacher.

Purpose

The purpose of this study was to examine changes in communication satisfaction and levels of computer anxiety in small rural school staffs as a result of the implementation of a local area network electronic mail system. Anticipated changes, based on an initial review of the pertinent literature, include changes in communication satisfaction, administrative procedures, teacher satisfaction with administration, professional and interpersonal staff relations, and anxiety level of teachers toward computers.

Research Questions

1. What similarities and differences in staff perceptions exist about communication satisfaction in three small schools, one using electronic mail, one implementing electronic mail, and one in which electronic mail is not used?

2. What is the impact of implementing an electronic mail system on the level of computer anxiety in staff members?

Significance

An electronic mail system may improve the level of communication satisfaction in a school faculty and decrease the levels of staff computer anxiety. By increasing communication satisfaction, electronic mail may indirectly increase teacher productivity, morale, and job satisfaction.

Hunter (1990) believes research is justified regarding the "creation of new social and organizational contexts to

facilitate teachers' work and collaborations" (p. 47). She further points to the fact that in research concerning computer mediated communication "teacher collaborations . . . have been secondary or incidental to the focus on student interactions" (p. 47). This study represents one of the initial efforts to investigate communication patterns through electronic mail in an educational setting. Regular use of electronic mail may decrease the level of computer anxiety in teachers, thereby making them more likely to use computers for other tasks.

<center>Research Hypotheses</center>

1. The implementation of electronic mail will positively affect faculty communication satisfaction.

2. The implementation of electronic mail will lower the level of computer anxiety of staff members.

<center>Definitions</center>

1. Communication Satisfaction: "the personal satisfaction inherent in successfully communicating to someone or in successfully being communicated with . . ." (Thayer, 1979, p. 112).

2. Communication Climate: "the extent to which communication in the organization motivates and stimulates workers to meet organizational goals and the extent to which it makes them identify with the organization" (Downs, 1988, p. 113).

3. Communication Satisfaction With Superiors (Downs, 1988):

> both the upward and downward aspects of communicating with superiors. Three of the principal items deal with the extent to which they are open to ideas, the extent to which they listen and pay attention, and the extent to which they respond to general questions about communication. (p. 113)

4. Communication Satisfaction With Organizational Integration: "the degree to which individuals receive information about the immediate work environment" (Downs, 1988, p. 113).

5. Communication Satisfaction With Media Quality: "the extent to which meetings are well organized, written directives are short and clear, and the amount of communication in the organization is about right" (Downs, 1988, p. 113).

6. Satisfaction With Horizontal Communication: "the degree to which the grapevine is active . . . and informal communication is accurate and free flowing" (Downs, 1988, p. 113 & 114).

7. Satisfaction With Organizational Perspective: satisfaction with "notification about changes, the organization's financial standing, and the overall policies and goals of the organization" (Downs, 1988, p. 113).

8. Satisfaction With Subordinates Communication: satisfaction with the levels of "upward and downward communication" between staff and subordinates (Downs, 1988, p. 113).

9. Satisfaction With Personal Feedback: workers' knowledge of "how they are being judged and how their performance is being appraised" (Downs, 1988, p. 113).

10. Computer Anxiety: "the fear or apprehension felt by an individual when using computers, or when considering the possibility of computer utilization" (Montag, Simonson, & Maurer, 1984, p. 5).

11. Electronic Mail: A computer-mediated communication system providing "as a minimum, facilities for creating messages, transmitting and displaying them at the destination" (Vervest, 1985, p. 12).

12. Local Area Network (LAN): A group of computers connected electronically in a small area, such as a building, allowing its users to store and retrieve data, or to share programs, and/or peripheral devices.

13. Small School: A school in Iowa with fewer than 750 students.

14. Rural School: A district where the number of inhabitants is fewer than 150 per square mile or where the school is located in a county with 60% or more of the population living in communities no larger than 5,000 inhabitants (Helge, 1986).

15. Wide Area Network (WAN): A group of computers connected electronically over a wide geographic area, usually through the use of telephone or dedicated lines, allowing users to store and retrieve data, or to share programs, and/or peripheral devices.

Assumptions

1. The random sample of teachers interviewed accurately reflects the opinions of the faculty of the schools.

2. Teachers' interviews are accurate indicators of teacher behavior and beliefs.

3. The implementation of electronic mail will similarly affect communication satisfaction in elementary and secondary schools.

Limitation

While prevalent in the business environment, local area network electronic messaging is uncommon in school settings. Finding a small rural school with electronic messaging for the faculty and a small rural school with a LAN ready for electronic messaging was difficult. This study was conducted in three sites which differed in grade levels of students served. The site currently utilizing a local area network electronic mail system is a kindergarten through 6th grade elementary, the site equipped for a local area network electronic mail system is a 9th through 12th grade high school, as is the control site.

Delimitations

1. The study was conducted in three small, rural, mid-western school districts.

2. The study occurred using a mail only system; findings may be different on a system incorporating real time communication.

3. The study was limited to a single building local area network mail system only and not to building-to-building, school-to-school, or wide area networks.

CHAPTER II

REVIEW OF LITERATURE

This study focused on the effect of computer-mediated communication in the form of electronic messaging on communication satisfaction level and computer anxiety level of the staff, teachers, principals, media specialists, and principals' secretaries in a small rural school. This chapter reviews selected literature reporting research findings on communication; specifically, it addresses a definition of communication, its importance to organizations, communication satisfaction, and computer mediated communication. Findings on computer anxiety are also explored.

Communication

Definition

Communication has been defined as the "sharing of intelligence through symbolic behavior" (Knower & Wagner, 1959, p. 1). Aristotle saw communication as the search for all available means of persuasion. Berlo (1960) stated three purposes of communication: ". . . informative--an appeal to the mind, persuasive--an appeal to the soul or the emotions, entertainment . . ." (p. 8). Culbertson (1959) stated "The process of communication involves the transmission of facts, rumors, or values from one person to another" (p. 1).

Gordon (1955) emphasized that communication is both sending and receiving. A successful circuit is accomplished only when the expression (message) of the sender and the

impression (received message) of the receiver are nearly identical in meaning. Wiles (1967) identified nonverbal behaviors such as gestures, facial expression, posture, spatial arrangements, and communication timing as important in the communication process. Thayer (1979) identified the needed elements of communication as: (a) language, (b) a minimal set of rules for the conduct of the encounter, (c) a relationship, mutually conceived of, and (d) a minimal degree of complimentarity with respect to the intentions of the communicators and the anticipated result of communication.

Rather than try to define communication in a way acceptable to all, it may be important to note a thought expressed by Wilbur Schramm (1971):

> Let us understand clearly one thing about it; communication (human communication at least) is something people do. It has no life of its own. There is no magic about it except what people in the communication relationship put into it. There is no meaning in a message except what people put into it.... to understand human communication process one must understand how people relate to each other. (p. 3)

Schramm's model of the communication process is shown in Figure 1.

In Schramm's model, the first component or process is the idea or impulse in the mind of the sender. The idea is then encoded and then constitutes a message or signal. The message or signal is received and decoded by the receiver and is an interpretation of the signal or message. This message is received directly and indirectly via the various publics concerned with the issue (Schramm, 1957, p. 76).

Figure 1. Schramm model of communication processes.
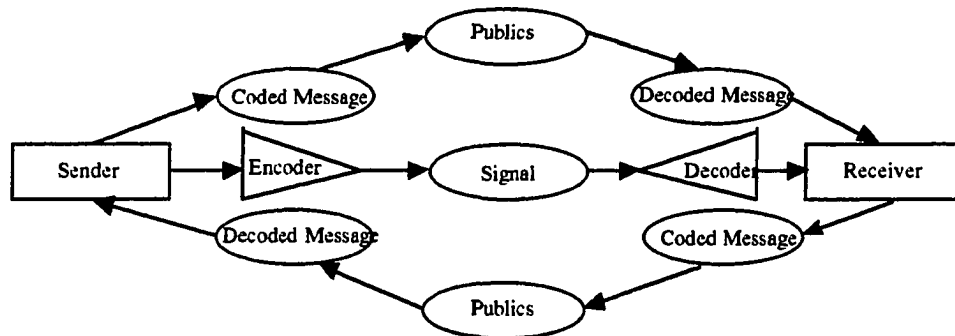
Note. From "How Communication Works" by W. Schramm. In D. C. Mortenson's (Ed.), Basic Readings in Communication Theory (pp. 36-52). New York: Harper and Row. Copyright 1973 by Harper and Row. Adapted by permission.

Schramm's model conceptualizes communication as a process, including the sender and receiver, the message, and the signal. This research deals with the effects of the signal, in this case being electronic mail, on the communication satisfaction and computer anxiety levels of educators. It is important to note that the signal is only one component of the more complex model and as such communication satisfaction, while effected by electronic mail, is effected by other factors.

Lewis stated, "Communication may take the form of written or spoken words, gestures, or visual symbols; it can convey messages by action, touch or sound" (1975, p. 4). Dance (1970) found 95 different definitions for

communication. Dance concluded that the definitions lead scholars in different, sometimes contradictory directions. Communication is characterized by "subtlety, variety, and ubiquity" (Hoy & Miskel, 1978, p. 239). It has been defined as "the simple transferal of a message from sender to receiver, involving both sending and receiving" (Redding & Sanborn, 1964, p. 5).

Importance of Communication to Organizations

Organizations are "social units (or human groupings) constructed and reconstructed to seek specific goals" (Parsons, 1960, p. 17). According to Etzioni (1964):

> Organizations are characterized by: (1) divisions of labor, power, and communication responsibilities, divisions which are not random or traditionally patterned, but deliberately planned to enhance the realization of specific goals; (2) the presence of one or more power centers which control the concerted efforts of the organization and direct them toward its goals; these power centers also must continuously review structure, where necessary, to increase its efficiency; (3) substitution of personnel, i.e., unsatisfactory persons can be removed and others assigned their tasks through transfer and promotion. (p. 3)

The presence of communication is a key component in any organization. In 1938 Barnard stated "An organization comes into being when: (a) there are persons able to communicate with each other, (b) there are persons willing to contribute action, and (c) there are persons committed to accomplishing a common purpose" (p. 82). Simon (cited in Duke, 1981, p. 53) stated "without communication there can be no organization." To underline the importance of communication to an organization Barrett and Bavelas (1951) saw

communication as the essence of organizational activity and as the basic process out of which all other functions derive (cited in Duke, p. 53). Gregg (1957) concluded communication to be the component of administration through which group members understand the purposes and tasks of the organization, and without communication, there can be no viable organization.

Charts showing organizational structure are typically little more than drawings indicating patterns of formal communication. Formal communication channels, along with the informal channels prevalent in any organization, create the understanding necessary for dividing work, developing morale, evaluating performance, and mobilizing resources of the organization (Bormann, Howel, Nichols, & Shapiro, 1969).

Communication forges bonds of common purposes and shared goals within an organization (Wiles, 1950). Gordon (1955) saw communication as being the lifeblood of every group. Schramm (1957) described society as a large group of communicating mechanisms, bound together by intricate and interconnected networks of communication, influence, and obligation. The formal and informal communication processes within the organization determine to a great extent the nature and function of the organization (Bobbitt, Breinholt, Doktor, & McNaul, 1978). Sproull and Kiesler (1991) state:

> A group is an organization with a purpose, structure, and procedures. Because a group is not just a collection of individual people, communications technology can change the whole groups' dynamics. The communications of a group are like the nervous system of

a person. They decide group functioning, and what is done to one part affects the rest of the system. (p. 76)

Communication within organizations encompasses the interpersonal relationships of people, their attitudes, and feelings within an organizational structure. Communication is defined as the sharing of messages, ideas, or attitudes resulting in a degree of understanding between a sender (manager) and receiver (employee) (Lewis, 1975). Figure 2 represents Lewis' view of the process of organizational communication.

Figure 2. Components and process of organizational communication.
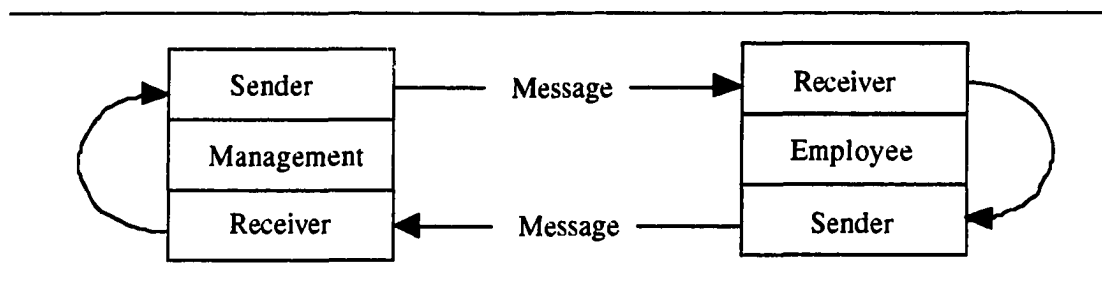
Note. From Organizational Communication: The Essence of Effective Management (p. 5) by P. V. Lewis, 1975, Columbus, OH: Grid. Copyright 1975 by Grid. Reprinted by permission.

Lewis postulated that within organizational communication (1975):

> Sharing is a two-way process, a give-and-take between a sender and receiver, so that interpersonal relations of individuals, their attitudes and feelings, enhance, not stifle, understanding. This dynamic sharing process

presupposes a search for meaning. If communication is
to take place between individuals, meaning must be
transferred from one mind to the other. In fact,
meanings reside in people and not in words themselves,
accomplishing understanding is extremely difficult. How
a receiver interacts with himself and others, and his
use of words, provide tremendous insight for
understanding human behavior in organizations. Yet, one
person never comprehends fully or identically what
another person is saying because of differences in such
elements as their environment, upbringing, and frame of
reference. (pp. 5-6)

Formal and informal communication structures provide
information flow channels which create a community of
understanding necessary for dividing the work, developing
morale, evaluating performance, and mobilizing resources of
an organization (Bormann et al., 1969). The formal and
informal communication processes within an organization
determine to a great extent the nature and functioning of the
organization (Bobbitt et al., 1978).

McCauley defined a communication channel as "the means
used to convey the stimuli; the pathway along which the
message travels" (1979, p. 5). Insuring that data are
transmitted within a network without loss is the primary goal
of a communication network (Kneital, 1975) and fulfilling
this goal is a major criterion for incorporating an
information system into an organization. Willets (1967)
hypothesized that open channels of communication contribute
to organizational success and performance. Redding argues
(1972):

One must still acknowledge that the considerable number
of studies, when taken all together do 'add up'. The
consistency of the findings from a wide variety of
studies is itself persuasive. And this consistency

seems to make two conclusions inescapable: that openness of communication is (a) a crucial dimension of organizational communication, and (b) an essential ingredient in any overall managerial climate associated with organizational effectiveness. (p. 386)

J. W. Jones (1981), in her dissertation on communication satisfaction in four rural school districts, defines the directions of communication channels in an organization. She states:

> Organizational communication may be described as having three directions: downward communication, upward communication, and horizontal communication. Each type of communication has different organizational purposes. Downward communication is characterized by the sending of orders, directives, goals, policies, etc., to members at lower levels in the organization. Downward communication can fail even if the message is clear, concise, and well illustrated and presented. Downward communication appears to be the most used form of communication in formal organizations, but the success of downward communication is minimal and may, if used excessively, create more problems.
>
> Upward communication permits information to flow from lower organizational levels to higher levels. It may provide both a source of organizational information for superiors and a means of improving worker morale and satisfaction. The encouragement of upward communication within an organization may create a climate in which downward communication can better be accepted.
>
> Horizontal or lateral communication flows within the organization and represents the strongest type of organizational communication. It is indispensable to the functioning of both of the other directions of communication. (p. 41)

Communication Satisfaction

Crino and White (1981), based on the work of Downs, Hazen, and Quiggins (1973), defined communication satisfaction as "an individual's satisfaction with various aspects of communication in his organization" (p. 833). Communication satisfaction is recognized as being a

multi-dimensional construct. In the book <u>Communication</u>

<u>Within the Organization</u> (1972), Redding summarized works of

Jain (1970), Level (1959), Minter (1969), Sanborn (1961),

Tompkins (1962), Zima (1968), and found 11 components of

communication satisfaction. These were:

> (a) an explanation of policies in answer to employee
> questions, (b) an understanding of what is expected of
> one in job performance, (c) an advance notice of changes
> through official sources, (d) the freedom to make
> suggestions to superiors, (e) the adequacy of
> information on those company matters regarded by the
> receiver as relevant to him, (f) the extent to which
> important information is obtained from sources or media
> preferred by the receiver, (g) the freedom to make
> complaints, to 'sound off,' (h) accessibility or
> approachability of superiors, (i) the degree to which a
> supervisor makes an effort to understand feelings and
> problems of subordinates, (j) the degree to which
> supervisors express appreciation of good performance by
> subordinates, and (k) the degree to which higher
> officers or managements are open and willing to initiate
> communication" (cited in Downs & Hazen, 1977, p. 64).

Wiio, in 1976, studied twenty-two companies in Finland

over a three year period by auditing communication practices,

and through factor analysis discovered four dimensions of

communication satisfaction: (a) job satisfaction, (b) message

content, (c) improvements in communication, and (d) channel

efficiency. Downs and Hazen (1977) used similar procedures

to identify eight factors of communication satisfaction.

Crino and White (1981) later validated these eight factors in

a study of textile mill supervisors.

Computer-Mediated Communication

Computer-mediated communication refers to a system in which communication is facilitated by a computer. Electronic mail occurs where:

> . . . messages are normally composed at the terminal; transmitted electronically; read by the receiver, usually at a later time, on a terminal; possibly answered; and erased or filed electronically for future reference. (Stein & Yates, 1983, p. 104)

P. Vervest (1985) saw electronic mail as a process which included a "facility for creating messages, transmitting and displaying them at the destination" (p. 12). Furthermore, electronic mail is "more than just delivering mail items at the proper destination: it is a single stage in the total process of information handling, and narrowly tied to the functions of text and data processing, filing, and retrieval systems" (Vervest, p. 12).

Computer-mediated communication studies have dealt primarily with communications using telecommunication in wide area networks (WANS). Research on this type of communication, where the network is different in physical structure from that of local area networks, provides insight into communication on local area networks. Stages of telecommunication network development, stages in personal telecommunication use, advantages of electronic mail, and problems of electronic mail will be reviewed.

Stages of Telecommunication Network Development

Aterton (1987) in *Teledemocracy: Telecommunications and Democratic Participation* notes that stages of network

telecommunications development and personal telecommunication move reciprocally and through stages. Figure 3 shows stages of telecommunication network development. Tovey, Savicki, and White (1990) elaborate upon each of the eight stages and provide indicators or requirements for success at each. These stages indicate changes in the structure and workings of the organization and in the workings of an individual. They label the stages of network growth as: pre-telecommunication networking, decision to telecommunicate, equipment installation and training, initial experimentation and use, emergence of network resource persons, deciding to make telecommunication the sole information source of critical information, development of network norms about usage, and telecommunication as standard operating procedure.

Pre-telecommunication networking. "The best predictor of successful electronic networking is conventional networking" (Tovey et al., 1990). The recognized shared mission of network members creates successful telecommunication networking. This mission and need to share information precedes the development of a successful telecommunications network.

Decision to telecommunicate. Reasons must exist for implementation of electronic mail. These may include geographic barriers or access to time-restricted information. One can expect a broad range of responses from people who may use the network. Some will be enthusiastic; some reluctant. Some will be competent and some inept in its use. A decision

must be made to use electronic messaging as a whole, or pressure on reluctant users to use the network evaporates.

Figure 3. Stages of telecommunication network development.

Pre-Telecommunication Networking

↓

Decision to Telecommunicate

↓

Equipment Installation and Training

↓

Initial Experimentation and Use

↓

Emergence of Network Resource Person

↓

Decision to Make Telecommunication Sole Information Source

↓

Development of Network Norms of Usage

↓

Telecommunication Is Standard Procedure
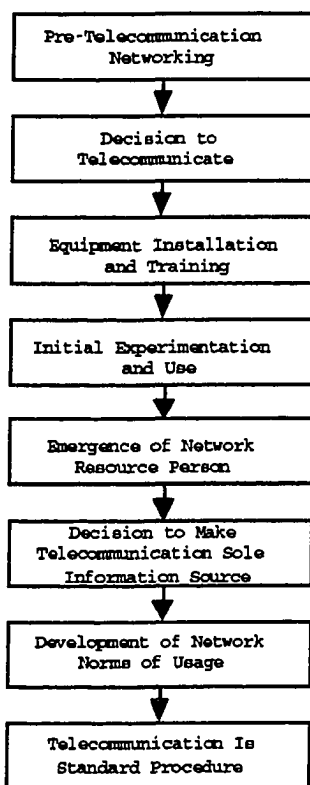
Note. Adapted from Network Development Stages in "Electronic Networking in Human Service Agencies: A Developmental Analysis" by R. Tovey, V. Savicki, and C. White, (1990), Child Welfare, 66(2), p. 121. Copyright 1982 by the Child Welfare League of America, Inc. Adapted by permission.

Equipment installation and training. Adequate training and support is crucial in this stage. As Schrumm (1988) points out, one-shot training can help, but the key to success is consistent access to technical support. The most effective consultant is another user.

Initial experimentation and use. New network users find contact both through the network and through conventional means. The tone of the network develops usually with the inclusion of jokes, gossip, and messages as people search out the right way to telecommunicate. Continued face-to-face interaction between users is key at this point.

Emergence of network resource persons. Some members of the network will emerge as resources for other users. These emergent leaders model telecommunication use, urge others to use telecommunication, and serve as advisors on etiquette and protection of confidentiality. They gain influence through their use of the network. These people are necessary to formulate techniques for network use and to share these techniques with other users.

Decision to make telecommunication sole source of critical information. The decision to make telecommunication the sole source of critical information is a pivotal stage for the network. In order for it to work, a critical mass of users (at least 51%) must use the network. This creates a division between the information "haves" and "have nots." Participation in the network is motivated by the need for

information. Support and training are necessary to bring
members on to the network.

Development of network norms of usage. Once a network
becomes the sole critical information dispersal tool, a more
formal structure for use develops. The original tone set by
the first users remains, but is overlaid with a more
structured view of what information should or should not be
placed on the network, who should or should not be included
in the network's information flow, who is responsible for
placing what information on the system, how often networkers
should check for new information, and who should be added to
the network. Questions arise concerning who to add to the
network and how to train them.

Telecommunication as standard operating procedure. At
this stage complaints arise when informational items are not
placed on the electronic mail network. Complaints concerning
being under informed indicate the amount of information
passed over the network is taken for granted.

Stages of Personal Telecommunication Use

Similar to the stages in network development, and
developing reciprocally, are the stages an individual goes
through when deciding to use a network and telecommunication.
Tovey et al. (1990) suggest the following stages found in
Figure 4. These stages are: decision to use
telecommunication, beginner, novice, operator, and tool user.

Figure 4. Stages of personal telecommunication use.

```
         ┌──────────────────────┐
         │    Decision To Use   │
         │   Telecommunication  │
         └──────────┬───────────┘
                    ▼
         ┌──────────────────────┐
         │       Beginner       │
         └──────────┬───────────┘
                    ▼
         ┌──────────────────────┐
         │        Novice        │
         └──────────┬───────────┘
                    ▼
         ┌──────────────────────┐
         │       Operator       │
         └──────────┬───────────┘
                    ▼
         ┌──────────────────────┐
         │      Tool User       │
         └──────────────────────┘
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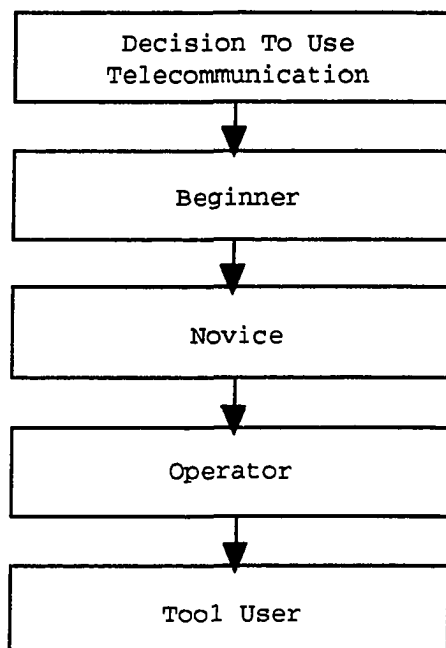
Note. Adapted from Individual Developmental Stages for Telecommunications in "Electronic Networking in Human Service Agencies: A Developmental Analysis" by R. Tovey, V. Savicki, and C. White, (1990), Child Welfare, 66(2), p. 118. Copyright 1982 by the Child Welfare League of America, Inc. Adapted by permission.

Decision to use telecommunication. A conscious decision must be made to telecommunicate. This decision occurs when benefits of telecommunication overcome any aversion to use of the medium.

Beginner. It is crucial that the beginning telecommunicator receive training and support. Telecommunication is not easy. Rank beginners suffer through hardware problems, confusion in how to use the system, and frustration at enduring the many problems of connecting to the electronic mail system and not finding any messages once attached. Success is felt when the beginner successfully accesses the network, when messages are received, and when messages are exchanged.

Novice. Novice users can reliably use the network but struggle over such questions as how to phrase messages, how to communicate without nonverbal cues, and how to create messages appropriate for transmission via electronic mail. Etiquette is very much a concern. The medium user is in search of a message.

Operator. At this stage technical aspects of the network become transparent. Operators experiment with the network's advanced capabilities. Indicators of users having reached this stage include their frequent checking for electronic mail, their passing on information from non-network persons or other sources without the use of paper, and their complaining about the need to use non-electronic means to keep in contact with non-networked personnel.

Tool user. Tool users come to view the network as a valuable tool in their everyday activities. They send

traditional modes of communication such as letters and memos via electronic mail.

Once the network and electronic mail have been established one can identify their effects. Any communication channel through which messages pass impacts the content and context of the message (Rice, 1987). Sproull and Kiesler (1991) believe ". . .that the means by which a message is conveyed affects the meaning of the message" (p. 54).

J. W. Chesebro and D. B. Bosnall (1989), reflecting on how a computer might affect communication, state:

> If we use technologies, the technologies will affect us. A decision to employ a computer as solely a transmission device may minimize these effects. Nonetheless, even if they view a computer as a mode of communication that could be replaced by other media, people react to the fact that they are communicating by way of a computer. Use of personal computers as transmitters does affect the users. The real question is how. If we are to control the computer and not vice versa, we need to be aware of the social consequences of its use. (p. 116)

Kiesler, Siegel, and McGuire (1984) discuss ways in which computer-mediated communication differs from more traditional form. They state:

> Computer-mediated communication differs in many ways, both technically and culturally, from more traditional communication technologies. Technically, it has the speed (including simultaneity, if desired) and energy efficiency, but not the aural or visual feedback of telephoning and face-to-face communication. It has the adaptability of written text. Messages can be sent to groups of any size and can be programmed for such special functions as automatic copying to a pre-specified distribution list. Culturally, computer-mediated communication is still undeveloped. (p. 1123)

Sherblom (1988) states:

> The real impact then of using computer-mediated
> communication in organizations may not be simply an
> increase in communication efficiency or a loss of
> communication cues. The real impact is more likely to
> be found in the subtle, yet persuasive and compelling
> ways in which the technology changes the communication
> function and context. (p. 51)

Sproull and Kiesler (1991) agree stating: "The more profound effect of computer-based communication may similarly come from changing patterns of organizational interaction" (p. 35). Kerr and Hiltz (1982), identified several impacts of computer-based communication on group behavior. These impacts included: (a) increases in informal communication, (b) an increase in the number of communication links, (c) decentralization of communication, (d) expansion of group size, (e) creation of new demands for funds, (e) creation of new ways to promote goals, (f) a reduction in the lag time in communication, (g) irregular participation, (h) an increase in the number of lateral linkages within organizations, (i) establishment of teams of workers reducing the influence of the hierarchy, (j) an increase in the content threads for discussion, (k) the creation of new kinds of groups, (l) and an increased need for a strong leader.

Kiesler et al. (1984) also state "little systematic research exists on its [electronic mail] psychological, social, and cultural significance" (p. 1134). They believe the technical and cultural questions and issues include: (a) whether or not immediate communication to a person results in an expectation of immediate reply therefore placing more

pressure on the respondent to reply quickly, (b) whether electronic communication is inefficient due to the lack of head nods, smiles, eye contact, and other nonverbal behavior to regulate, modify and control exchanges, (c) whether or not computer-mediated communication weakens social influences by removing nonverbal communication clues, (d) whether the loss of contextual or dynamic clues to status will affect communication and, (e) whether electronic communication is dehumanizing resulting in stronger or more uninhibited writing and assertiveness.

Chesebro and Bosnall (1989) identify nine issues surrounding the effects of computer-mediated communication. The first deals with computer-mediated communication as a highly selective communication medium in which all nonverbal communication cues are removed. They see this as having both positive and negative effects. A 1966 Mehrabian and Werner study shows that 93% of the meaning came from nonverbal clues when nonverbal behavior and words conflicted (cited in Chesebro and Bosnall, 1989, p. 117). This loss of nonverbal communication may cause confusion. Positive functions of computer-mediated communication include focusing on written communication, forcing people to use words correctly and vividly, forcing people to communicate information that can only be conveyed in writing, and removing nonverbal clues present in other modes of communication.

Second, Chesebro and Bosnall (1989) view computer-mediated communication as both a social and anti-social

technology. They call computer-mediated communication anti-social because the time spent with a computer is nonsocial. Users are isolated without access to the nonverbal communicative clues of the other communicators. The lack of human contact when communicating can aid in deception because many of the clues of deception are transmitted nonverbally. Although traditional mail reveals social clues such as quality of paper, differences in handwriting, and quality of print based on the type of typewriter used; electronic mail obliterates all such clues. Thus, computer-mediated communication may enhance self-image by giving everyone an equal voice in communication.

Third, computer-mediated communication can affect task and social relationships. In task-oriented relationships, computer-mediated communication facilitates an exchange of information, fosters innovation, and increases flexibility and participation in organizations. Computer-mediated communication often supplements or supplants face-to-face, telephone, or written communication.

Fourth, Chesebro and Bosnall (1989) believe computer-mediated communication to be an ineffective conflict resolution device. The ability to react to the nonverbal and vocal clues which often aid in conflict resolution is lost.

Fifth, computer-mediated communication is an efficient non-verbal communication media. Teletypewriting is a more efficient means of communication (as measured by number of words and sentences used) than other communicative forms.

The sixth effect cited was that computer-mediated communication was a time saving device. This is true when electronic mail is used and especially when each message offers a header explaining the message's contents.

The seventh effect was the result of a new cultural system. Computer networks occupy a unique niche in both spatial and temporal terms. As such, the computer network is a new reality with its own set of social norms and social environments.

Eighth, Chesebro and Bosnall (1989) believe computer-mediated communication stimulates alternative means of communication and affects use of other means of communication. In order to accommodate the stark nature of computer-mediated communication, written communications may increase in order to confirm or enrich computer-mediated communication.

Lastly, they believe computer-mediated communication erodes leader-centered communication. Computer users report a feeling of equality when using computer-mediated communication. People share information. Computer networks may more effectively utilize the resources of all participants.

Kerr and Hiltz (1982) identified several impacts of computer-mediated communication on individual behavior. These include: (a) individuals having the choice of when to communicate, (b) individuals having the opportunity to be in the center of the action, (c) increasing connectedness of

individuals, (d) creating opportunities for flextime,
(e) enabling individuals to belong to groups more easily,
(f) a blurring of the distinction between work and leisure,
(g) the speeding of interactions, (h) the reduction of
travel, (i) and receiving better answers to technical
questions.

Research by R. E. Rice and D. Case (1983) using
university managers showed that electronic mail was more
appropriate for some tasks than for others. After 2 to 5
months' use of electronic mail, managers rated the use
frequency of electronic mail for various tasks. The results
are shown in Table 1.

Tasks requiring social interaction and social intimacy,
such as bargaining or negotiating, getting to know someone,
resolution of disagreements, exchanging confidential
information, and decision making were not viewed by a
majority of participants as being appropriate for electronic
mail.

The same study showed that electronic mail served as an
additional form of communication and it was not perceived as
a replacement for other communication forms. Research by
Sproull and Kiesler (1986) supported this finding.
The Rice and Case study (1983) also showed that amount of
personal contact reported did not decrease.

Table 1

Percentage of Managers Using Electronic Mail for Various Tasks Following Five Months of Use

Task	Percent responding use for this task
Exchanging information	100.0%
Asking questions	95.0%
Exchanging opinions	81.0%
Staying in touch	84.1%
Generating ideas	73.0%
Decision-making	46.7%
Exchanging confidential information	30.0%
Resolving disagreements	15.3%
Getting to know someone	14.5%
Bargaining/negotiating	18.0%

Note. Adapted from "Electronic Message Systems in the University: A Description of Use and Utility" by R. Rice and D. Case, 1983, Journal of Communication, 33. p. 138. Copyright 1983 by the Journal of Communication. Adapted by permission.

Advantages of Electronic Mail

Stein and Yates (1983) state that electronic mail speeds the metabolism of an organization by avoiding having secretaries type handwritten notes, by avoiding inter-office

mail delays, and by avoiding the back-and-forth missed calls often referred to as telephone tag. It can better deal with time-sensitive material that might otherwise be dealt with via telephone.

Personal messages and idle chatter that accompanies most telephone calls can be eliminated if desired. Immediate answering of mail is made easy by the answer command found on many mail systems. Electronic mail users also state that electronic mail may replace more formal and longer forms of communication. Their research finds that electronic mail replaces very few face-to-face meetings but does allow on-going dialogue among people who might not otherwise communicate frequently.

Tovey et al. (1990) see equalization of participation opportunities, efficiency of response, and collaborative activities as advantages of electronic networking. In electronic networking, everyone can participate on equal footing. Everyone simultaneously receives the same message. Electronic mail also streamlines the information exchange by eliminating telephone tag and calling trees. Traditional communication is subject to the serial transmission effect, described by Redding (1972) as distortion that occurs during the person-to-person relay of a message; electronic mail reduces the possibility of this effect (Porter et al., 1986). Like registered mail, many electronic mail programs provide time and date when the message was sent. Electronic mail, much like the bulletin boards found in some offices, also

provides opportunity for collaborative activity. On electronic bulletin board systems, individuals can read, respond, read again, respond again and respond again while viewing input from other readers (Bell & House, 1986).

Problems of Electronic Mail

Some problems have been associated with electronic mail. Problems with hardware and software remain but are not the sole problems (Tovey et al., 1990). The speed of electronic mail can also create problems. Stein and Yates (1983) point to this speed as resulting in the sending of first drafts without regard for structure or tone and increased possibilities of inappropriate responses often referred to as flaming or responding in the heat of anger. They conclude the biggest problem in electronic mail is not the technology, but unanticipated social effects including: (a) changes in individual work habits, (b) changes in interpersonal relations, (c) different demands on one's time, and (d) changes in how decisions are made in the organization. Individual work-habits change as the organization of the work day is changed. Users check and respond to electronic mail messages as well as telephone messages. Interpersonal relations may change because of the cold nature of an electronic medium lacking the physical nuances of face-to-face interaction or the voice intonations of telephone interaction. Relationships may also change because of the medium's relative heat: readers respond immediately in anger without thinking. The use of telecommunications and the

acquisition of the necessary telecommunication skills demands an individual's time. Tovey et al. (1990) believe that while face-to-face decision making will not be eliminated, information overload may occur, decisions may be processed in unanticipated ways, and people may feel left out of the process.

Messages sent through electronic mail also lack clues which signal levels of formality such as stationery quality or manuscript format (i.e. typing vs. handwriting). The tone, style, and structure of electronic mail must indicate variations in the level of the communication's formality (Stein & Yates, 1983). As Sproull and Kiesler (1991) state: "In the case of electronic mail, plain text and perceived ephemerality induce relatively open and blunt remarks, little influenced (for better or worse) by social niceties" (p. 54).

In school settings, the advantages of electronic mail may outweigh its disadvantages. All people on the school's network will receive important information at the same time. Staff will be well served by the speeding of communication, by the opportunity for immediate access to time-sensitive material, by the ability to respond immediately to messages, and by the elimination of the distortion which occurs when messages are sent by person-to-person communication channels.

In addition to helping communication, electronic mail may decrease the level of computer anxiety in teachers. Failure of staff to use computers because of anxiety negates any advantages of computer use for the teacher, and because

the teacher is a role model, also provides a poor example of computer use for the students.

Computer Anxiety

Computers have become important tools in education. Anxiety toward computers results in avoidance of computers, excessive caution when using computers, negative remarks toward computers and computing and attempts to shorten periods of computer use. If computer use can aid in education it is important that levels of computer anxiety be reduced.

One area of study concerning computer anxiety is in the area of anxiety surrounding computer testing. Research projects by Jonassen (1986); Lee and Hopkins (1985); Llabre, Clements, Fitzhugh, and Lancelotta (1987) compared anxiety levels of subjects who completed standardized tests using a computer with subjects completing the same test with pencil and paper. In all studies the group using the computers measured a higher anxiety level.

Gressard and Loyd (1986) and Wilson, Genco, and Yager (1985) compared the anxiety level of a paper and pencil group to a computer group when being administered an attitude battery. Although neither study found significant differences in the anxiety levels between the two groups, Gressard and Loyd (1986) suggested that the use of computers in non-threatening, nonacademic situations might prevent some cases of computer anxiety.

These studies not withstanding, other literature suggests use of computers reduces computer anxiety. Albritton and Sievert (1987) investigated the effects of human factors on the outcome of computer literacy programs. The sample of 61 college library staff volunteers were administered the Computer Anxiety Index (CAIN). They were divided into two groups. One group took part in a series of computer literacy seminars; one group did not. Results showed lower anxiety scores for those who had prior use of a computer and lower anxiety scores for those who used a computer in their current position in the library. The CAIN was not administered prior to the literacy workshops so the effect of the workshops could not be measured.

A significant decrease in computer anxiety in university professors following a series of in-service sessions was reported by Ernest and Lightfoot (1986). These in-service sessions emphasized hands-on use of applications and other commercial software. A study by Baylor (1985) found a significant increase in positive attitude toward computers by educators following an introductory computer course.

Campbell (1986), during the development and validation of the Computer Anxiety Scale, found home ownership of a computer and regular school use both significantly related to lower computer anxiety levels. No relationship was established between level of computer anxiety and grade or gender. Lower computer anxiety levels were shown by Johanson

in 1985 for both girls and boys who had access to computers in their home.

Computer programming and use of word processing both were found to decrease computer anxiety. Gilroy and Desai (1986) selected groups specifically for not having prior computer experience. Word processing was found more effective than programming in decreasing anxiety, but programming was more effective than no treatment at all. Surveys by Arndt, Feltes, and Hanak (1983) found secretaries who used a word processor had lower computer anxiety scores than those who did not. Based on a study using 134 undergraduate students Morrow, Prell, and McElroy (1986) suggested that simple hands-on use of a computer may offer a potential for reducing computer anxiety.

Using a computer has a positive affect on teaching because teacher use of computers provides a role model for students and the computer makes the teacher more productive. Faculty need methods of decreasing computer anxiety in order to be willing to use the computer more often and in different ways. Using the computer for electronic mail will decrease the level of computer anxiety thereby increasing its use for other purposes.

Summary

Research shows communication to be a key component in an organization necessary for the sharing of information, the definition of the purpose for the organization, and the sharing of organizational goals. Organizational

communication is a complex process including the sender, the media, and the receiver. Each of these components effects communication within the organization. Research also shows that using computer-mediated communication affects the communication process. Satisfaction with communication leads to satisfaction within the organization.

Computer-mediated communication is unique in its advantages and disadvantages, and its affects on the communication and structure of an organization. This unique communication system may dramatically impact the structure of a school site. Research shows computer anxiety results in the decreased use of computers. Increased use of computers, through the use of electronic mail, may decrease this level of anxiety.

<div align="center">Research Note</div>

The lack of significant research in the area of electronic mail use in schools is evident in a search of the literature. In 1984 Kiesler et al. noted a lack of published research on group behavior in environments using computer-mediated communication. As late as 1989 in their book <u>Computer-Mediated Communication: Human Relationships in a Computerized World</u> authors J. W. Chesebro and D. G. Bosnall comment on the lack of research on personal computers as transmitters, stating, "Even though the social consequences stemming from computer use are critical, researchers have not explored these issues in depth" (p. 116). This is especially expected in education given the recent emergence of the

technology, the cost of the technology, and the lag in implementation of new technologies in education. This scarcity of research on the topic required an examination of research in collateral areas.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to examine changes in communication satisfaction and levels of computer anxiety in small rural school staffs as a result of the implementation of a local area network electronic mail system. This chapter describes the sites involved in the study, and the design of the two components of the study by delineating subjects, instruments, data collection procedures, and data analysis procedures for each component. A diagram showing the components of the study is seen in Figure 5.

Figure 5. Diagram of study components.
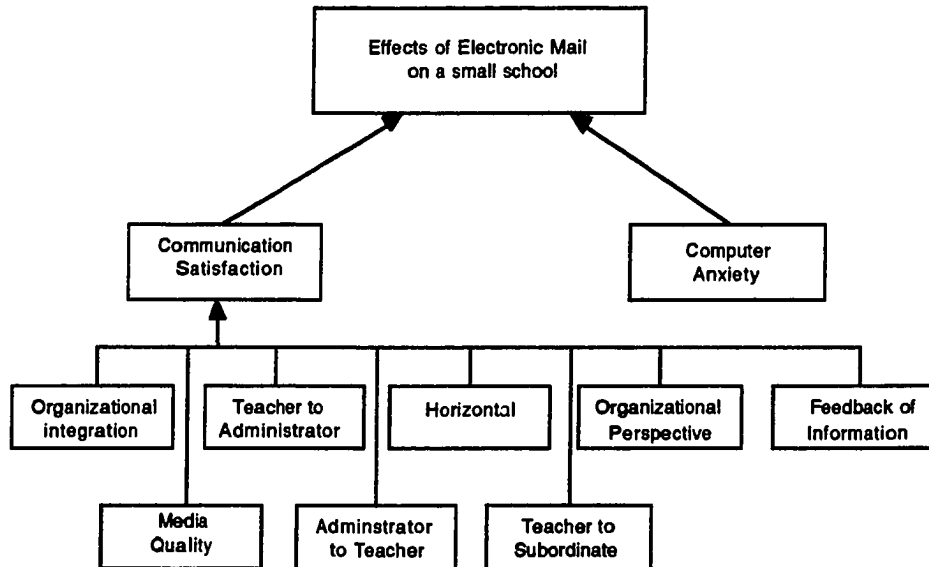
Sites

Three school settings were investigated in the study. Site One was a K-6 elementary school with a population of 267 students, 20 teachers, one counselor, one full time media specialist, and one full time principal. Classes were self contained with students leaving the classroom for physical education and a pullout resource program for students with identified special needs.

Site One had been using electronic mail since August, 1989. The teachers and administration prided themselves in having a school recognized as providing leadership in the use of technology. This recognition was evidenced by a state governor's award and by an annual computers in education conference held at the site.

The site used AppleShare and Aristotle networking software on an AppleTalk network. The principal, principal's secretary, counselor, media specialist, and all teachers except the Physical Education teacher had access to an Apple II series computer in their room connected to the network and electronic messaging software. The Physical Education teacher used a computer housed in the music room and shared with the music teacher. The network was used as a method of sharing software, as an electronic storage area for teacher data, and as a means of electronic messaging. The electronic message system, Scholastic Corporation's Bank Street Writer, allowed for individual and group messages. It did not allow for real time interaction nor was it linked to other mail or

messaging systems. The principal served as the site's system administrator.

Electronic messaging was installed at Site Two for this research project. Site Two was a 9-12 secondary building with a population of 312 students, 24 teachers, one counselor, one media specialist, one principal's secretary, and one full time principal. The student population was drawn from two communities. This site had the computer equipment and network needed for the implementation of an electronic messaging system. The school used three networks, with each network using AppleShare and Aristotle networking software on an AppleTalk network. The networks were connected via a bridge to allow inter-network communication.

One of the networks serviced the Apple II lab which was used by students for classes and during open hours for their personal use. This network provided program sharing, printer services, and a limited electronic storage area for the students. The second network serviced a Macintosh computer laboratory providing the same services. The third network serviced the teachers and administrators. This network provided software sharing, printing capabilities, and electronic storage for the building's staff. All teachers had access to an Apple II computer on the network, although two Physical Education teachers had to leave their rooms to gain access. The network administrator was a teacher allowed one period per day for maintenance of the networks and other computer equipment. The electronic messaging system

implemented at the site for the study was Scholastic Corporation's Bank Street Writer, the same messaging system found at Site One.

Site Three was a 9-12 school with a population of 274 students, 24 teachers, one counselor, one media specialist, one principal's secretary, and a half time principal. The student population was drawn from two communities. This school had no network, and few teachers had computers in their rooms for individual use. The school contained one non-networked computer laboratory used for student instruction.

All of the schools were within 30 miles of the same major employment and shopping area. The schools' students were from both town and rural areas and were similar in ethnic composition and size. All towns were identified as urban/rural in the 1990 U.S. Census data. Table 2 displays demographic data regarding the communities containing the three schools studied and the towns in the districts of the three schools. In Table 2, site 1 refers to the town where Site One is located, sites 2a and 2b refer to towns sending students to Site Two, sites 3a and 3b refer to towns sending students to Site Three.

Component One

Component One identifies the subjects, instruments, data collection procedures, and data analysis procedures used in the survey phase of the study. These surveys were directed

toward gathering information on communication satisfaction and computer anxiety.

Table 2

Demographic Data

Site	City Population	% Population Under 18	% Ethnic Population
1	1,552	24%	1.3%
2a	1,230	23%	1%
2b	2,128	24%	3.8%
3a	1,605	21%	1.2%
3b	881	22%	<1%

Note. 1990 U.S. Census Bureau.

Subjects

The subjects involved in Component One were the teachers, counselors, principal's secretaries, and media specialists at each site. At Site One this consisted of the 20 teachers, a counselor, principal's secretary, and media specialist for a total of 24 possible participants. Site Two subjects consisted of the 24 teachers, counselor, principal's secretary, and the one media specialist for a total of 27 possible participants. Site Three subjects consisted of the 25 teachers and the one media specialist for a total of 26 possible participants.

Instruments

The instruments used in this component were the Downs/Hazen Communication Questionnaire (Downs & Hazen, 1977) and the Computer Anxiety Index (Montag, Simonson, & Maurer, 1984), both of which can be seen in Appendix A.

The Downs/Hazen Communication Satisfaction Questionnaire

The Communication Satisfaction Questionnaire (CSQ) was designed by Cal Downs and Michael Hazen in 1977 in order "to explore the relationship between communication and satisfaction" (Downs & Hazen, 1977, p. 63). Basing their proposal on the works of Redding (1972), Downs et al. (1973) proposed that communication satisfaction was a multi-dimensional construct. They concluded "satisfaction is a multi-dimensional construct which characterizes several different organizational variables, e.g., task feedback, work-group relations" (Crino & White, 1981, p. 832). Downs and Hazen (1977) found eight dimensions of communication satisfaction. These dimensions are: (a) communication satisfaction, (b) communication climate, (c) communication satisfaction with superiors, (d) communication satisfaction with organizational integration, (e) communication satisfaction with media quality, (f) satisfaction with horizontal communication, (g) satisfaction with organizational perspective, (h) satisfaction with subordinates communication.

Using these eight dimensions, Downs and Hazen (1977) developed a questionnaire "to test the hypothesis that

communication satisfaction is multidimensional rather than unidimensional, and to determine how the individual dimensions relate to global job satisfaction" (p. 64). Each of the communication satisfaction dimensions became a sub-scale on the questionnaire. Each sub-scale was measured using five questions. Answers were based on a seven point Likert scale ranging from "Very Satisfied" to "Very Dissatisfied". The score on each scale was determined by taking the mean of the five answers for the five questions related to the sub-scale item. Table 3 shows a listing of the questions from the questionnaire used to measure each sub-scale.

Test reliability was determined by using test-retest technique. The test was given, then given again one week later. The reliability coefficient was found to be .94. Crino and White (1981, p. 834) determined the dimensionality of the components by using component analysis on the inter-item correlation matrix. They then used minimum eigenvalue cut-off value of 1.0 to demonstrate that an eight-factor solution is appropriate for the scale of satisfaction. Table 4 shows these results. According to Crino and White (1981, p. 834) these finding were consistent with the eight factor dimensionality of the instrument originally proposed by Downs and Hazen.

Greenbaum (1986) noted:

Crino and White's study of the Down's and Hazen instrument presented two estimates of internal consistency for each sub-scale:
1. The coefficient of alpha: these were found to be quite high, ranging from a low of .75 for Horizontal

Informal Communication to a high of .86 for Personal Feedback.

2. Average correlation among sub-scale items: these were found by Crino and White to be "quite high" ranging from .38 for Horizontal Informal Communication to .54 for personal feedback. (p. 29)

Table 3

Questions Related to Sub-Scales on the Downs and Hazen

Communication Satisfaction Questionnaire

Sub-Scale	Questions
General Organizational Perspective	3, 9, 10, 13, 14
Personal Feedback	4, 5, 6, 11, 15
Organizational Integration	1, 2, 7, 8, 12
Relation With Supervisor	17, 19, 22, 26, 31
Communication Climate	16, 18, 20, 23, 24
Horizontal Informal Communication	25, 27, 28, 29, 34
Media Quality	21, 30, 32, 33, 35
Relation With Subordinate	36, 37, 38, 39, 40

Note. Adapted from Communication Audits (p. 99) by C. W. Downs, 1988, Glenview, IL: Scott, Foresman and Co. Copyright 1988 by Scott, Foresman and Co. Adapted by permission.

Crino and White (1981) reported the Downs and Hazen instrument appeared to provide a sound empirical method for analyzing satisfaction in communication within an

organization. Downs, writing in 1988, stated "it has proved to be a useful, flexible, and efficient means to audit organizational communication" (pp. 130-131).

Table 4

Eigenvalue and Percentage Contribution of Variance of Principal Components

Factor	Eigenvalue	Percent of Variance
1	15.14	37.9
2	2.49	6.2
3	2.17	5.4
4	1.55	3.9
5	1.45	3.6
6	1.42	3.6
7	1.32	3.3
8	1.02	2.6

Note. From "Satisfaction in Communication: An Examination of Downs-Hazen Measure" by M. D. Crino and M. C. White, 1981, Psychological Reports, 49, p. 834. Copyright 1981 by Psychological Reports. Reprinted by permission.

Crino and White (1981) also tested the validity of the measure by an item analysis on all items to determine whether they differentiated significantly between satisfied

and dissatisfied workers. A Chi-square statistic and .05 level of significance were used to determine whether the responses of the "satisfied" and "dissatisfied" were significantly different. The results revealed that 83 of the 88 items discriminated significantly. Greenbaum (1986) states:

> It was concluded that the CSQ (Communication Satisfaction Questionnaire) was ideal for measuring the dependent variable of teacher communication satisfaction, being both a relatively short instrument and one designed primarily for the measurement of communication satisfaction components. (p. 46)

The open ended questions were removed from the original questionnaire design and wording was changed to pertain to an educational setting following the example of Wilson (1981). Changes were approved by Dr. C. W. Downs during a phone interview in April of 1991.

The Computer Anxiety Index (Montag et al., 1984), known as the CAIN, was developed at Iowa State University and copyrighted by Simonson and Maurer in 1984. The test rests on the assertion made that a person with computer anxiety would exhibit the following behaviors; (a) avoidance of computers, and the area where they are located, (b) excessive caution when using computers, (c) negative remarks toward computers and computing, and (d) attempts to shorten periods when computers were being used. Computer anxiety was defined as "the fear or apprehension felt by individuals when they used computers, or when they considered the possibility of computer utilization" (Montag et al., 1984, p. 45).

The test was designed using procedures defined by Hennerson, Morris, and Fitz-Gibbons (1978). Reliability was determined using a test-retest technique. College students in teacher education testing sessions were given the test and retested three weeks later. Reliability was found to be at the .90 level.

Validity was determined using a concurrent validity based on the application of the CAIN compared against the state portion of the State-Trait Anxiety Index and against rating of anxiety as determined by two raters during the subjects work time at computers. The CAIN was found to relate significantly to both the State-Trait Anxiety Index (r = .32) and the observation (r = .36) (Montag et al., 1984).

Data Collection Procedures

The procedure used in the first component was a quasi-experimental design called the Recurrent Institutional Cycle design or Patched-Up design by Campbell and Stanley (1963) which was modified for this study. A model of the original design can be found in Figure 6. In the original design strategy, one begins with an inadequate design and adds features, or patches up problem areas, to control for sources of invalidity. Another characteristic of this design is that the effect of the treatment is shown in several different ways. The design attempts to combine both longitudinal and cross-sectional approaches to research.

In the original design shown in Figure 6, comparisons
are made between observations O_1 and O_2 and between
observations O_2 and O_3. Any differences between observations
O_1 and O_2 could be attributed to the treatment or to
differences in the populations but could not be attributed to
effects of history, maturation, or test-retest effect. If a
comparison of observations O_2 and O_3 measurements were used
alone and differences found, these differences would be
vulnerable to the effects of history, maturation, and test-
retesting. These observations would control for differences
in population. Taken together, one test "patches-up" the
weakness of the other.

Figure 6. Recurrent institutional cycle design.

$X \quad O_1$

$O_2 \quad X \quad O_3$

Note. From Experiments and Quasi-experimental Design for
Research (p. 58) by D. T. Campbell and J. C. Stanley, 1963,
Chicago: R. McNally. Copyright 1963 by R. McNally.
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In the modified design seen in Figure 7, two
observations at a third site, O_3 and O_6, and an additional
observation at Site One, O_4, were added. Additional
comparisons between O_1 and O_3, O_2 and O_3, O_3 and O_6, O_1 and
O_4, and O_5 and O_6 were added in the modified design.

Figure 7. Modified recurrent institutional cycle design.

Site One	X	O_1		O_4	
Site Two		O_2	X	O_5	
Site Three		O_3		O_6	

Note. Adapted from Experiments and Quasi-experimental Design for Research (p. 58) by D. T. Campbell and J. C. Stanley, 1963, Chicago: R. McNally. Copyright 1963 by R. McNally. Adapted by permission.

The O_1 against O_3 comparison provides an additional comparison of a site with electronic mail to a site without electronic mail, enhancing the cross-sectional nature of the design. The O_2 against O_3 comparison compares a site with plans to implement electronic mail with a site not planning electronic mail implementation. The O_3 against O_6 comparison examines maturation at a site without electronic mail. The O_5 against O_6 comparison serves as a comparison between changes which occurred at Site Two as a result of implementing electronic mail and changes at Site Three where electronic mail was not being used, thereby adding to the longitudinal aspect of the original design and helping to control for the effects of history, maturation, and test-retest. The O_4 observation is added as a measure so the O_1 against O_4 observation strengthens the longitudinal nature of

the design by comparing history, maturation, and test-retest effects of this site with the other sites. A complete timetable of observations and treatment can be seen in Appendix C.

In order to achieve a statistical measure of the change in communication satisfaction, the Downs and Hazen Communication Satisfaction Questionnaire (Downs & Hazen, 1977) and Computer Anxiety Index (Simonson & Maurer, 1984) were administered to the teachers and media specialist at the three sites. These administrations composed observations O_1, O_2, and O_3. The principals at each site first notified the staff that the study was being done and of the purpose of the study. It was made clear that participation in the study was on a voluntary basis. During the last week of February and the first week of March the researcher personally visited with each of the staff members and gave them the questionnaire. Each was instructed to return the completed questionnaire to the principal's secretary.

Staff were reminded with bulletins to complete and return the surveys. Even though the questionnaires were anonymous, the researcher contacted all staff members and asked them to respond if they hadn't already done so. Completed surveys were collected from the principal's secretary two weeks after the administration of the survey.

Following the initial administration of the questionnaire in each of the schools, the teachers, building principal, principal's secretary, counselor, and media

specialist at Site Two were trained in the use of electronic mail. Teachers were encouraged to use the system by having daily bulletins distributed through the electronic mail system and attendance by period reported by the teachers to the principal's secretary using the electronic mail system. What other uses could be found for the electronic mail system were left to the staff.

In December, 10 months following the initial administration of the questionnaire, the principals again notified their staff that a questionnaire would be administered. The researcher handed out the questionnaires in meetings with the staff and asked the staff to return the questionnaire to the principal's secretary upon completion. Two weeks were allowed for returning the questionnaires, during which time bulletins were issued to the staff reminding them to return the questionnaires and the researcher contacted all staff members and asked them to respond if they hadn't already done so. The questionnaires were collected from the principal's secretary at the end of the two week time period. These returns comprised observations O_4, O_5, and O_6.

<div align="center">Data Analysis</div>

Each of the eight sub-scales of the CSQ and level of computer anxiety determined by the CAIN were evaluated following the original and Modified Recurrent Institutional Cycle design model as shown in Figures 6 and 7. Step-wise discriminant analyses were used to determine if differences

in communication satisfaction existed between Sites One and Two at observations O_1 and O_2 and within Site Two at observations O_2 and O_5. Step-wise discriminant analyses were also used to find communication satisfaction differences between observations O_1 and O_3, observations O_2 and O_3, between observations O_3 and O_6, O_1 and O_4, and observations O_5 and O_6.

The step-wise discriminant analysis procedure used to analyze the data is a statistical procedure where "The first task of discriminant analysis is to find the linear combination of variables that best discriminates between, or separates, groups" (SPSSX Users Guide, 1986, p. 689). In addition to the list of variables comprising any function formed, the eigenvalue, the Canonical Correlation, Wilks' Lambda, Chi-square, significance level, and percentage of grouped cases correctly classified using the discriminant function created were reported. The default selections for a step-wise discriminant function in SPSSX were used.

The eigenvalue is a special measure computed in the process of deriving the discriminant function which measures the relative importance of the function. The canonical correlation expressed is a measure of the discriminant functions ability to correctly discriminate between groups. The closer to 1 the canonical correlation, the greater the accuracy of the discriminant function formed in identification of cases. Wilks' Lambda is an inverse measure of the discriminating power in the original variables which

has not yet been removed by the discriminating function--the larger lambda is, the less information remaining. Wilks' Lambda can be transformed into a Chi-square to measure statistical significance. Both Chi-square and p. values are given. The percentage of grouped cases identified correctly is also given to show the discriminating power of the discriminant function created.

The factors identified as being a part of the discriminant funtion were analyzed using a t-test procedure to determine if each was significantly different. When the percentage of cases accurately classified was large, and the Wilks' Lambda was small, a t-test procedure was used on all the variables to determine which, if any, were significant by themselves.

A t-test procedure was used to determine if differences in computer anxiety existed between Sites One and Two at observations O_1 and O_2 and within Site Two at observations O_2 and O_5. A t-test procedure was also used to find computer anxiety differences between observations O_1 and O_3, between observations O_2 and O_3, between observations O_3 and O_6, between observations O_1 and O_4, and between observations O_5 and O_6.

Component Two

Component Two deals with the survey phase of research. It includes information on the selection of subjects, instruments, data collection procedure, and data analysis procedure used.

Subjects

Six teachers at Sites One and Two were randomly selected and asked to participate in the interview. Random selection was accomplished by the generation of two random number lists of 100 numbers, one for each site, using a computer-based random number generator and matching these numbers to the number of a faculty member on an alphabetic listing of on-site faculty. At both locations, the first six teachers asked to participate in the survey agreed. The principals, principal's secretaries, media specialists, and system administrators were also interviewed. Questions pertinent to the system administrator were added to the interview of the principal at Site One who served as that site's system administrator.

Instrument

The Staff Communication Interview Guide was designed by the researcher for a semi-structured interview situation. The questions focused on the teachers' impressions of the effect of electronic mail on communication in the school, changes in productivity, changes in relationship with peers, changes in relationship with the principal, changes in knowledge of educational program, and changes in understanding of the school's direction and purpose as a result of the implementation of electronic mail. Content validity was established through research findings reported in the literature with subsequent review of the instrument by Dr. Sharon Smaldino, Associate Professor of Education,

University of Northern Iowa and the building principals

involved in the study. The questions were formulated using

the suggestions of Bogdan and Biklen (1982). Questions were

open ended and "flexible enough for the observer to note and

collect data on unexpected dimensions of the topic" (1982, p.

71).

<div align="center">Data Collection Procedures</div>

The interviews followed a process and procedure

suggested by Bogdan and Biklen for interview schedules

(1982).

> 1. A specific time and place was established for the
> interview.
> 2. Small talk was used to "break the ice".
> 3. The subject was informed of the purpose of the study
> and interview.
> 4. The subject was told the interview would be recorded
> and that the recording was to be transcribed for
> analysis. The subjects were also informed the tapes
> would be erased and that their name, the sites name, and
> any names at the site they mention would not appear in
> the transcripts.
> 5. The interview ensued. (p. 71)

All interviews were conducted by the researcher. The

interviews were taped and transcribed for inclusion in the

study. These interviews focused on; (a) teacher impressions

of the effect of electronic mail on communication in the

school, (b) changes in productivity, (c) changes in

relationship with peers, (d) changes in relationship with the

principal, (e) changes in knowledge of what is occurring in

the building and, (f) changes in understanding of the

school's direction and purpose as a result of the

implementation of electronic messaging. This approach,

beginning with open ended questions, was based on research
guidelines which focus on discovering categories, themes, and
theory directly from data (Bogdan & Biklen, 1982).

<div align="center">Data Analysis Procedures</div>

A modified version of the analytic induction approach to
collecting and analyzing the interview data was used which
was based on the following steps suggested by Bogdan and
Biklen (1982):

1. Early in the research a rough definition and
explanation of the particular phenomenon is developed.
2. The definition and explanation are modified as new
cases are encountered that do not fit the definition and
the explanation as formulated.
3. The definition and/or explanation are modified as
new cases are encountered that do not fit the definition
and the explanation as formulated.
4. Data that might not fit into the formulation is
actively sought.
5. The definition and/or explanation are accepted or
rejected and new definitions and/or explanations
suggested. (p. 67)

The modifications centered on the questions previously
mentioned without limiting new data which might come forward.
The modified steps are:

1. Early in the research a rough definition and
explanation of the particular phenomenon is developed.

2. The definition and explanation are held up to the
data as collected.

3. The definition and/or explanation are evaluated in
view of the data.

4. Data that might not fit into the formulation is
actively sought.

5. The definition and/or explanation are accepted or rejected and new definitions and/or explanations suggested.

The researcher was trained in interview interpretation by Dr. Christine Canning, Assistant Professor of Education, University of Northern Iowa. Transcripts of the interviews were interpreted by the researcher, and validated using corroborating discussions with Dr. Christine Canning, Assistant Professor of Education and Dr. Robert Muffoletto, Associate Professor of Education, University of Northern Iowa.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to examine changes in communication satisfaction and computer anxiety factors as the result of the implementation of a local area network based electronic mail system. The following effects were investigated: communication satisfaction, productivity, principal-staff communication, awareness of events at site, knowledge of and implementation of school goals, professional and interpersonal staff communication, and anxiety level of teachers toward computers.

Research hypotheses were:

1. The implementation of electronic mail will positively affect faculty communication satisfaction.

2. The implementation of electronic mail will lower the level of computer anxiety of staff members.

These hypotheses were investigated using data gathered from two administrations of a questionnaire composed of the Communication Satisfaction Questionnaire (Downs & Hazen, 1977) and the Computer Anxiety Index (Montag et al., 1984). A research procedure was modified from the Recurrent Institutional Cycle or "Patched Up" design by Campbell and Stanley (1963) seen in Figure 8. The design was modified to examine changes between Site One, which had electronic mail, Site Two, which did not have electronic mail but was planning its implementation, and Site Three which had neither electronic mail nor plans for implementation. The research

measured differences at each school between first and second administrations and differences between Site Two and Site Three following implementation of electronic mail at Site Two. This design model can be seen in Figure 9.

<u>Figure 8</u>. Recurrent institutional cycle design

Site One	X	O_1		
Site Two		O_2	X	O_5

Note. From <u>Experimental and Quasi-experimental Design for Research</u> (p. 58) by D. T. Campbell and J. C. Stanley, 1963, Chicago: R. McNally. Copyright 1963 by R. McNally. Reprinted by permission.

The questionnaires were first administered at the three sites: Site One which was using electronic mail, Site Two where electronic mail was going to be installed, and Site Three which had no plans to implement electronic mail. Electronic mail was then installed at Site Two and the staff trained in its use. The second administration of the questionnaires followed 10 months after the initial administration.

Additional information was gathered in Component Two through the use of semi-structured interviews. These interviews were conducted with the principal, principal's

secretary, media specialist, system administrator, and six randomly chosen teachers at both sites using electronic mail.

Figure 9. Modified recurrent institutional cycle design.

Site One		X	O_1		O_4
Site Two			O_2	X	O_5
Site Three			O_3		O_6

Note. Adapted from Experiments and Quasi-experimental Design for Research (p. 58) by D. T. Campbell and J. C. Stanley, 1963, Chicago: R. McNally. Copyright 1963 by R. McNally. Adapted by permission.

This chapter includes the statistical analysis and interpretation of the questionnaires composed of the CSQ and CAIN. It also includes staff comments from the interviews and an interpretation of those comments.

Interpretation of Results from the
Communication Satisfaction Questionnaire

Each of the eight sub-scales of the CSQ were first evaluated following the traditional Recurrent Institutional Cycle design as found in Figure 8, observation O_1 with O_2 and O_2 with O_5. Further comparisons were made adding the O_1 with O_3, O_2 with O_3, O_3 with O_6, O_1 with O_4, and O_5 with O_6

observations outlined in the Modified Recurrent Institutional Cycle Design found in Figure 9.

Each set of observations from the CSQ was first submitted to a step-wise discriminant analysis procedure to determine if a function composed of a number of variables could be used to determine if one observation differed significantly from another observation. A t test was then run on any variables found to be part of identified discriminating functions. When the percentage of cases accurately classified was large, and the Wilks' Lambda was small, a t-test procedure was used on all the variables to determine which, if any, were significant by themselves. Results of the discriminant analysis and tables showing the results of the t test are given for each observation. An interpretation follows each section of results.

Findings Using Recurrent Institutional Cycle Design
CSQ Observation O_1 With O_2

Results. A step-wise discriminate analysis procedure, using SPSS-X default values, was used on the eight communication satisfaction variables to determine if a function could be found which would measure a significant difference in the communication satisfaction between Site One, a site using electronic mail, and Site Two, a site not using electronic mail but planning to institute electronic mail. Using the default values, the computer failed to identify a discriminant function.

Interpretation. Since the analysis failed to identify a discriminating function, no t test analysis was conducted. No significant difference in variable of communication satisfaction was measured at this time between Site One and Site Two.

CSO Observation O_2 With O_5

Results. Analysis was done to determine if a significant difference could be found at Site Two between the observation prior to the implementation of electronic mail at observation O_2, and following introduction and use of electronic mail at observation O_5. A step-wise discriminant analysis procedure, using SPSSX default values, was performed on the eight communication satisfaction variables. The step-wise procedure was completed with the inclusion of General Organizational Perspective, Media Quality, and Organizational Integration. This discriminant function, composed of the three step-wise selected variables, produced a Canonical Correlation of .52, an eigenvalue of .37, a Wilks' Lambda of .73, a Chi-square of 10.96 with 3 degrees of freedom and significance at the .05 level. The function formed correctly classified 72% of the grouped cases.

Variables contributing to the discriminant function were tested using a t-test procedure. The results of the t test are seen in Table 5.

Interpretation. Using a step-wise discriminant analysis and SPSSX default values, a discriminant function was developed which measured a significant difference between the

first administration and second administration of the CSQ at
site two. This function was composed of the variables
General Organizational Perspective, Media Quality, and
Organizational Integration. The results of the t tests on
these factors at Site Two showed none of these three factors
differed significantly by itself from the first application
to the second application of the questionnaires. An
improvement in General Organizational Perspective resulted in
a large t value.

Table 5

Results of t-tests on Discriminant Analysis Function at Site
Two Grouped by Questionnaire Administration

Variable	Admin-istration	N	Mean	S.D.	t-value (df)	p
General Organizational Perspective	1	20	4.83	.73	1.82 (37)	.08
	2	19	5.24	.79		
Media Quality	1	20	5.70	.69	-1.14 (37)	.26
	2	19	5.43	.76		
Organizational Integration	1	20	5.38	.79	-.45 (37)	.66
	2	19	5.27	.69		

Interpretation Using the
Recurrent Institutional Cycle Design

The O_1 with O_2 and O_2 with O_5 comparisons compose the
comparisons used in the Recurrent Institutional Cycle design

as described by Campbell and Stanley (1963). If electronic mail did significantly affect communication satisfaction, one could anticipate the finding of a discriminant function which would be able to differentiate between findings of observations O_1 and O_2 and between observations O_2 and O_5.

A discriminant function was identified for Site Two which could differentiate between the first evaluation, observation O_2 when Site Two had no electronic mail, and second evaluation observation O_5 following implementation of electronic mail at Site Two. No function was identified between Site One observation O_1, a site with electronic mail, and Site Two observation O_2, a site without electronic mail at the time of the initial observation.

Prior to the installation of electronic mail at Site Two, the staffs of sites One and Two appeared to be satisfied with communication occurring in their schools. Following installation of electronic mail at Site Two a measurable change occurred there. The components of this change were an increased satisfaction in the staffs' general organizational perspective, a decrease in their satisfaction with media quality, and a decrease in their satisfaction with organizational integration.

Downs (1988) defined satisfaction with organizational perspective as being characterized by ". . . notification about changes, the organization's financial standing, and the overall policies and goals of the organization" (p. 113). It became regular practice at Site Two to notify other

teachers over the network concerning special speakers in a class, special events such as field trips, and the students who would be missing classes for any special reason. The increase in satisfaction with organizational perspective may be a result of this improved knowledge of events scheduled and the people involved, plus increased knowledge of what was occurring in classes in way of special speakers and special experiences such as field trips. Involvement in the study may have also caused an examination of the purpose and importance of the school. In discussion with the principal, and in observations during the necessary visits to the site, pride in being part of the experiment was evident. This pride may be reflected in the improvement measured by this component.

The two other components of the measurable function were a decrease in the satisfaction with media quality and in organizational perspective. This study forced staff to critically evaluate these areas of communication. Both of these decreases may reflect an increase in awareness and critical evaluation of these two areas.

Findings Using the Modified Recurrent Institutional Cycle Design

CSQ Observation O_1 With O_3

Results. The O_1 with O_3 observation compared a site with electronic mail, Site One, with a site not planning to implement electronic mail, Site Three. A step-wise discriminant analysis was performed, using SPSSX default

values, on the eight variables of the CSQ. The step-wise procedure was completed with the inclusion of the variables Media Quality, Relationship With Subordinates, and Satisfaction With Horizontal Communication. With only three variables, the discriminant function correctly classified 100% of the cases. The discriminant function composed of the three variables produced a Canonical Correlation of .95, an eigenvalue of 9.89, a Wilks' Lambda of .09, a Chi-square of 70.44 with 3 degrees of freedom, and significance at the .01 level.

Due to the strength of the percentage correctly classified and the small cumulative Wilks' Lambda, a t test was performed on these three communication satisfaction factors plus all others. Results of this t test are shown in Table 6.

Table 6

Results of t-tests on All Communication Satisfaction Variables Between Site One and Site Three, Observations O_1 With O_3

Variable	Site	N	Mean	S.D.	t-value (df)	p
Media Quality	One	19	5.74	.52	-14.47	<.01*
	Three	14	2.83	.63	(31)	
Relation With Subordinates	One	19	5.62	.79	-2.06	.06
	Three	14	4.97	1.04	(31)	

(table continues)

Variable	Site	N	Mean	S.D.	t-value (df)	p
Horizontal Communication	One Three	19 14	5.46 3.80	.79 .71	-6.25 (31)	<.01*
General Organizational Perspective	One Three	19 14	5.07 3.97	.99 .89	-3.29 (31)	<.01*
Communication Climate	One Three	19 14	5.31 2.80	.89 1.09	-7.30 (31)	<.01*
Personal Feedback	One Three	19 14	5.12 2.94	1.25 .77	-5.75 (31)	<.01*
Organizational Integration	One Three	19 14	5.55 4.44	.68 .92	-3.99 (31)	<.01*
Relation With Superior	One Three	19 14	5.84 2.74	1.0 1.2	-8.12 (31)	<.01*

Note. * Significant at .05 level.

Interpretation. The variable, Relation With
Subordinates, was significant with the other variables in the
discriminant function, but was not significant by itself.
All other variables were found to be significantly different.

CSQ Observation O_2 With O_3

Results. The O_2 with O_3 observation examined
differences between a site planning to implement electronic
mail and a site not planning to implement electronic mail. A
step-wise discriminant analysis was performed, using SPSSX
default values, on the eight variables of the CSQ. With only

three variables chosen the function could correctly classify 97% of the cases. These variables were Satisfaction With Media Quality, Relationship With Subordinates, and Relation with Superior. The discriminant function produced showed a Canonical Correlation of .92, a Wilks' Lambda of .15, a Chi-square of 56.60 with two degrees of freedom and a significance level of less than 01.

Due to the strength of the percentage correctly classified and the small cumulative Wilks' Lambda, a t test was run on these three variables and all of the others. Results of this t test are shown in Table 7.

Table 7

Results of t-tests on All Communication Satisfaction Variables Between Site Two and Site Three. Observations O_2 With O_3

Variable	Site	N	Mean	S.D.	t-value (df)	p
Media Quality	Two	20	5.70	.69	-12.37 (32)	<.01*
	Three	14	2.83	.63		
Relation With Subordinates	Two	20	5.45	.84	-12.37 (32)	.16
	Three	14	4.97	1.04		
Relation With Superior	Two	20	6.14	.83	-9.80 (32)	<.01*
	Three	14	2.74	1.2		

(table continues)

Variable	Site	N	Mean	S.D.	t-value (df)	p
General Organizational Perspective	Two	20	4.83	.73	-3.09 (32)	<.01*
	Three	14	3.97	.89		
Personal Feedback	Two	20	5.38	1.04	-6.96 (32)	<.01*
	Three	14	2.94	.77		
Organizational Integration	Two	20	5.38	.79	-3.16 (32)	<.01*
	Three	14	4.46	.92		
Communication Climate	Two	20	5.41	.86	-7.81 (32)	<.01*
	Three	14	2.80	1.09		
Horizontal Communication	Two	20	5.36	.64	-6.71 (32)	<.01*
	Three	14	3.80	.71		

Note. * Significant at .05 level.

Interpretation. The variable, Relation With Subordinates, was significant with the other variables in the discriminant function, but was not significant by itself. All other variables were found to be significantly different by themselves.

CSQ Observation O_3 With O_6

Results. The O_3 with O_6 observation looked for significant changes in a site without electronic mail, Site Three, during the period between the first and second administration of the questionnaires. A step-wise discriminant analysis procedure was done, using SPSSX default values, to determine if a function capable of measuring a significant difference could be found at the site between the

two observations. The step-wise procedure concluded with the inclusion of Media Quality and Horizontal Communication.

The created discriminant function showed a Canonical Correlation of .56, eigenvalue of .45, Wilks' Lambda of .69, Chi-square of 9.21 with two degrees of freedom and was significant at the .01 level. The function correctly grouped 71% of the cases.

Variables contributing to the discriminant analysis function were tested using a t-test procedure. Results of this test can be seen in Table 8.

Table 8

Results of t-tests on the Discriminant Analysis Function at Site Three Grouped by Questionnaire Administration

Variable	Admin-istration	N	Mean	S.D.	t-value (df)	p
Horizontal Communication	1	14	3.80	.71	-.29	.77
Satisfaction	2	14	3.70	1.13	(26)	
Media	1	14	2.86	.63	2.68	.01*
Quality	2	14	3.59	.85	(26)	

Note. * Significant at the .05 level.

Interpretation. A discriminant function was found consisting of two of the eight variables of the CSQ. Results following a t-test analysis indicate a significant change

occurred in the perception of the staff toward the variable
media quality. Since electronic mail was not used here, the
change noted must be the result of factors not examined in
the study.

CSQ Observations O_1 With O_4

Results. The O_1 with O_4 observation determined if a
function could be found which would discriminate between the
first and second administration of the questionnaires at Site
One, a site which used electronic mail. A step-wise
discriminant analysis procedure was performed on the eight
variables of the CSQ. Using the default values, the computer
failed to identify a discriminating function.

Interpretation. Since the analysis failed to identify a
discriminating function, no t test was performed. No
significant difference in levels of communication
satisfaction were measured.

CSQ Observations O_5 With O_6

Results. The O_5 with O_6 observation examined
differences between a site which had recently implemented
electronic mail and a site which had not implemented
electronic mail. A step-wise discriminant analysis was
performed on the eight variables of the CSQ. As a result,
the step-wise procedure was completed with the inclusion of
Relation with Superior, Relationship With Subordinates, Media
Quality, General Organization Perspective, Horizontal
Informal Communication, and Personal Feedback. The
discriminant function produced showed a Canonical Correlation

of .87, a Wilks' Lambda of .24, a Chi-square of 40.42 with six degrees of freedom and a significance level <.01. The function formed classified 91% of the grouped cases correctly.

Due to the strength of the percentage correctly classified and the small cumulative Wilks' Lambda, a t test was performed on these communication satisfaction factors plus all of the others. Results of this t test are shown in Table 9.

Interpretation. The variable, Relation With Subordinates, was significant with the other variables in the discriminant function, but was not significant by itself. All other variables were found to be significantly different by themselves.

Table 9

Results of t-tests on All Communication Satisfaction Variables Between Site Two and Site Three, Observations O_5 With O_6

Variable	Site	N	Mean	S.D.	t-value (df)	p
General Organizational Perspective	Two	19	2.73	.79	-6.42	
	Three	14	4.41	.68	(31)	<.01*
Personal Feedback	Two	19	2.69	1.0	-5.79	
	Three	14	4.77	1.0	(31)	<.01*

(table continues)

Variable	Site	N	Mean	S.D.	t-value (df)	p
Relation With Superior	Two Three	19 14	1.98 4.62	.77 1.17	-7.82 (31)	<.01*
Communication Climate	Two Three	19 14	2.86 4.97	.91 .97	-6.38 (31)	<.01*
Horizontal Communication	Two Three	19 14	2.76 4.30	1.03 1.13	-4.08 (31)	<.01*
Media Quality	Two Three	19 14	2.57 4.41	.76 .85	-6.56 (31)	<.01*
Relation With Subordinates	Two Three	19 14	2.49 2.91	.97 .98	-1.22 (31)	.23
Organizational Integration	Two Three	19 14	2.73 3.67	.69 1.07	-3.09 (31)	<.01*

Note. *Significant at the .05 level.

Interpretation Using Modified Recurrent

Institutional Cycle Design

Significant differences in the variables of communication satisfaction were found between Site Three and both Sites One and Two, at the initial observation and final observation. No differences were found in Site One between the initial and final observations. A discriminant function was identified which could measure a difference in communication satisfaction at Site Three between initial and final evaluations. This function, composed primarily of an improvement in evaluated media quality, was found although no electronic mail was introduced. Further discussion with the

school's principal at Site Three found a concentrated effort during the period between first and second evaluations to improve communication with the staff. This communication, which was partly made up of improved informational bulletins, may have influenced this finding. Significant differences continued to be found between Site Two and Site Three at the second evaluation. Even with the significant improvement in Media Quality measured between first and second administrations of the instrument at Site Three, there continued to be a significant difference in perceived Media Quality and all other communication variables except Relations With Subordinates between Site Two and Site Three at the time of the second administration.

A paired t test might have been useful in further determining changes. Unfortunately, an imposed requirement for anonymity at one of the sites made any coding necessary for such a test impossible.

Summary

At the initial evaluation, significant differences in communication satisfaction were measured between Sites One and Two, and Site Three. No significant difference was found between Site One and Site Two.

No significant changes in level of communication satisfaction occurred at Site One during the period of study. A discriminant function was found which could discriminate between the first and second set of observations at Site Two, observation O_2 and O_5. An increase in the level of

satisfaction with Organizational Perspective was the primary component of this function.

A discriminant function was found which could discriminate between the first and second set of observations at Site Three, observation O_3 and O_6. This function was composed primarily of a significant change in level of satisfaction with media quality. This change might be explained by an increased emphasis on staff communication by the principal as demonstrated by the improvement in bulletins and other informational printings by the principal's office.

Interpretation of Results from the

Computer Anxiety Index

Changes in computer anxiety were evaluated using the CAIN and following the Modified Recurrent Institutional Cycle design found in Figure 9. This design called for analysis composed of comparing observations; (a) O_1 with O_2, (b) O_2 with O_5, (c) O_1 with O_3, (d) O_2 with O_3, (e) O_3 with O_6, (f) O_1 with O_4, (g) and O_5 with O_6.

CAIN Observations

Results

The difference in level of computer anxiety between each set of observations as measured by the CAIN was tested for significance using a t-test procedure. The results of all comparisons of observations based on the CAIN are seen in Table 10.

Table 10

Results of t-tests of CAIN, All Observations

Variable	Obser-vation	N	Mean	S.D.	t-value (df)	p
O_1 with O_2	O_1	19	2.04	.76	-.57	.57
	O_2	20	2.20	1.02	(37)	
O_2 with O_5	O_2	20	2.20	1.02	-.76	.45
	O_5	18	2.46	1.09	(36)	
O_1 with O_3	O_1	19	2.04	.76	.13	.90
	O_3	13	2.00	.81	(30)	
O_2 with O_3	O_2	20	2.20	1.02	.59	.54
	O_3	13	2.00	.81	(31)	
O_1 with O_4	O_1	19	2.04	.76	.30	.76
	O_4	14	1.96	.58	(31)	
O_5 with O_6	O_5	18	2.46	1.09	.41	.68
	O_6	13	2.24	.82	(19)	
O_3 with O_6	O_3	13	2.00	.81	-.75	.46
	O_6	13	2.24	.82	(24)	

Interpretation

Observations were made comparing computer anxiety: (a) between a site with electronic mail and one without electronic mail but planning to implement it, O_1 with O_2, (b) computer anxiety at a site before and after implementation of electronic mail, O_2 with O_5, (c) between a site with

electronic mail and one without plans to implement it, O_1 with O_3, (d) between a site planning to install electronic mail and one with no plans to install electronic mail, O_2 with O_3, (e) at a site with electronic mail between observations, O_1 with O_4, (f) between a site which had just implemented electronic mail and a site with no plans to implement electronic mail, O_5 with O_6, and (g) at a site without plans of implementing electronic mail at the beginning and end of the time period, O_3 with O_6. No significant differences were found between any of the observations.

Discussion

No significant differences were measured between the sites' levels of computer anxiety at either time of evaluation nor was there any significant change in any of the site's levels of computer anxiety during the study period. Implementation of electronic mail created no significant change in the levels of computer anxiety as measured by the CAIN.

Survey Results

The surveys used in the study were given to the principal, principal's secretaries, media specialist, system administrator, and six randomly chosen teachers at Sites One and Two. At Site One, two second grade teachers, two fifth grade teachers, a physical education teacher and a teacher teaching a remedial pullout program (Chapter 1), were interviewed. Each had been employed at the site for at least

three years. At Site Two, a mathematics, biology, social studies, home economics, business education, and science teacher were interviewed. All had worked in the district for at least three years.

The interviews followed a survey instrument designed by the researcher, and the interviews follow a procedure outlined by Bogdan and Biklen (1982, p. 71). The interviews focused on changes in communication satisfaction, productivity, principal-staff communication, awareness of events at site, knowledge of and implementation of school goals, professional and interpersonal staff communication, and in the anxiety level of teachers toward computers as a result of the implementation of electronic messaging. The results of the teacher surveys for each of these areas follows.

Effect of Electronic Mail on Communication Satisfaction

Teachers were asked if they perceived any difference in communication in the school with electronic mail when compared with the period before electronic mail. Eleven of the twelve teachers perceived an improvement in communication. An elementary instructor stated, "I feel it has helped with the communication process between everybody." When asked in what way it has helped various reasons emerged.

Both the Chapter 1 teacher at Site One and Home economics teacher at Site Two referred to a decrease in paper shuffling. When asked specifically about this, the home economics teacher stated:

If you think of something you have to get out, such as a message for a meeting, you can do it immediately, rather than typing it up, running it off, and distributing it in the mailboxes. I think we are much much more efficient and much more willing to put out these memos because it is so easy to do so.

Three Site One and one Site Two interviewees specifically mentioned the time-saving component of electronic mail. This time saving comes from not having to go to other teachers' classes trying to find them, then seeing if they are available to talk. A second grade teacher at Site One stated:

. . . now we can just sit down and type in the information we want; we don't have to run around the building. We spent a lot of time going from room to room to talk. Now if I have a specific concern, say one of my students who works with the guidance counselor, I can write my concern and send it to her and she has it already before she sees the child. It saves a lot of time.

A second grade teacher at Site One saw the mail as more private than placing notes in other teacher's mailboxes. The teacher stated "Mailboxes are not very private. If you wanted to send confidential information, the mailbox was not the appropriate place to do it."

Four of the teachers, three from Site Two and one from Site One commented on the ability to communicate during times when they had a class in their room. The business education instructor at Site Two stated "If I needed to talk to one of the other teachers I had to go there or send a student there. Now I just send a message through the computer while I am in my room with my students."

Of the 11 interviewed teachers who saw an improvement in communication as a result of electronic mail, only one mentioned the immediate reception of information as a primary advantage. Ten mentioned its importance as a device for initiating information transfer either in the form of a question requesting information or the dispersal of information such as a memo concerning an upcoming event or an answer to a question from another electronic mail sender.

The science teacher interviewed at Site Two stated "It [electronic mail] has helped them [other teachers] because I think in your room you have access to information immediately. You don't have to wait to get down to the office to pick up a slip."

The one teacher interviewed who did not see an improvement in communication, the mathematics teacher at Site Two, said, "If I had something I wanted them [other teachers] to see, I would put it in their mailboxes," but did comment that "In some cases it may have helped."

The principal at Site One saw electronic mail as an aid to communication. He stated ". . . in my perception, there is a great deal more communication going on now than there was prior to the installation of the network." When questioned whether electronic mail had helped communication in the school, the principal answered that it did, but underscored the necessity of everyone having access to a computer.

Effect of Electronic Mail on Productivity

Principal's secretaries at both sites saw the computer as increasing their productivity. At Site One the secretary saw it as a step saver. She stated "It has helped from the standpoint that I also do the attendance that I take to the school nurse. It has saved me steps, many of them." The secretary also noted:

> The principal puts on a lot of his own communication, so I don't do a lot of that. It used to be that I would type them up and put them in their [teacher's] mailboxes. Now he [the principal] will just sit down to the computer and put it out.

At Site Two, the secretary perceived an improvement in the speed at which attendance was taken stating "Attendance was a lot faster." This same secretary stated:

> It [electronic mail] saved me maybe fifteen minutes at the beginning of the day for the bulletin and attendance. I didn't have to leave the office at all. It was right there where otherwise I usually took 10-15 minutes because I had to go clear out through the shop and other areas.

The media specialist at Site One stated "When a class needs their crayons or scissors I can E-mail those two teachers instead of running clear down there and trying to find them. That saves at least five minutes every time."

Of the teachers interviewed, five stated electronic mail had improved their productivity, six said they had no change in productivity, and one, the mathematics teacher at Site Two, believed electronic mail had hurt his productivity. He stated, "It is so damn slow and hard to use. It takes me

five minutes to do what I used to do in 30 seconds for taking roll."

The Chapter I teacher at Site One stated, "We don't have to run to the mailbox in the workroom. We can stay in our room and get our work done." Several talked about how the change to electronic mail had increased their use of the computer for other reasons and how computer use had made them more productive. A second grade teacher at Site One stated:

> I just know it [electronic mail] is something I was not comfortable with in the beginning. I ordered a computer at home too. With all the curriculum development it is just something that I know is a tool and I force myself to use it. I am enjoying it. It is not just completely E-mail. It is just the computer itself.

The biology teacher at Site Two stated "The most valuable thing about E-mail is the efficiency that the computer can give you . . . the increased amount of quality work that you can do."

The principal at Site One perceived an increase in his personal level of productivity. When asked about his level of productivity since implementation of electronic mail, the principal stated:

> Sure, I can do a lot more. That is not necessarily only E-mail, it is the computerization in my office but it is an example of the same kind of thing. It used to be a process where I would write out my bulletin, give it to my secretary, she would type it up, give it back to me, I would proofread it, and put it in the mailboxes. Right now when I have got a message, I just sit down, type it in, and send it. It probably saves 80% of the time for the whole process to occur. So both she [secretary] and I have more time to do other things. Again, that is not just E-mail, that's having the computer and all the other tasks that it does, but yes it has had a big impact on my job.

At Site Two, when asked whether electronic mail had increased teacher productivity, the principal stated "I think it will take some time, but yes I do. The first thing that I look at is that I think they will utilize computers more. I think the bottom line is that we will increase productivity."

Effect of Electronic Mail on Professional and
Interpersonal Staff Communication

Teachers were asked if there was a change in the amount of communication with their peers or in the amount of face-to-face meetings. No teacher stated there had been a decrease in communication, and two commented that an increase had occurred.

A Site One teacher commented on the amount of "social" conversation saying there was ". . . more in the respect that a lot of social things get communicated by E-mail." Another teacher, a fourth grade teacher at Site One, saw an increase in communication with the other division of teachers in her school. She noted she was communicating:

> . . . a little more with the lower elementary than I did before, just because our schedules are different and I do have a chance to communicate with them this way. Normally during a regular school day without E-mail I wouldn't have that [communications] opportunity and E-mail serves that purpose in opening up communication lines between the upper and lower [elementary] levels. There used to be kind of a division and there still is just due to physical location; it is separated and also schedules are different. But I think that it [electronic mail] has broken down some of the barriers because we do have this network that allows people to do that.

All but three of the teachers interviewed had seen no change in the number of face-to-face meetings. One teacher

thought they had more, one thought they had less. A second grade teacher at Site One was exemplary of the comments concerning the number of face to face meetings held by the majority of teachers. She stated:

> No, I don't think it will change the way we interact with each other. I see the use of it as a way to expedite information and knowledge but there is still that need to communicate with each other, especially if there is a great deal of detail. If I write to the guidance counselor about a child, that is just preliminary information. We are going to get together and talk about it. There is no way we will be able to do the whole thing over E-mail. First of all we would spend all day at the computer.

Site One and one Site Two teachers who had perceived a decrease in the number of face-to-face meetings referenced a decrease in meetings and saw the decrease as a positive. A fifth grade teacher at Site One stated:

> There are so many things that you have to do--there are more and more demands on teachers. The less time you have to spend doing rinky dinky things, the more I appreciate that. If it can be handled with getting information, all it is is disseminating information, this is a good way to do it without meeting and people getting off on tangents that have nothing to do with the price of beans in Omaha. I like it for that reason.

The biology teacher at Site Two stated, "I think it is possible that we have lessened the amount of meetings that are necessary because communication is better. The meetings that you do have are more meaningful."

The Chapter One teacher at Site One saw an increase in face-to-face meetings stating:

> Mine, personally, has increased because I feel it is okay to put it on E-mail but you still need that teacher input immediately sometimes and you just need to check it out and see how they really feel and talk directly to them.

Maintaining the number of face-to-face meetings with teachers was important to both principals. At Site Two, the principal did not have a computer at his desk. He commented,

> I don't want to be a principal who is in his office. I want to be out in the building. I am convinced that is the way to be effective. As long as it is working this way, I think I will be one of the last to get a unit [computer].

At Site One, the elementary site, when asked if he had fewer face-to-face meetings with teachers the principal stated,

> No, I don't really think so. What I do have is a lot less classroom interruptions which may translate into fewer face-to-face communications, but it is a good way to do that. They don't need me to come and interrupt their class and drop a note on their desk or to tell the teacher something. If it is not that important, I can just E-mail it. I don't have to worry about the classroom interruption. I guess that would occur. I think on the whole I do not think there is any less face-to-face communication than there was. We still have faculty meetings when we need to have them. The classroom teachers still talk face-to-face about many things.

Effect of Electronic Mail on Staff-Principal Communication

A distinct difference appeared concerning the use of the electronic mail system between the two principals at the sites using electronic mail. The principal at the elementary school was a regular user of the electronic mail system and when asked how many times he checked the mail daily he replied, "Usually three or four times a day." The principal at Site Two, a secondary school, decided not to install a computer in his office but use his secretary's computer when

he wanted to send a message out. Concerning communicating with staff he states:

> I feel pretty good about the communications level we had before E-mail was put in effect. I get around the building a lot. I'm up and down the hall. I am in every class. When they need to see me, they know I am going to be there in person at least three or four times a day right outside the classroom.

Because of this difference in principal's use of electronic mail, differences existed in the teacher-principal communication over electronic mail at the two sites. At the elementary site all of the teachers stated that they perceived an increase in the amount of information they received from the principal after the implementation of electronic mail. None of the teachers believed they communicated more with the principal after electronic mail implementation but a second grade teacher noted,

> If . . . he [the principal] had a bad day or if . . . he is down about something, I will write him a note on E-mail and help him to feel better about the situation. He will do the same for me. I really believe the principal is an isolated entity in the building. I believe the principal does not always get positive strokes. So one way I use E-mail is to write to him and boost his day up, or [I write] thank you notes for helping with an idea. [Its] a way to be more personable and friendly.

None of the teachers at site two, the secondary school, saw any change in their relationship with the principal.

Effect of Electronic Mail on

Awareness of On Site Activities

Eight of the teachers perceived an increase in their knowledge of activities at the site because of electronic

mail. When asked for examples of this increase, the Chapter I teacher at Site One stated "I know what is going on in all the classrooms from the principal's notes."

When asked about the amount of information they had about events at their site since implementation of electronic mail a second grade teacher stated:

> More. One good example is the student council. The classroom teacher very rarely knew what was going on with the student council. Now the student council information is sent directly to us. The media person sends information about what she is doing with the kids through the E-mail, especially the TAG kids. The TAG program jots down what the kids are working on.
> It has broken down the barrier between K-3 and 4-6. We never see each other during the day as far as time schedules; so there used to be a barrier. Now we communicate and the barrier has been lifted and gone. Everybody has the same information at the same time.

A fifth grade teacher at Site One also commented on the effect of electronic mail on the scheduling barrier between K-3 and 4-6 teachers. Asked about the amount of communication with the other staff members, she noted:

> [I am communicating] a little more with the lower elementary than I did before, just because our schedules are different and I do have a chance to communicate with them this way. Where normally during a regular school day without E-mail I wouldn't have that opportunity, . . . and E-mail serves that purpose in opening up communication lines between the upper and lower [elementary divisions].

The science teacher at Site Two stated:

> . . . now teachers send a lot of messages and they are more apt to tell you when they have a guest speaker, or when students are going to be absent for a field trip, you know right away.

The Home Economics teacher at Site Two also stated:

> I am aware of everybody's meetings instead of just my
> own, which is sort of interesting. You keep a little
> bit better informed about other professional things or
> student activities.

Effects of Electronic Mail on Knowledge

and Implementation of School Goals

Seven of the 12 teachers could state a goal of their school and 6 of these stated that electronic mail had a positive effect on reaching that goal. For example, a 5th grade elementary teacher at Site One stated:

> I know that our school is involved in teacher
> empowerment. I think E-mail definitely plays a part in
> teacher empowerment.
>   I think that teachers make decisions and sometimes
> the decisions are made over E-mail. Information is
> disseminated and you are asked to make a decision and
> then let people know what your decision has been. I
> think that is one way that [electronic mail] has
> affected teacher empowerment.

Integration of technology into the curriculum was another goal of Site One. A second grade teacher at Site One stated,

> If you think of curriculum, . . . we are always trying
> to integrate technology into the curriculum with aspects
> of the standards. There is a lot of people using
> computers to do curriculum work.
>   The school has always been number one in
> technology. We set out to be number one. So I think
> the computer and the use of computer is growing. There
> are always new ideas on ways to use computers, and I
> think one way we do it is to share across the E-mail.

The Home Economics teacher at Site Two stated: "One of our goals is a learning to learn. . . . I definitely think when our students see us using the computer comfortably it encourages them to use it." The biology teacher commented on

the effect of electronic mail on the life-long learning goal of the school, saying:

> The computers I think really fit right in with the life-long learning because we are trying to get the teachers to use it as a part of their daily routine. The kids seeing the teachers use the computer as a constant tool learn to see the computer as part of the furniture, an accepted thing. I think it kind of helps them to see the practicality and gets rid of the black-box syndrome that you have to have special qualifications in order to use the computer.

Summary

A significant difference at Site Two between first and second evaluation could be measured with a function created through discriminant analysis. This function was formed from improved satisfaction in the staff's general organizational perspective, and a decrease in satisfaction with the quality of media, and organizational integration.

As significant as the change at Site Two was, the lack of differences between Sites One and Two and their differences with Site Three may be more important. One could expect to see a difference in communication satisfaction at the initial application of the survey between Site One, with electronic mail, and the other two sites without. However, the surveys showed no significant differences in communication satisfaction between sites One and Two while both these sites' communication satisfaction levels differed significantly from Site Three.

Tovey et al. (1990) believe that the best indicator of communication success on a network is success in communication using traditional forms of communication. This

research enforces that belief. Other factors such as frequency of communication, quality of communicated material, and purpose of communication are more important than the means of communication in affecting communication satisfaction. Based on this belief, it is doubtful that electronic mail by itself would cause a significant improvement in communication satisfaction at a site with low levels of communication satisfaction.

The interviews indicated a perceived improvement in the teachers' levels of communication satisfaction, and the knowledge of events at their sites. At the elementary site, Site One, a difference was also noted in the level of communication from principal to teachers.

The communication patterns at sites One and Two differed in respect to the role of the principal in the communication process. At Site One, the principal had become the "moderator" of information. Communication came to the principal and then was dispersed. This appeared to work well at this site.

Although he supported electronic mail as a means of communication, the principal at Site Two did not involve himself in the electronic mail process on a regular basis, instead preferring face-to-face meetings over electronic ones. As a result, information flow among the staff appeared to be more significant at this site than at Site One. Staff at Site Two appeared to send more messages of general information relevant to the operation of the school than at

Site One. While different than what was found at Site One, this structure appeared to work effectively for both the principal and other staff members.

This difference in communication channeling using electronic mail is important. In one, the principal retains more control over communication. The communication is like an hourglass with information as the sand and the principal as the point all sand passes through. That point controls how much and how fast information is allowed to pass. At Site Two, communication appears to be more like a web with each staff member representing a point of connection and each point being connected to each other point on the webbing. The principal has created the web but prefers to visit each point of the web personally rather than becoming just another point. He influences communication by using a different form of communication, face-to-face.

Teachers were divided in their perceptions whether electronic mail had changed their level of productivity or their reaching school goals. The majority of teachers felt there had been no decrease in the level of face-to-face meetings. Staff did comment on their pride toward their schools and their schools' use of a technologically advanced idea such as electronic mail.

Another significant change was in the increased use of computers by staff members. Staff members, principals, and the system administrator at Site Two commented on the increase in use of computers not only for electronic mail but

for other purposes as well. Implementation of electronic mail had provided the staff with computers and also required their use. This required use seemed to help overcome any computer anxiety they may have been feeling.

Computer anxiety did not appear to change significantly as a result of implementing electronic mail. The importance of computers to education has become so accepted that even teachers who are not using computers still recognize the importance of computers. This recognized importance seemed to overcome any anxiety held toward computer use.

Chapter V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

This chapter is divided into four major sections. The
first section offers a summary of the information in the
other chapters of this study broken into the two component
areas. The first component involved use of a questionnaire
comprised of the CSQ and CAIN instruments and measuring
communication satisfaction and computer anxiety. The second
component used a staff communication interview guide created
by the researcher and designed to examine the perspectives of
the staff on the effects of electronic mail on changes in
communication satisfaction, productivity, principal-staff
communication, awareness of events at site, knowledge of and
implementation of school goals, professional and
interpersonal staff communication, and anxiety level of
teachers toward computers. The second section of this
chapter contains conclusions based on the findings of the
research. The third section contains a discussion of the
conclusions. The final section presents implications for
further study and suggestions for implementation of an
electronic mail system.

Summary

Questionnaires

Communication Satisfaction

Research by Barnard (1938), Simon (cited in Duke, 1981,
p. 53), and Barrett and Bavelas (1951) emphasize the
importance of communication to any organization.

Communication provides understandings necessary for work, morale, evaluating performance, dividing resources, and mobilizing the resources of the organization (Bormann, 1969).

Bayer (1983), Driscoll (1983), and Rothberg (1984), all identified isolation and lack of communication as major problems facing teachers in today's schools. Engelking (1986) reported that a poor relationship existed between administration and teachers, and teachers and their peers because of a lack of communication. Being unable to leave their students, teachers are limited in times they can initiate and receive communication from other faculty members.

Research based on use of electronic mail in the business environment, points to several effects of electronic mail on communication satisfaction which may be applicable to the school setting. Sproull and Kiesler (1991) found that the ". . .speed and asynchrony of electronic mail allow it to act like an information accelerator for one-to-one communication" (p. 35). They state further that the most ". . . important organizational consequence [of electronic mail] may stem from the fact that electronic group communication is as easy as one-to-one communication" (p. 35). Tovey et al. (1990), found that electronic mail allows everyone to receive the same message at the same time and streamlines the exchange of information. Redding (1972) found a decrease in serial effect (distortion that occurs in a message when passed from person to person). Tovey et al. (1990) point to other

effects associated with electronic mail. These effects include increased efficiency, organizational change and social effects including change in work habits, change in interpersonal relations, different demands on one's time, and a change in how decisions are made in an organization. They found the best predictor of successful electronic communication at a site was the success of conventional communication at the site. It is the recognition of a shared mission that creates the need for communication and precedes the development of a successful electronic messaging system.

Wiio (1976) defined communication satisfaction as a multidimensional construct identifying four dimensions of communication satisfaction. Downs and Hazen (1977) identified eight dimensions of communication satisfaction, a view validated by Crino and White (1981).

Based on these eight dimensions of communication satisfaction, Downs and Hazen (1977) developed a questionnaire for the measurement of communication satisfaction. The questionnaire measures eight components of communication satisfaction. These are satisfaction with communication climate, relation with superiors, organizational integration, media quality, horizontal communication, general organizational perspective, personal feedback, and communication with subordinates. Each scale was measured in this study.

The effect of electronic mail on communication satisfaction was studied through the administration of the

CSQ, a measure of communication satisfaction, twice at each of three sites. Site One had electronic mail prior to the measurements. Site Two implemented electronic mail between the first and second measurement. Site Three did not have, and did not plan to implement, electronic mail during the period of the study. The two measurements were taken 10 months apart.

Results were compared using both the Recurrent Institutional Cycle design (Campbell & Stanley, 1963) and a Modified Recurrent Institutional Cycle Design. Discriminant analysis was used to identify a discriminant function. A t-test procedure was then used to separately test the significance levels of factors composing the discriminant function.

At the first administration, significant differences were found in all communication satisfaction factors except Communication With Subordinates between Sites One and Site Three and Site Two and Site Three. No significant difference was found between Site One and Site Two. A discriminant function composed of General Organizational Perspective, Media Quality, and Horizontal Communication was found which differed significantly between the first and second administration at Site Two, the site where the electronic mail was implemented. No significant differences were found at Site One between first and second administrations. Satisfaction with media quality differed from the first administration to second administration at Site Two.

Computer Anxiety

The second purpose was to examine changes in computer anxiety levels following implementation of electronic mail. Research by Campbell (1986), Arndt et al. (1983) and Morrow et al. (1986) all show that increased use of computers decreases computer anxiety. Level of computer anxiety might decrease with the increased use of computers for electronic mail. Computer anxiety was measured using the CAIN. Research followed the Modified Recurrent Institutional Cycle design. A t-test procedure was used to look for significant differences both between the sites and within the sites from measurement to measurement. No significant difference in the level of computer anxiety was found either between or within sites.

Interviews

Interviews were conducted with six randomly selected teachers, building principals, principal's secretaries, media specialists, and network administrators at each of the two sites having electronic mail. These interviews followed a modification of the interview design suggested by Bogdan and Biklen (1982).

The surveys indicated a perceived improvement in the teachers' level of communication satisfaction, and their knowledge of events in their building. At Site One, a difference was also noted in the level of communication from principal to teachers. Teachers were divided in their perceptions whether electronic mail had changed their level

of productivity or their reaching school goals. The majority of teachers felt there had been no decrease in the level of face-to-face meetings.

Conclusions

No function was found which could discriminate between Site One and Site Two before or after installation of electronic mail at Site Two. A discriminant function was developed which measured a significant change in communication satisfaction between the first and second measurements at Site Two. This function was composed of a perceived improvement in satisfaction with General Organizational Perspective and small perceived decreases in satisfaction with Media Quality and Organizational Integration.

A discriminant function, composed of a significant improvement in Media Quality and a small decrease in satisfaction with Horizontal Communication Satisfaction, was developed at Site Three between first and second applications of the questionnaire. A discriminant function was also developed which identified significant differences between Site One and Site Three, and Site Two and Site Three. This function was composed of significant differences on seven of the eight variables of Communication Satisfaction including General Organizational Perspective, Personal Feedback, Organizational Integration, Communication With Superior, Communication Climate, Horizontal Communication, and Media Quality.

Discussion

Questionnaires

Measurements at the time of the first administration of the survey instrument showed no difference between the factors of communication satisfaction between Site One, a site with electronic mail in place, and Site Two, a site without electronic mail but planning its installation. Significant differences did exist between Site One and Site Three, a site with no plans for electronic mail, and between Site Two and Site Three.

Difference Between Site One, Site Two, and Site Three at Initial Observation

Communication satisfaction is affected by more than a change in the medium of communication, in this case electronic mail. Sites One and Two were similar in their levels of communication satisfaction at the initial application of the questionnaire even though one was using electronic mail and one was not. Sites Two and Three were significantly different in their levels of communication even though neither were using electronic mail at the time of the initial application of the questionnaire. Other factors affecting communication satisfaction include, clarity of communication, frequency of communication, what is or is not communicated, and reciprocity of communication between staff and administration.

In this study, Sites One and Two were similar in some ways that allowed the staff to be satisfied with the

communication at their site. Site Three was somehow dissimilar in ways that caused the measures of the levels of satisfaction on seven of the eight factors of communication satisfaction to be significantly lower than observed at either Site One or Site Two.

Differences at Site Two Before and After Implementation of Electronic Mail

A discriminant function was found that could be used to differentiate between first and second evaluations at Site Two. The major factor in the function was an improvement in General Organizational Perspective, the knowledge of the overall policies, and goals of the organization.

No single factor of communication satisfaction was found to be significantly different at Site Two between administration of the survey before and after implementation of electronic mail. This lack of difference could have been caused by a number of factors: the implementation of electronic mail did not make a significant difference; the measurement device suffered from the ceiling effect wherein a very high initial score made improvement impossible; or taking the initial test may have made the staff more aware of communication and therefore more critical of the communication at their site.

The researcher believes that the ceiling effect accounted for the lack of significant change being identified on any one of the communication satisfaction variables. Five of the six teachers interviewed, the media specialist,

systems administrator, principal's secretary, and principal perceived an improvement in communication at the sites. Scores on the factors of communication satisfaction at the initial administration of the measure ranged from a mean of 4.83 to a mean of 6.14 on a seven point scale. Given the size of the sample, these high scores makes the measure of significant improvement difficult.

Interviews

Component Two centered on the evaluations of the six randomly selected teachers at both sites with electronic mail. Questions asked specifically concerned their impressions of the effect of electronic mail on communication satisfaction, their level of productivity, their relationship with their peers, their relationship with the principal, their knowledge of what was occurring at the site, and in the understanding of the school's direction and goals.

Eleven of the 12 teachers interviewed felt the implementation of electronic mail had resulted in an improvement in communication at their sites. These teachers perceived a decrease in the time needed for communication, an improvement in the privacy of electronic mail over written communication, and an appreciation for being able to communicate with other staff members without having to leave their rooms unattended.

Principals' secretaries and media specialists at both sites with electronic mail believed it had increased their levels of productivity. Of the 12 teachers, 5 believed

electronic mail had increased their productivity; 6 perceived no change, and 1 believed it had decreased their level of productivity.

No teachers believed there had been a decrease in communication following implementation of electronic mail, two believed there had been an increase. Nine teachers believed there had been no change in the number of face-to-face communications, two believed there had been a reduction, and one perceived an increase.

Implementation of electronic mail highlighted a difference in the communication style of the principals. At Site One the principal acted as a moderator of communication over the network. Messages involving the entire staff were sent to him for dispersal. Because of this, the principal was an active user of the electronic mail system. At Site Two teachers sent information directly to the other staff members. The principal preferred to communicate on a face-to-face basis using these meetings to control communication. Interviews at both sites reflect staff satisfaction with both forms of principal communication.

Eight of the teachers believed they were better informed about what was happening at their site because of electronic mail. Teachers cited as examples of being better informed the willingness of other staff members to make announcements of special occurrences in their classes and increased communication between teachers who previously had trouble communicating because of schedule differences.

Half the teachers interviewed believed electronic mail helped implementation of school goals. Both sites had goals to implement technology into instruction, and teachers commented specifically on the example set by their use of electronic mail.

The interview procedure did not limit the findings to those areas specifically asked about in the questions. Additional topics mentioned during the interviews were also actively explored. These additional comments were collected into seven general areas of information, need for all to have a computer, required uses of electronic messaging, effects on class and students, increased computer use, organizational awareness, special use, positive comments, and negative comments. A short description of the findings in each of these areas follows.

Need for Individual Computer Stations

Interviews emphasized a necessity that each person on the electronic mail network have his/her computer. When some individuals did not have a computer it decreased productivity by causing messages to be sent both electronically and on paper. It decreased confidence in the system because teachers were unsure if the message would reach the person in a timely manner. Individuals who did not have a computer often did not answer messages in a timely manner.

Effects on Classes and Students

Teachers could identify few effects of electronic mail on their classes. Two noted that it increased their

students' interest levels in computers and that the students wished to submit the attendance for the teacher using electronic mail. One noted that while it did not directly affect his/her class, it was used to facilitate what was done in class by using the computer to contact the media specialist and others for class supplies.

Many comments were made concerning the role of the teacher as technology user. Many of the interviewees saw the daily use of electronic mail and the computer as having a positive influence on their students. It also was reported to create interest in the technology and generate questions from students.

Increased Computer Use

Over the course of the interviews, 20 comments were made concerning the increased use of computers caused by the implementation of electronic mail. This implementation of computers went beyond the sole use of computers for electronic mail. The system administrator at Site Two reported an increase in questions about all types of software and other uses of the network following the implementation of the electronic mail system. Six different comments were made by people saying the electronic mail system provided them with the incentive and opportunity, by having a computer at their desk, to increase their computer use. Others commented on their perceived increase in computer use at their site.

Organizational Awareness

Nine interviewees mentioned an increased awareness of what was happening at the site. This awareness was often focused upon the area of special information such as daily and weekly schedules, information on special activities such as student council or TAG, announcements of special speakers, activities of special committees or other departments, and information on new programs such as whole language, being implemented at the site.

Special Use Areas

Electronic mail was very attractive to those people who for various reasons needed to communicate to many of the staff or to various members of the staff often. These people include the media specialist, principals' secretaries, and leaders of student groups such as Student Council and Academic Decathlon. They saw it as a way to save many steps to and from the office or teachers' rooms. They also saw it as a way to easily disperse information. Special types of uses included using the electronic mail system as a decision making device with the principal asking a question and polling the teachers, as a scheduling device by the media specialists, as a way of checking on students or reporting student deficiencies to other teachers, and as a way of dispersing schedules and rosters for class trips or athletic events.

Positive Comments

Staff commented on the ease of communication, increased use of computers, the modeling of computer use by teachers, and an increase in information from their principal. All but one of the teachers were complimentary of electronic mail and would be unhappy if it was removed. The sole teacher who thought it was a problem stated, "In some cases it may have helped".

Negative Comments

Even though all but one of the staff interviewed were complimentary toward electronic mail, many could point to problem areas and suggestions for improvement. One principal and one teacher commented about not allowing the computer to replace their time with clerical duties, something both saw as possible. Many commented on the belief that electronic mail could decrease the number of face-to-face meetings and they saw face-to-face meetings more important than electronic mail in making decisions.

Several system and computer problems appeared. One problem was the need for alternate plans when the system breaks. Other problems included the need to check repeatedly during the day for mail because the current system did not inform users of incoming mail, the need for a printer to allow selected messages to be produced in hard copy for easy reference, and the desire for the system to inform the sender when a message has been read.

Recommendations

For Further Study

This study examined the effects of implementing electronic mail in small, rural school districts. Based on the review of literature and the data collected in this study, the researcher makes the following recommendations for further study:

1. Replicating this study should occur in other demographic areas and in other size sites to investigate effects of electronic mail under other conditions to find if similar discriminant functions emerge.

2. Increasing the study focus to include the subject of school-based communication in order to improve both the morale and longevity of teachers and the efficiency of the educational workplace.

3. Investigating the concept of communication satisfaction in the context of effective school research in order to determine if a relationship exists between staff communication satisfaction and school effectiveness.

4. Replicating this study using technologically advanced forms of electronic mail which address the technological shortcomings of the system used. Several of the interviewees mentioned technical difficulties such as a failure by the system to notify staff immediately upon receipt of mail, lack of feedback notifying senders that their mail has been read, and the present requirement that

currently running applications be stopped in order to use electronic mail.

5. Researching the cultural effects of electronic mail centering specifically on the changes in human relationships which occur as a result of electronic mail in the school setting. Most interviewees commented the number of face-to-face meetings did not decrease, but did comment on changes in the content of these meetings.

6. Researching electronic mail to include a measurement of the number of messages and the composition of messages prior to, and following, the implementation of electronic mail.

7. Researching cost benefit factors of implementing electronic mail.

8. Researching differences between the first and second administration of the measurement at Site Two to investigate further the conceived discriminant function and whether this function can be found at other locations implementing electronic mail.

9. Researching the differences in communication control demonstrated by the principals at sites One and Two. Interviewees at both sites commented on the effectiveness of their principals at communicating although one used electronic mail regularly and one did not.

10. Researching changes in communication satisfaction following implementation of electronic conferencing.

For the Decision to Implement Electronic Mail

A primary question to be asked is whether electronic mail is valuable enough for districts to justify spending the money needed for hardware and software to implement the system. When asking this question, one must answer a series of questions dealing with technological and communication conditions in the school.

What is Needed?

Technologically, the implementation of electronic mail is based on a series of needed components. In order to have electronic mail, a site needs a computer network, electronic messaging software, training, and support. A computer for everyone who will use the mail system is recommended in order to avoid problems of scheduling and confidentiality. Having a computer for every staff member, and making the computer an important means of communication, leads to increased computer use in areas other than electronic mail. The use of a computer network eases program and file storage, again acting to increase teacher computer use.

Is There Adequate Support?

As important as the equipment is the individual who answers questions and provides training on the use of the system. This person or persons should be readily available so the frustration level with the system does not rise to the point that the user decides it is simpler to side-step the system.

Is Electronic Mail Part of a Concise Plan for Technology Implementation?

It is important to note that at Site Two, electronic mail was an addition to a well-planned progression of technological advancement. This planning is key to the installation of a successfully operating system by making certain equipment purchased now will integrate with previously purchased equipment, and with equipment to be purchased in the future. Few schools can afford to purchase computers for every teacher, install network hardware and software, install electronic mail, and train its staff for use on a computer network and an electronic mail system. Through careful planning, including setting of long range goals, purchases and training can be made which move the site closer to its goals.

What are the Benefits?

The perceptions of teachers interviewed was that the implementation of electronic mail led to an increase in the amount of use of computers by teachers. The "forced" use of electronic mail, such as requiring teachers to transmit attendance or receive bulletins via electronic mail, increased interest among teachers who were not familiar with computers. This regular use of computers by the teachers was seen as a good role model for students.

This research shows implementation of electronic mail will increase the teachers' perception of their level of communication satisfaction. It also increased the teachers'

perception of the flow of information from principal to staff where the principal used the electronic mail on a regular basis.

As pointed to by Tovey et al. (1990), the best indicator for success of an electronic mail system is the current success of communication. Electronic mail systems may raise the level of communication, may improve the flow of information, may increase teacher use of computers, and may improve communication satisfaction at a site where communication is healthy, but this research does not show that electronic mail by itself will make a situation with poor communication better.

For What to Look for in an Electronic Mail System

An ideal electronic mail system would allow for immediate notification of mail once the computer is turned on, notification of mail immediately upon its arrival, the ability to easily determine which mail is of immediate importance and which can be left for later, and notification to the sender that a message has been read. The program should allow for easily customizing lists of receivers so a sender can transmit duplicate information to those on these lists without having to send to every individual person.

The ideal system would allow for open sessions and private messages. Open sessions could be used for continuing dialogues on questions dealing with the school and its operations. The system would allow for real-time messaging at the computer where a dialogue could be held at the

computer between two or a group of staff members without disrupting their classes.

The computer operating the mail system should be capable of accessing the mail system without having to shut down the program currently running. The need to shut down the currently operating program, starting the mail system, shutting down the mail system, and restarting the previously operating program was mentioned in the interviews as a detriment to use of the computer for programs other than electronic mail.

This research shows that electronic mail did cause a significant change in communication satisfaction at the site where electronic mail was installed. Teachers perceived an improvement in communication with staff and principal, improved knowledge of educational program, and improved knowledge of the school's direction and purpose as a result of electronic mail. These changes make the implementation of electronic mail a worthwhile addition to the communication mechanisms of a school site.

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APPENDIX A

COMMUNICATION SATISFACTION

AND

COMPUTER ANXIETY

QUESTIONNAIRE

Dear Educator;

An attempt is being made by me to study communication satisfaction and the feelings of educators toward computer use within school systems. The ultimate goal of the study is to determine how implementation of electronic mail systems will alter communication satisfaction and the feelings toward computer use in a school setting. The questions you answer will not only help with my study but provide valuable information on how satisfied you are with the communication occurring in your school and your feelings toward computers and computer use.

I need your help by answering the following questionnaire. All responses are confidential. Please do not place your name anywhere on these sheets. All responses will be grouped for evaluation based on the information given below. The results will be reported in my dissertation and shared with you at your request. Participation in this questionnaire is voluntary though I strongly urge you to participate. Given the relatively small number of questionnaires at any given school every individual's return is extremely important in acquiring an accurate view of a school.

The questionnaire should take no longer than 20 minutes to complete. Please return to the box identified in your principal's office. A copy of the dissertation will be available at your school upon its completion. A description of the dissertation is available upon request from your principal.

If you would like additional information please contact me. Thank you for your help.

Sincerely,

Donald D. Luck
137 Schindler Education Center
University of Northern Iowa
Cedar Falls, IA 50614-0615
(319) 273-2885

Grouping Information

The following information will be used to place you in categories for comparison. Group information only will be reported in the study. No individual information will be reported.

Year of birth _____	Gender_____	Education Level (circle one) BA BA +15 BA +30 MA MA +15 MA +30 Ph.D., Ed.D.
Including this year, how many years have you taught? _____		

At what level do you spend the majority of your time teaching? (Circle one) Elementary (K-5) Middle School (6-8) High School (9-12)	By your own evaluation, how often do you use a computer for- (circle one) Instruction never frequently 1 2 3 4 5 6 7
Including this year, how many years have you taught in this shool? _____	management/utility programs database, word processing, etc. never frequently 1 2 3 4 5 6 7 personal use never frequently 1 2 3 4 5 6 7

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APPENDIX B

STAFF COMMUNICATION

INTERVIEW GUIDE

<u>Staff Communication Interview Guide</u>

The purpose of the research is to determine the changes in communication satisfaction and levels of computer anxiety following the implementation of a local area network electronic mail system. This interview will be recorded and transcribed. Your name will not appear on the transcription and the tape will be erased following the transcription.

I and two other evaluators will read the transcripts, compare them with others interviewed, and attempt to draw conclusions about the effects of electronic mail from the interviews.

<u>Effect of Electronic Mail on School Communication</u>

Has the electronic mail system helped you communicate or made it more difficult?

Probe for examples and clarification.

Has the electronic mail system helped people in the school communicate or made it more difficult?

Probe for examples and clarification.

Are you more or less aware of what is happening in the school since the implementation of electronic mail?

Probe for examples and clarification.

What changes do you see in communication in the school?

Probe for examples and clarification.

<u>Changes in Productivity</u>

How has your ability to get work done changed since the implementation of electronic mail?

Probe for examples and clarification.

<u>Changes in Relationship With Peers</u>

Do you communicate more or less with other teachers since the implementation of electronic mail?

Probe for examples and clarification.

What type of communication do you share with other teachers on the electronic mail system?

Probe for examples and clarification.

Do you perceive any changes in the number of face to face meetings with other teachers since electronic mail?

Probe for examples and clarification.

Changes in the Relation With the Principal

How aware are you of the view of your principal on current issues in education or problems here at school?

Has this changed since electronic mail?

Probe for examples and clarification.

Do you think your principal communicates with you and the staff as a whole more regularly since electronic mail?

Probe for examples and clarification.

Has your communication with the principal changed since electronic mail?

How so?

Understanding of School Goals

Can you identify a shared goal of your school?

What is it?

Has this goal been aided or deterred by the use of electronic mail?

Why?

General

Would you characterize yourself as being (in favor of, opposed to) the use of the electronic mail system.

Why?

Have you noticed any changes in your work in the media center as a result of e-mail?

Probe for examples and clarification.

What have you considered most valuable about electronic mail?

Probe for examples and clarification.

What has been the biggest problem with the electronic mail system?

APPENDIX C

TIMELINE OF THE STUDY

Time Line

School 1	School 2	School 3
↓	↓	↓
Administer Questionnaire	Administer Questionnaire	Administer Questionnaire
↓	↓	↓
E-Mail use continues	Training Administered E-Mail use begins	No E-Mail
↓	↓	↓
E-Mail use continue	E-Mail use continue	No E-Mail
↓	↓	↓
Questionnaire Given	Questionnaire Given	Questionnaire Given
↓	↓	
Interviews	Interviews	

Transcripts and field notes evaluated
data evaluated

↓

Conclusions