School of Education Articles   School of Education

1995

Educators' Use of a Statewide Telecomputing Network: A Descriptive Analysis

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Recommended Citation

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This study investigated educators' use of TENET, a statewide educational telecomputing network in Texas. It also documented the development and testing of a lengthy theory-based questionnaire and verified the efficacy of a method for administering surveys via electronic mail. A 70-item survey was sent to a random sample of 300 TENET users. The response rate was 66%. The majority of respondents were highly experienced and educated public school teachers, support staff, and administrators, who were experienced computer users with easy access to equipment needed to use TENET. About half had taught themselves to use the system and nearly 40% had no ongoing source of assistance for using it. Most worked with others who also used TENET and reported talking with others about their network use. Participants logged on to TENET an average of 4-6 times per week. Electronic mail was the most often used network function. Nearly all felt TENET was useful, both as a means for communicating with others and for accessing information. The network served professional, as well as social and diversionary functions. Respondents expressed a need for more time and assistance for learning to use the network, better network connectivity within schools, and greater access for students.

INTRODUCTION

In recent years there has been a significant increase in the number of educators with access to educational telecomputing networks (e.g., electronic mail and bulletin board systems), as well as growth in the number and quality of networked educational resources. In late 1993, 38% of a weighted random sample of American educators reported having access to telecomputing facilities from their school buildings, with 4% of that sample having access from their own classrooms (National Institute of Standards and Technology, 1994). Of particular importance is the increased number of K-12 educators with access to the "Global Matrix," which encompasses the Internet and other inter-connected computer networks. This international network of information networks serves more than 30 million users (Quarterman, 1993) in more than 146 countries (Calcari, 1994). It is rapidly finding its way into businesses, homes, and classrooms, growing at a rate of approximately 100% per year (Quarterman, 1993) or one new host every 30 minutes (Calcari, 1994). By 1995, more than 40 states reported providing public educators with some level of Internet access (Doty, 1995).

Telecomputing networks can increase opportunities for interaction and collaboration among, and ultimately development of, communities of K-12 teachers, preservice teachers, teacher educators, content-area experts, and others in professions and organizations serving school populations. In addition, they can help educators stay current with best practices in their field and can help them to overcome problems such as teacher isolation and limited on-site access to information. Telecomputing networks also provide educators and students with the ability to search for and retrieve seemingly unlimited amounts of information. Such networks may "help educators equip students with the knowledge and thinking skills they will need to function as productive citizens in the upcoming century" (Frazier & Frazier, 1993, p. 19).

The virtual site for the study to be reported in this paper is the Texas Education Network (TENET), which was authorized and established through Senate Bill 650 of the 71st Texas Legislature (Parker, 1989) and officially opened in August of 1991. The network's purpose is to facilitate learning and communication among Texas educators and students. More than 33,000 educators (representing approximately 15% of the state's teaching force) registered for TENET accounts during its first 3 years of operation. The network has been expanding rapidly, with the number of accounts increasing at a rate of about 1,000 per month. At the time the

study was conducted, TENET offered electronic mail, discussion forums or newsgroups, Clarinet's news service, a user directory, reference databases, interactive access to remote Internet services (via Telnet), access to file archives via Internet file transfer protocol (FTP)) and the ability to locate Internet resources via a menu-driven "Gopher" system.

Prior Surveys of K-12 Educators' Use of Telecomputing Systems

Although a considerable amount of descriptive information exists about the kinds of telecomputing activities and projects being conducted by educators, and some small-scale research studies focusing mainly on individual projects have been reported, there has been little broad-scale systematic analysis of educators' usage of telecomputing networks (Honey & Henríquez, 1993). At the time the present study was conducted, three survey-based studies of precollege educators' use of telecomputing networks could be located.

The most comprehensive survey reported to date is a nationwide paper-based survey conducted by researchers at the Bank Street College of Education (Honey & Henríquez, 1993). Respondents were a non-random sample of 550 educators who were active users of telecomputing systems. They were highly educated and experienced teachers, nearly all (92%) of whom were employed by public school systems. Almost 80% had earned at least a master's degree and 83% had been teaching for 10 or more years. This was also a group with much experience in the use of computers. Eighty-two percent had been using computers in their teaching for 5 years or more, with 19% using computers in their teaching for more than 10 years. On the average, they had been using telecomputing for professional activities for 4.2 years and for student learning activities for 3.4 years. About three-fourths of the sample had network access from a computer and modem in their home. The majority (88%) were self-taught and 40% had no ongoing source of assistance for using telecomputing networks. Most (73%) worked with others who were also using such networks and 38% served as resource persons for their co-workers.

The professional development activities that were most frequently reported and that were rated as most effective were sending e-mail to colleagues, exchanging information on bulletin boards or forums, and accessing databases with information relevant to students. The strongest incentives for using telecomputing as a professional resource were the opportunity to communicate containing other educators, the ability to access infor-

mation that would otherwise be difficult to obtain, and the reduction of teacher isolation. Use of telecomputing for student learning activities occurred with much less regularity than did professional development activities. Respondents saw expanding students' awareness of the world, accessing otherwise difficult-to-obtain information, and improving students' inquiry-based and analytical skills as the main reasons to involve students with educational telecomputing activities. The most frequently reported student learning activities involved accessing encyclopedias, news retrieval services, and weather information. The most highly rated barriers to effective use of telecomputing were insufficient access to phone lines in the school building, lack of time in the school schedule, inadequate district or school communication about telecommunications-related topics, and inadequate financial support for network services.

The second study, conducted by WEB Associates of Naples, Florida, was an evaluation of a single statewide educational telecomputing network after its first year of operation (Frazier & Frazier, 1993). This study included an electronically administered, brief survey which was completed by a non-random sample of 408 account-holders on the Texas Education Network (TENET). The majority of the sample (86%) were directly involved with public K-12 education, with 44% being classroom teachers. About 60% had used another telecomputing system, while for the rest, TENET was their only exposure to such networks.

A large proportion of the sample were relatively frequent users, with 66% reporting that they logged on to the system one or more times per day. Nearly half (47%) estimated that they used TENET for more than 3 hours each week. Slightly more than half (56%) reported logging in primarily from their homes, rather than from their workplaces. Like the participants in the Bank Street survey, respondents rated electronic mail as being the most useful network feature. Access to Internet resources and participation in group discussions or conferences were rated secondarily and tertiarily useful, respectively. The most highly ranked barriers to usage were not enough time, inavailablity of people with whom respondents wanted to communicate, busy signals, and not enough phone lines at their points of access.

Overall, the members of this sample found using TENET to be worthwhile (95%), with 58% reporting that it had been useful to them in many respects and 32% reporting that it had revolutionized their work and/or communications processes. Data gathered from multiple sources, including the survey as well as interviews and observations, created a picture of how the network was used. Teachers reported engaging in professional development activities such as exchanging ideas, sharing experiences, discussing

current educational topics, and accessing information. They also indicated that TENET increased their productivity by providing an efficient means of communicating (reducing "telephone tag"), eliminating travel time, getting quick notification about events, and receiving individually tailored answers to questions. As an instructional tool, teachers cited a range of student activities including accessing information not otherwise available, communicating with people worldwide, participating in research projects and simulations that enhance thinking skills, and providing practice in other kinds of skills such as writing.

A third, smaller-scale study examined the communication patterns of a non-random sample of 65 educators who were early users of UNITE, a telecomputing system developed at the University of Kansas which included electronic mail and hypertext database facilities and a graphical user interface (Broholm & Aust, 1994). Data were collected via a questionnaire and unobtrusive computer monitoring of message exchanges (but not message content). The sample included public school teachers, librarians, and university instructors. Sixty-five percent of the participants reported reading electronic mail and 49% also sent electronic mail messages. The majority of e-mail exchanges occurred among geographically dispersed teachers within the same content area specialization. Librarians sent more messages and corresponded with more individuals than did non-librarians. E-mail was used to discuss both work-related and social issues. When message senders were asked to characterize the nature of their online discussions with colleagues, 77% were classified as exclusively professional, 19% were seen as both professional and personal, and 4% were labelled as purely personal or social. Participants identified time constraints as limiting their use of the system, as did those who responded to the other two surveys. In addition, physical accessibility to a terminal was related to the amount of messages sent; the farther away the terminal, the less the system was used.

Purpose and Rationale for the Current Study

The rapid growth rates in the availability and use of educational telecomputing systems underscores the immediate need for applicable research results that will help guide efforts to design, implement, and make effective use of such networks. The primary aim of the present study was to investigate educators' use of a statewide educational telecomputing network. Specifically, the following research questions were asked:

1. What are the characteristics of network users, the contexts in which they use the network, and their perceptions of it?
2. How much is the network used overall and how often are different types of network services used?
3. What are the outcomes of network use?

Few other research efforts in the area of educational telecomputing have systematically addressed such questions. The current study differed from most previous research in that it was a large-scale survey of a randomly selected sample of users of a single educational telecomputing network. Although many claims have been made regarding the benefits of such networks, and substantial resources have been devoted to their development and implementation, there has been little empirical evidence to support these claims or to justify the allocation of resources to such endeavors. Information gleaned from the present study can help justify and guide the development and implementation of educational telecomputing networks, as well as provide a basis for improving methods of helping educators acclimate to and apply online resources to serve their needs and meet their goals.

This study also documents the development and testing of a survey instrument that measures a wide range of variables identified as important, according to several theoretical perspectives, to understanding usage of computer-mediated communication systems. Thus far, research on use of educational telecomputing has for the most part disregarded such theories, most of which have been developed in the field of communication. The selection of variables to be measured by the survey was based primarily upon a model for studying personal computing developed by Dutton, Kovaric, and Seinfield (1985) which, in turn, was based upon the theories of "Diffusion of Innovations" (Rogers, 1983, 1986) and "Uses and Gratifications" (Katz, Blumler, & Gurevitch, 1974). In addition, the survey includes items which allow its results to be compared to those from previous studies of educational telecomputing systems. The availability of a reliable and valid instrument based upon theory and broadly applicable to the use of computer-mediated communication systems in educational settings can help to build a base of generalizable research and test the applicability of communication theories in the context of educational telecomputing systems.

Finally, this research tested the effectiveness of a method for administering surveys via electronic mail. This method provides a means of studying the use of telecomputing networks (and possibly other topics) in a manner that may require less time and money than would a conventional

mailed survey. As use of telecomputing systems continues to grow, so does the applicability of electronic mail surveys. Thus, it is important to determine whether this method, which had been used previously in the study of a public telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995), can be effectively applied in educational settings.

METHOD

Sample

Sampling procedure. Surveys were sent via electronic mail to a random sample of 300 TENET account holders who had used the system at least once during a 2-week period immediately prior to the survey mailing. In addition, these individuals had previously agreed to participate in research on TENET. During the Fall of 1993, users were asked to update their personal information in TENET's user directory, and as part of that process, they were also asked about whether they would be willing to participate in research regarding TENET. The system operator provided us with a list of 8,382 users who had responded affirmatively to that question, as well as a list of 7,620 users who had logged on to TENET during a 2-week period in mid-June. The sampling frame consisted of 3,839 users who appeared on both lists. A random sample of 300 user IDs was then drawn from the sampling frame using the *Statistical Package for the Social Sciences*' (SPSS) SAMPLE command.

Response rate. A total of 190 surveys were returned within 4 months of the initial mailing. Data provided by the system operator indicated that 12 of the 300 who were sent surveys did not log on during the survey period. Thus, the response rate based upon the 288 users who actually received the survey was 66%. Excluding undeliverable surveys and/or ineligible respondents from consideration in calculating response rates is common practice with conventional interviews and mailed surveys (Babbie, 1990; Dillman, 1978). According to Dillman, this procedure provides a more direct indicator of a method's response-inducing capabilities than do other methods.

Response bias. To investigate the potential for response bias, we compared the frequency of log-ons by respondents and nonrespondents. These data were generated from log files kept on the TENET computers over the 4-month survey period. This comparison revealed that respondents were

likely to use the system more often $(t = -4.21, p < .001)$ and for more time $(t = -3.22, p < .001)$ than were nonrespondents. On the average, respondents logged in more than twice as often and for more than twice as much time than did nonrespondents.

Additionally, we compared responses of early versus late responders by conducting one-way analysis of variance among surveys received during four different time periods. As shown in Table 1, those who returned the survey during time periods closer to the initial mailing date were likely to spend more time using the system, and were likely to log-on, read, and write e-mail messages more frequently than were those who returned the survey later. In addition, they were more socially integrated with a community of TENET users, they had more interpersonal contacts who could be reached via TENET, and they were more likely to consider the system to be relatively advantageous compared to other ways of communicating and getting information, than were those who returned the survey later. Assuming that late-respondents were similar to nonrespondents, then, by extrapolation, differences among the four groups suggest possible differences between respondents and nonrespondents.

Procedure

Initial mailing. Procedures for administering the survey were adapted from Dillman's (1978) Total Design Method for mailed surveys and had been used in a previous survey of users of a community telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995). A cover letter and 70-item survey were sent to sample members via electronic mail. The cover letter introduced the questionnaire and attempted to motivate individuals to respond. Each person's first name was typed into the greeting of the cover letter, which was sent in a separate message immediately preceding the survey. Although it would have been much quicker to mass-mail the surveys and cover letters (by including multiple e-mail addresses on the address list of a single message), they were instead sent one at a time and addressed to specific individuals in order to personalize the survey and thus encourage people to respond. The initial mailing yielded a return rate of about 25%.

Directions for several methods of completing and returning the survey

Table 1

Descriptive Statistics and F-tests for Selected Variables by
Date Survey Returned

Variable		**Response periods**				
		1st mailing	**1st follow-up**	**2nd follow-up**	**3rd follow-up**	**F**
Log-on	M	3.43	2.98	2.20	1.76	
frequency	SD	1.32	1.34	1.15	.89	15.14***
	n	(75)	(46)	(46)	(21)	
Total	M	2.87	2.38	1.98	1.48	
duration	SD	1.46	1.21	1.06	.51	9.31***
	n	(75)	(47)	(45)	(21)	
Read	M	3.47	3.34	3.18	2.57	
e-mail	SD	.92	.87	1.07	1.17	4.82**
	n	(75)	(47)	(45)	(21)	
Write	M	3.00	3.00	2.35	2.29	
e-mail	SD	1.05	.91	1.15	1.27	5.50**
	n	(73)	(47)	(43)	(21)	
Relative	M	17.35	17.60	16.98	15.19	
advantage	SD	2.95	2.46	3.03	2.56	3.92**
	n	(74)	(47)	(46)	(21)	
Social	M	12.78	13.43	11.83	10.27	
integration	SD	2.72	2.77	2.79	2.65	6.08***
	n	(73)	(47)	(46)	(21)	
Interpersonal	M	5.84	5.36	4.70	2.71	
contacts	SD	3.14	3.20	2.79	2.47	5.43**
	n	(74)	(47)	(46)	(21)	

Note. Maximum alpha level was set at .01 to account for the number of
        comparisons made.
*** $p < .001$. ** $p < .01$.

were provided at the beginning of the questionnaire. Options for respond-
ing included (a) using a system editor to reply online, (b) downloading the
survey, editing in answers, and uploading the reply, (c) printing out the
survey and returning it via postal mail, and (d) requesting a paper ques-
tionnaire and returning it in the self-addressed stamped return envelope
supplied. The latter option was provided so that users without the technical
expertise needed to complete the survey online could still participate.
About two-thirds (68%) of the surveys returned were sent via e-mail and
the rest (32%) were delivered via postal mail.

Follow-ups. Up to three follow-up messages were sent to nonrespondents at 2, 4, and 8 weeks from the initial mailing date. As with the initial mailing, the follow-up messages were sent individually and each person's first name was typed into the greeting of the message. Each follow-up message served as a reminder and used a slightly different approach and successively stronger appeals for the return of the survey. These follow-up messages yielded returns of 16%, 18%, and 7%, respectively.

Privacy safeguards. A primary ethical issue related to collecting data via computer is that of privacy. Sending out surveys and making use of computer-monitored data (e.g., to generate a list of current users in order to develop the sampling frame) without the awareness of participants can be considered invasions of privacy (Babbie, 1990; Rice, 1990; Rogers, 1986). Thus, precautions were taken to ensure that the use of this information would not harm participants in any way. In accordance with standard procedures for the protection of human subjects, informed consent was obtained by providing an explanation of the purpose of the survey, what participants would be asked to do, and how long that would take. In addition, survey recipients were told that their participation was voluntary, that they could refuse to participate with no penalty, that they could notify the researcher at any time if they did not want to be contacted again, and that their responses would be kept completely confidential. To provide for confidentiality, the identifying information (the sender's name and e-mail address) on each survey returned electronically was removed and then replaced with a random ID number. This was done soon after the receipt of the survey had been recorded and the survey and computer-monitored data had been coded and merged. The code identity list was kept secure and stored separately from the data.

Data coding. One of the advantages of electronically administered questionnaires is that they allow at least some, if not all, of the data coding to be automated. Surveys in which respondents edited in their responses could usually be coded by computer, whereas others had to be coded by hand in the usual manner, as did responses to open-ended questions. To allow automated coding, those who replied electronically entered their responses after a "==>" prompt. A computer program extracted the data after all the "==>" prompts for each survey and placed it in a file which could then be processed using *SPSS*. Data that was coded in this manner was checked carefully and errors were corrected by hand.

In addition, answers to open-ended questions and comments inserted by respondents within or at the end of the survey instrument were either

transcribed (for those received via postal mail) or cut and pasted (for those received via electronic mail) to into a word processed document in tabular format. This allowed us to categorize and sort data for the purpose of analyzing the content of the answers to open-ended questions and written survey comments.

Instrument

As mentioned earlier, the 70-item questionnaire was designed to measures variables which have been identified as important, according to several theoretical perspectives, to understanding use of computer-mediated communication systems. Whenever possible, survey questions were based upon reliable and valid measures that had been used in previous studies. Many of the items were derived from prior surveys of a community telecomputing system conducted by Swift (1989) and Anderson (1992). In addition, items from other surveys of educational telecomputing systems (Frazier & Frazier, 1993; Honey & Henríquez, 1993) were included to allow comparisons between the current results and those reported previously.

Personal attributes. Demographic characteristics measured included age, gender, level of education, number of years working as an educator, primary job responsibility, employer type, community type, and city of residence (see Table 2). In addition, years of experience with using computers, TENET, and other telecomputing networks were measured (see Table 3). Response categories for many of the items measuring personal attributes were based upon those used in other studies (Anderson, 1992; Frazier & Frazier, 1993; Honey & Henríquez, 1993).

Environmental characteristics. Variables in this category included access, time, pressure, assistance, social integration, and interpersonal contacts (see Tables 4 and 5). Four of these variables could be measured by scales that combined several items.

Equipment access was measured by three 5-point semantic differential scales which asked respondents to indicate their perceptions of the equipment they normally used to connect to TENET. Similar items were used by Culnan (1984) and Anderson (1992). In the current study, Chronbach's alpha was .84 for this scale. Respondents were also asked about the location of the equipment they ordinarily used to access TENET, the means by which they usually connected to the system, and the frequency with which

they felt it was difficult to connect to the system. The latter three items were based upon those used by Anderson (1992).

Three items assessing time pressures asked respondents to indicate how often their lives contained time pressures, crises or urgent matters, and unexpected problems or situations. These items were based on those used by Steinfield (1986) and Anderson (1992). In the present survey, the reliability coefficient was .85 for this scale.

The type of assistance, if any, that respondents had for their use of TE-NET was assessed by two single items based on those used by Honey and Henríquez (1993). One item asked about the primary means by which respondents learned to use TENET. Another asked about the primary source of continuing assistance for using the system.

Four items measured "social integration" (Burt, 1973) or the extent to which individuals participated in a community of other TENET users. Three of the items inquired about the frequency of (primarily) off-line social interactions related to TENET and one item asked about the degree to which users thought of themselves as members of the TENET community. These items were based upon those used by Swift (1989) and Anderson (1992). In the current study, Chronbach's alpha was .82 for this scale. Another related item, based on one used by Honey and Henríquez (1993), asked users to indicate their role in telecomputing activities in relation to others in their workplace. Finally, one item asked whether respondents served as a TENET trainer or newsgroup moderator.

The number of interpersonal contacts respondents could reach via TE-NET was measured by four items asking about how many contacts were: Co-workers or colleagues, social or personal contacts, people in Texas but outside respondents' school districts, and people outside Texas. The first two of these items were based upon those used by Swift (1989) and Anderson (1992). In the present survey, the reliability coefficient was .74 for this scale.

Perceived media characteristics. This category of variables included respondents' perceptions of TENET's ease of use, social presence, utility, and relative advantage (see Table 6). Each of these variables could be measured by scales combining several items.

Ease of use was measured by three 5-point semantic differential scales. Respondents were asked to indicate the degree to which they felt TENET was easy, simple, and understandable. These items were based upon those used in several other surveys (Anderson, 1992; Hiltz & Johnson, 1989; Steinfield, 1986; Swift, 1989). In the current study, Chronbach's alpha was .92 for this scale.

"Social presence" or the degree to which users perceived co-communicators to be socially and psychologically present (Short, Williams, & Christie, 1976) was measured by three 5-point semantic differential scales. Respondents were asked to indicate the extent to which they perceived TENET to be sociable, personal, and sensitive. These items had been used in a number of other studies (Anderson, 1992; Garramone, Harris & Anderson, 1986; Steinfield, 1986; Swift, 1989). In the present survey, the reliability coefficient was .80 for this scale.

Respondents' perceptions of TENET's utility were measured by 4 items. Three 5-point semantic differential scales asked them to indicate the degree to which they felt TENET was useful, effective, and efficient. These items had been used in several previous studies (Anderson, 1992; Steinfield, 1986; Swift , 1989). A fourth item, which asked respondents to indicate their judgement of TENET's worth, was based upon an item used by Frazier & Frazier (1993). In the current study, Chronbach's alpha was .65 for the scale containing these four items.

"Relative advantage" (Rogers, 1983) or the degree to which TENET was perceived as being better than other ways of communicating or accessing information, was measured by four items. Two of these items asked respondents to indicate the extent to which they agreed that it would be more difficult to reach people or access information without TENET. Another pair of items asked respondents to indicate the degree to which they agreed that TENET allowed them to find information they would not have otherwise sought or to communicate with people who they would not otherwise have contacted. All four of these items had been used by Anderson (1992) and were based upon those previously used by Hiltz and Johnson (1989) and Marshall (1987, 1990). In the present survey, the reliability coefficient was .77 for the scale containing these four items.

Usage. The survey contained items assessing both amount and various types of TENET use (see Tables 7 and 8). Items assessing amount of use included frequency (number of log-ons), session length (average number of minutes per session), and duration (amount of connect time) over a 2-week time period. These items were based upon those used in several other surveys (Anderson, 1992; Frazier & Frazier, 1993; Swift, 1989). Eight additional items assessed the frequency of various types of use that could occur on TENET. Items assessing the frequency of reading and sending e-mail and newsgroup messages were based upon those used by Swift (1989) and Anderson (1992). Other items were added to assess the frequency of using Internet resources, directory assistance, and other online databases.

Gratifications obtained. Gratifications obtained from media use have of-
ten factored into three categories: Cognitive, diversion, and interpersonal
utility (Blumler, 1979; Palmgreen, Wenner, & Rayburn, 1980). Several
items measuring these types of gratifications were adapted from those used
by others in research on computer-mediated communication systems
(Anderson, 1992; Garramone et al., 1986; Rafaeli, 1986; Steinfield, 1986;
Swift, 1989). Other items were adapted from those used by Honey and
Henríquez (1993). A fourth category of gratifications was created in order
to measure benefits obtained from using TENET for student-oriented pur-
poses. Some of these items were also adapted from those used by Honey
and Henríquez (1993), while others were developed based on information
from the previous TENET evaluation (Frazier & Frazier, 1993). A factor
analysis of all the gratification items yielded a four factor solution, as ex-
pected. Four items loaded on the cognitive factor, three loaded on the inter-
personal factor, another three loaded on the diversion factor, and five load-
ed on the student-oriented factor. Alpha coefficients for the four scales created
from these items were .75, .64, .70, and .88, respectively (see Table 9).

RESULTS

Personal Attributes

Demographic characteristics. TENET users tended be seasoned educators
who worked in public school systems and had completed advanced levels
of schooling (see Table 2). Seventy-seven percent of the respondents
worked in public school systems. The majority (66%) had 10 or more years
of experience working as educators. Teaching tenure ranged from 0 to 44
years, with an average of 15 years. Thirty-five percent of the sample were
classroom teachers, 16% served in support roles such as that of library me-
dia specialist or computer coordinator, and 24% were school or district-
level administrators, regional service center staff, or state education agency
personnel. More than half (60%) had completed one or more graduate-lev-
el degrees.

   Respondents ranged in age from 20 to 70, with a mean age of 44.
Slightly more than half were female (53%). The sample was geographical-
ly diverse; 42% worked in an urban setting, 33% worked in a suburban
community, and 26% worked in a rural area. Respondents were scattered
among nearly 100 different Texas towns and cities, with clusters of 10
or more located in several of the larger cities (Austin, Houston, and
San Antonio).

Table 2
Demographic Characteristics of Respondents

Variable	n	Percent
Age		
20-39	58	31%
40-49	80	43
50 and over	47	25
Gender		
Male	88	47
Female	99	53
Highest level of education completed		
Less than 4 years of college	17	9
4-year undergraduate degree	20	11
Some graduate school	38	20
One or more graduate degrees	113	60
Years working as an educator		
0-9 years	62	34
10-20 years	74	40
Over 20 years	47	26
Primary job responsibility		
Pre-K or elem. school teacher	16	9
Middle school teacher	23	12
High school teacher	27	14
Library media specialist	13	7
Computer coordinator/specialist	17	9
School/district administrator	34	18
TEA/service center personnel	13	7
College/university faculty/student	10	6
Other	27	18
Employer type		
Public school system	143	77
Private school (K-12)	4	2
College or university	14	8
Other	24	13
Type of community in which workplace located		
Rural	47	26
Suburban	60	33
Urban	77	42

Note: TEA stands for Texas Education Agency.

Computer experience. Respondents had a great deal of experience with using computers (see Table 3). Eighty-seven percent had 5 or more years of experience with computers, with 36% having over 10 years of computer experience. Slightly less than half (44%) had been using TENET for over 2 years. Thirty-seven percent had never used another telecomputing network. Of those who had used other networks, about half (54%) had been using them for more than 2 years.

Table 3
Amount of Experience With Technology

Variable	n	Percent
Experience using computers		
Less than 2 years	4	2%
2-4 years	21	11
5-7 years	41	22
8-10 years	55	29
11 or more years	67	36
Experience using TENET		
Less than 1 year	22	12
12-18 months	49	26
19-24 months	35	19
25-30 months	31	17
More than 2 1/2 years	50	27
Experience with other telecomputing networks		
No use of other networks	69	37
Less than 1 year	17	9
1-2 years	37	20
3-5 years	38	20
More than 5 years	26	14

Environmental Characteristics

Access. The majority of respondents reported easy access to TENET (see Table 4). Over 90% reported that the equipment they ordinarily used to connect to the system was close by, accessible, and convenient. More than half (57%) usually accessed TENET from home (see Table 5). Of those who typically used TENET at work, nearly 90% had access from their own classroom or office. Eighty-six percent reported having relatively few difficulties connecting to the system. Most (87%) dialed into TENET via modem; 61% dialed a local number and 26% dialed a toll-free number (which had a 45 minute daily time limit). Slightly more than 10% typically accessed TENET via a direct network connection.

Cost. Another aspect of access is affordability. Although it was not directly addressed by the survey, cost and/or source of funding emerged as issues of concern to some survey respondents. Twelve respondents chose to address this topic when asked for general comments at the end of the survey. Some expressed frustration about the expense of providing connectivity within

school buildings to allow more widespread access to TENET. One princi-
pal wrote, "We have fifty or more Macs on campus but cannot get funding
for phone lines to use TENET." Another respondent said, "I am quite con-
cerned about...the push for financially strapped districts to get a direct In-
ternet connection." A third participant expressed what many apparently re-
alized: "School districts are slow to make this available in the classroom.
Phone lines are expensive." Yet several respondents didn't seem to allow
cost issues to curtail their wishes for students to have greater and more eq-
uitable access. As one participant said:

> I'm anxious for the Information Highway to come to fruition. Realiz-
> ing that financial resources are limited, I would still like to see every
> student in Texas have access from their home as well as their school.

Half of those who addressed cost in their comments expressed their ap-
proval of what was perceived to be a very low price ($5/year for public
school personnel and $25/year for others) for the amount of interpersonal
and informational resources available via TENET. One respondent, for ex-
ample, said:

> When I first began using TENET, I could not believe that such a po-
> tentially valuable resource was available to us at such a reasonable
> cost. As time has passed, I have come to depend upon it more and
> more, and I would be absolutely devastated if it were no longer available.

Other respondents seemed to echo this person's implied concern that
they might lose access, due to economic constraints. One person, for exam-
ple, simply said, "Please do not take TENET away from us or make it too
expensive for teachers to have access." A few compared TENET to
commercially available online services, apparently agreeing that it is
less costly, but at the expense of being less user-friendly and/or techni-
cally sophisticated.

Training and time. As shown in Table 5, about half of the respondents had
learned to use TENET without assistance, whereas the rest learned with
the help of a friend or colleague (23%) or by attending inservices, confer-
ence workshops, or college courses (24%). Nearly 40% had no ongoing
source of continuing assistance for their use of TENET. Others had help
available through other teachers or school staff (19%) or from district-level
computer coordinators, TENET trainers, regional service center staff, or
university faculty (29%).

All of the comments that addressed assistance for using TENET mentioned the need for help with technical, rather than curricular or communications challenges. Three types of help were mentioned: informal assistance from other individuals, written documentation, and telephone support from TENET's "help desk." One respondent expressed some frustration with the type of individualized assistance available via the "help desk," but stated how useful competent one-on-one assistance can be: "Usually I end up calling our computer coordinator or one of my "computer wizard" students is able to figure out the problem."

Several of the comments linked assistance with time pressure. Given the busy schedules of typical teachers and administrators, it is not surprising that most respondents reported experiencing pressures in their environment at least occasionally. As shown in Table 4, 93% said their lives sometimes or frequently involved time pressures, 87% reported the occurrence of unexpected problems or situations, and 78% reported experiencing urgent matters or crises.

Such pressures, especially with regard to time, may limit the extent to which users explore various features of the system, especially those that are somewhat complex, as one user explained:

> I would enjoy using many more of the features of TENET if my time allowed me to learn them or if they were easier. Each time I have ventured into other areas I either do not understand or run out of time, therefore my attempts have become few and far between.

Time pressure and available assistance combined to discourage at least one other member of the sample, who said: "Training and time for use are major problems for personal use beyond electronic mail." Another respondent mentioned the availability of a printed manual, but the lack of time to use it: "I have a manual from an introductory course but haven't had the time to consistently devote to sitting down and working through menus, etc." Another respondent explained that time pressure precluded the use of a manual, and stated a preference for individualized assistance: "I would enjoy and get more out of TENET if I could get some good one-on-one assistance...right now I don't have time/energy to read another reference manual."

Social context. Most respondents (88%) were not the only person using telecomputing at their work site. Of those, about half collaborated with others on telecomputing activities or served as a resource person for others

(see Table 5). In addition, 11% of the sample held leadership positions on TENET by serving as a trainer or newsgroup moderator. As shown in Table 4, most (80%) thought of themselves as members of a community of TENET users even when they were not using the system. Many engaged in interactions with others concerning past (64%) or future (60%) TENET sessions, while nearly three-quarters exchanged tips with others about what to do or how to do something on TENET.

On the average, respondents regularly communicated with at least one or two other people they knew via TENET (see Table 4). Nearly two-thirds kept in touch with 3 or more co-workers or colleagues (including those who were friends), whereas slightly less than a quarter usually corresponded with 3 or more personal or social contacts (who were not also co-workers or colleagues). About half consistently contacted more than 2 people outside their school district but within Texas, whereas only 22% regularly reached more than 2 out-of-state contacts. The value of such connections was described particularly well by one participant:

> I see myself as a participant in a global village where without having to go through the red tape of governments and political interests, I can easily communicate with other educators and students around the globe. I am as intelligent as every person with whom I can ask a question and get an answer.

Perceived Characteristics of TENET

Ease of use. On the average, respondents perceived TENET as being relatively user-friendly (see Table 6). About two-thirds considered it "understandable," 56% felt it was "simple," and 58% rated it as relatively "easy" to use. Comments regarding TENET's ease of use were mixed, with some indicating a high degree of satisfaction with the user interface and others complaining about its complexity.

Social presence. Responses were less positive regarding the system's "social presence," or the degree to which communicating via TENET shares some of the qualities of face-to-face communication (see Table 6). Half of the sample indicated that they thought the system was "sociable," whereas less than half found it to be "sensitive" (43%) or "personal" (41%).

Table 4

Descriptive Statistics for Environment Characteristics-
Continuous Variables

Variable	Mean	SD	N	% responding in top 2 categories
Equipment access[a]				
Accessible/inaccessible	4.75	.65	175	94%
Close/distant	4.71	.79	170	92
Convenient/inconvenient	4.67	.73	174	92
TENET access[b]				
Lack of difficulty connecting	3.31	.77	189	86
Time pressure[a]				
Time pressures	3.48	.65	188	93
Unexpected problems/situations	3.32	.69	188	87
Urgent matters/crisis	3.04	.76	187	78
Social integration[b]				
Exchange tips with others	2.93	.84	190	74
Talk about past sessions	2.73	.90	189	64
Talk about future sessions	2.60	.93	189	60
Feel part of TENET community[c]	4.19	.95	189	80
Interpersonal contacts[d]				
Co-workers or colleagues	1.92	1.03	187	64
Social or personal contacts	.90	.95	187	23
People in TX/outside district	1.47	1.12	188	47
People outside TX	.84	1.07	189	22

[a]Response categories for these semantic differential scales ranged from 1 to 5.
[b]Response categories were: 1=never, 2=seldom, 3=sometimes, 4=frequently.
[c]Response categories ranged from 1=strongly disagree to 5=strongly agree.
[d]Response categories were: 0=none, 1=one or two, 2=three to four, 3=five or more.

Table 5

Descriptive Statistics for Environmental Characteristics-
Categorical Variables

Variable	n	Percent
Access		
Location of equipment used most often to access TENET		
At home	107	57%
At work, classroom or office	69	37
At work, not in classroom or office	9	5
Other	3	2
Method used to connect to TENET		
Via modem (local call)	114	61
Via modem (toll-free number)	49	26
Via direct network connection	21	11
Other	4	2
Assistance		
Primary way learned to use TENET		
Self-taught	95	51
With assistance of friend / colleague	44	23
Inservice, workshop, or course	45	24
Other	4	2
Primary source of continuing assistance for using TENET		
Teachers or staff at workplace	26	14
Teachers or staff not at workplace	9	5
Computer coordinator or TENET trainer	21	11
Regional service center staff	26	14
College / university faculty	7	4
No ongoing source of assistance	72	38
Other	27	14
Role in relation to others		
TENET trainer or newsgroup moderator?		
Yes	20	11
No	167	89
Role in telecomputing activities in workplace		
Only person using telecomputing	23	12
Several use telecomputing, but our activities are unconnected	81	43
Collaborate with other colleagues who are working on telecomputing activities	49	26
Serve as resource person for others	35	19

Utility. Nearly all the respondents (96%) felt that TENET was useful (see Table 6). More than half (56%) found it to be useful in many ways, whereas almost one quarter felt that it had "revolutionized their work or communication processes." Several in this last group chose to comment in emphatic ways, saying, for example, "I cannot imagine life without it now." Another respondent quipped, "I like it. I find it very useful. I hope no one screws it up." Another commented:

> I am having surgery...at the end of this month and I am requesting a room equipped for telecommunications. I am completely in love with the system and cannot live without it. I correspond daily, all over the world.

About three-fourths also rated TENET as "effective" (78%) or "efficient" (73%). For example, one respondent wrote: "TENET has contributed greatly to my effectiveness as a school administrator." Another person said: "I think I have learned two years of resource knowledge and technical help in one year by having the assistance of other people online."

Relative advantage. Respondents generally found TENET to be advantageous, compared to other media, for accessing information and communicating with others (see Table 6). Most (87%) agreed that without TENET it would more difficult to obtain information and that they often looked for information on TENET that they would not otherwise have sought. One respondent, for example, said, "I...access academic information I would have to drive long distances to get." Another remarked, "Gathering information is much easier than before I used TENET."

About 80% said that without TENET it would be more difficult to reach people they wanted to contact and that they often communicated with people who they would not otherwise have contacted. One respondent succinctly stated, "E-mail beats playing phone tag." Another commented, "I communicate with people that I usually find difficult to contact." A similar observation provided more detail:

> TENET has allowed me to contact people who have different work schedules, long distance phone [numbers,] extremely busy schedules, and to do it at my convenience...after my children are in bed.

Most respondents who chose to comment upon the relative advantage of the network mentioned access to other people and information resources in the same or contiguous sentences. For example, one respondent said:

I now have access to resources and persons I would not have dreamed possible. Because of this I can attempt larger, more complex projects with hopes of finding [aid]. I can also communicate with more people, more often, than would otherwise be possible.

Another respondent commented upon the relative advantage of using TENET resources, linking it to time shifting:

TENET has made a world of resources relevant to my job available to me. It has allowed me to communicate with other professionals at my convenience—not restricting me to "office hours."

Table 6
Descriptive Statistics for Perceived Media Characteristics

Variable	Mean	SD	N	% responding in top 2 categories
Ease of use[a]				
Understandable/confusing	3.86	1.00	184	66%
Easy/difficult	3.73	1.06	185	58
Simple/complex	3.73	1.12	185	56
Social presence[a]				
Sociable/unsociable	3.54	.96	183	50
Sensitive/insensitive	3.38	.95	178	43
Personal/impersonal	3.33	1.06	184	41
Utility[a]				
Useful/useless	4.60	.62	185	96
Effective/ineffective	4.18	.81	185	78
Efficient/inefficient	3.99	.91	183	73
Judgement of TENET's worth[b]	3.02	.72		
Has not been useful			5	3
Some limited use for me			32	17
Useful in many respects			104	56
Revolutionized work / communication			44	24
Relative advantage[c]				
Harder to get info without TENET	4.35	.92	190	87
Look for info not otherwise sought	4.30	.90	190	87
Harder to communicate without TENET	4.22	1.01	190	81
Communicate with people not otherwise contacted	4.21	.96	188	82

[a]Response categories for these semantic differential scales ranged from 1 to 5.
[b]Response categories for this item are shown below.
[c]Response categories ranged from 1=strongly disagree to 5=strongly agree

Amount and Type of Use

On the average, respondents reported logging onto TENET 4-6 times per week for 15-30 minutes per session and for a total of about 1-3 hours over a 2-week period (see Table 7). The most popular use of TENET was reading electronic mail. As shown in Table 8, more than three-fourths of the respondents reported almost always or frequently reading electronic mail messages, whereas somewhat fewer (60%) reported sending messages. Slightly less than half said they often read newsgroup messages (46%). However, only a very small percentage (3%) reported frequently posting newsgroup messages. About 30% of the respondents frequently connected to other Internet services via telnet, while about a quarter frequently used gopher to access Internet resources. Special information databases, such as Grollier's Encyclopedia and the AskEric service were used frequently by 16% of the respondents, while TENET's user database was used frequently by only 9% of the respondents.

Table 7

Frequency and Duration of Log-ons

	Duration (minutes)				
Frequency	< 15	15-30	31-45	> 45	Total
<once/week	8%	5%	3%	0%	16%
1-3 times/week	6	17	9	4	36
4-6 times/week	2	7	5	2	16
Once/day	4	4	3	3	13
>once/day	4	7	7	3	19
Total	23	39	27	11	100

Note: N =182.

Gratifications Obtained

Cognitive. The most strongly supported gratifications obtained from using TENET were cognitive in nature, as shown in Table 9. More than three-fourths of the respondents agreed that TENET had helped them to "access curriculum materials, content-area information, or news about current events" and to "find out about state, district, or local happenings or staff development activities." Nearly two-thirds also agreed that TENET had enabled them to "participate in discussions on educational issues, problems, or other current topics" and to "exchange teaching ideas, information, or advice." For example, a librarian at a private school with no technology consultant wrote:

Table 8

Usage Patterns for E-mail, Bulletin Boards, Internet Resources,
and Databases

	E-Mail		Newsgroup		Internet		Databases	
	Read	Write	Read	Write	Telnet	Gopher	User	Reference
Almost always	59%	35%	28%	1%	8%	8%	0%	3%
Frequently	18	25	18	2	22	16	9	13
Sometimes	15	23	32	11	33	25	34	34
Seldom to never	9	17	24	86	37	52	57	50
N	(188)	(184)	(187)	(181)	(187)	(186)	(186)	(187)

> Through TENET I have access to LM-Net [an active discussion group
> for information specialists] and a world of library resources to help. I
> have received valuable information over TENET. I can keep in touch
> and participate actively with people I have met via TENET. It has been
> a tremendous benefit to me professionally and a valuable source of in-
> formation to help me help teachers in my school. I love TENET.

Interpersonal. Support for social or interpersonal gratifications resulting
from TENET use was more mixed than that for cognitively-oriented satis-
factions. While almost three-fourths felt that TENET had helped them
"keep in touch with family, friends, and/or colleagues," less than half
found it helpful for planning or scheduling work-related meetings (41%) or
social activities (18%).

Diversion. Support for diversion or entertainment-oriented gratifications
was also mixed. Almost 60% of the respondents indicated that TENET al-
lowed them to "participate in entertaining conversations or activities" and
that it "provided a nice break from work." On the other hand only 34%
felt that TENET provided a "means of filling up free time." Given the lev-
els of time pressure reported by participants, it is likely that they did not
believe that they had much "free time" to fill.

Student-oriented. Benefits obtained from student-oriented uses of the net-
work were the least strongly supported. Forty-four percent of the respon-
dents indicated that TENET had helped them "send or receive reports or
student information." Forty-two percent of the respondents agreed that TE-
NET provided students with "access to resources for research projects" and
37% said that it "enabled students to exchange messages with people be-
yond school boundaries." About one-quarter indicated that the network had

allowed their students to "participate in online classroom exchange projects" or to "practice writing skills in an authentic context."

At the time of the survey, students were only allowed to access the network indirectly via their teacher, as accounts designated for student use were unavailable. Survey comments indicated considerable concern about lack of sufficient student access to TENET for use in instructional activities. Comments included: "TENET is used very little by students because of limited access" and "We need to find ways to get TENET into classrooms so students can use it." One respondent expressed concern about students' abilities to access and use networked information in the future as related to this difficulty:

> My children use Internet sources from home, but they should be using networked information at school. I believe that by the time they are in college, online communication and information resources will [be] as standard as the telephone and television today, and I am afraid that they will not be prepared by the schools to use the resources.

Multiple gratifications. Different types of gratifications obtained from using TENET's online facilities did not, of course, occur in isolation. One participant's comments reflected a broad range of gratifications and uses well:

> I have been given the opportunity to access information relevant to my graduate studies, visit with professionals across the world about emerging issues, keep in touch with colleagues and friends who have left the area, access information relevant to my profession, give immediate and timely feedback, schedule appointments/meetings, schedule social events (I just scheduled a lunch at the Olive Garden with eight others) and even discuss the possible sale of my house.

Another user commented:

> The very real frustrations and sense of isolation which tends to move in on a secondary art teacher in the public school [have] been replaced by a source for professional exchange, for the continuation of my own learning, for participation and exchange for my students...Through TENET, I feel that I can rise above the continuing demands of the working day and keep a more positive perspective on a very hard job and feel as if I am not alone in trying to mold a more positive future through the children.

Table 9
Descriptive Statistics for Gratifications Obtained

Variable	Mean	SD	N	% responding in top 2 categories
Cognitive				
Access materials, news & information	4.14	.91	189	79%
Find out about events & activities	3.91	1.04	188	76
Participate in educational discussions	3.89	.97	190	63
Exchange ideas, info & advice	3.83	1.13	189	65
Interpersonal				
Keep in touch with people	4.06	1.14	188	75
Plan/schedule work-related meetings	3.22	1.26	187	41
Plan/schedule social activities	2.49	1.17	189	18
Diversion				
Engage in entertaining activities	3.71	1.13	187	59
Take a break from work	3.58	1.32	185	58
Fill up free time	2.81	1.42	187	34
Student-Oriented				
Exchange student info / reports	3.36	1.16	185	44
Access resources for research	3.29	1.27	184	42
Exchange messages outside school	3.18	1.28	185	37
Participate in on-line projects	2.91	1.18	187	26
Practice writing in authentic context	2.89	1.14	182	24

Note: Response categories ranged from 1=strongly disagree to 5=strongly agree.

DISCUSSION

The results of this study provide information about the characteristics of TENET users, the contexts in which they used the network, and their perceptions of it, as well as patterns of network use and outcomes of such use. This research also documents the development and testing of a lengthy survey instrument measuring a wide range of variables thought to be important to understanding usage of computer-mediated communication systems according to several theoretical perspectives. Many of the survey items were based upon reliable and valid items used in previous studies. In the current study, reliability coefficients (from .65 to .92) for scales com-

bining several items were, for the most part, well above generally accepted minimum standards of reliability (.50) for data used to make decisions about groups (Worthen, Borg, & White, 1993). This broadly applicable, field-tested instrument can serve as the basis for further generalizable, theory-based research on the use of educational telecomputing systems.

The methodology used in this study was also shown to be an effective and efficient way of collecting data from a random sample of network users via electronic mail surveys. The response rate of 66% for the current survey is typically considered good for mailed surveys (Babbie, 1990) and falls within the range (from 50% to 93%) usually attained by surveys employing the Total Design Method (Dillman, 1978). It is similar to the response rate of 68% obtained in a previous study that employed the same methodology to survey users of a public telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995). For ethical reasons, one of the criteria for informants' inclusion in the current sample was a previous affirmative answer to a question regarding their willingness to participate in research on TENET. Thus, it is possible that the response rate obtained in this study was somewhat higher that it would have been if that criteria had not been used. Nevertheless, the response rate for the current survey suggests that the methodology used can be effectively applied in the context of educational telecomputing systems.

At the time this study was conducted, it was unique among surveys of precollege educators' use of telecomputing networks because the sample was randomly selected. This allowed us to estimate the ways in which our results may differ from "true" population values. The sample represented individuals who used TENET during the summer and who had held a network account for nearly one year or longer. Investigation of possible response biases indicated that respondents tended to log-on more frequently and for more time than did nonrespondents. In addition, the analyses suggested that respondents were more likely to frequently read and write e-mail, be integrated with a community of network users, regularly reach several interpersonal contacts, and perceive the network to be relatively advantageous compared to other media for interpersonal communication and information access, than were nonrespondents. This information suggests that the range of responses for these variables was probably restricted and thus relationships which may be observed upon further statistical analysis of the data will probably be lower than they might have been otherwise. It also points out the need for additional research that provides information about less active users.

Respondents to the current survey, as well as those who participated in previous studies of this nature, can probably be categorized as "innovators" or "early adopters" (Rogers, 1983) of educational telecomputing systems.

At the time of the current survey, approximately 15% percent of Texas teachers had registered for TENET accounts. According to Rogers, innovators and early adopters typically make up 16% of the members of a social system. Having a high level of education has been a consistent predictor of adoption and use of new communication technologies (Rogers, 1986). Respondents to the current survey were, for the most part, highly experienced and educated public school teachers, support staff, and administrators, with 66% teaching for 10 or more years and 60% holding a graduate degree. Those who responded to an earlier nationwide survey conducted at the Bank Street College of Education (Honey & Henríquez, 1993) were even more experienced and educated, with 83% teaching for 10 or more years and 79% holding a graduate degree. Similar to the Bank Street study, those responding to the current survey were experienced computer users, indicating that they were not only early adopters of computers, but also were probably fairly skilled in using them. In both the current study and the Bank Street survey, more than 80% had used computers for at least 5 years. Those who responded to the current survey also generally had easy access to equipment needed to use TENET, often from a home computer and modem. More than half of the respondents to the current survey, as well as of those who participated in the previous evaluation of the same network after its first year of operation (Frazier & Frazier, 1993), usually connected to the network from home. An even greater percentage (73%) of the respondents to the Bank Street survey reported having access to a modem at home.

Other contextual factors that may influence the use of telecomputing networks in education include the system's ease of use and the availability of assistance and time for learning to use the network. The majority of respondents perceived TENET as being relatively easy to use. About half had taught themselves to use the system. An even higher percentage (88%) of those who responded to the Bank Street survey were self-taught (Honey & Henríquez, 1993). The need for time and assistance for learning to use the network was mentioned by a number of respondents in their comments. Indeed, 38% had no ongoing source of assistance for using TENET. Similarly, 40% of respondents to the Bank Street survey reported no source of ongoing assistance. However, in the current survey 88% worked with others who also used TENET. Similarly, in the Bank Street survey, 73% worked with others who used telecomputing networks. The results of the two studies differed, however, in that 38% of respondents to the previous survey served as a resource person for others, where as only 19% played that role in the current study. Survey comments indicated that respondents preferred informal interpersonal sources of assistance over manuals and other more

formal means of help. Indeed, the majority of respondents reported talking with others about past or future TENET sessions or exchanging tips with others.

These findings give us an idea of the conditions under which use of telecomputing networks in education is likely occur, at least during the early development of such networks. These conditions include several years of experience with computers and convenient access to a computer and modem. Proximity to other network users may also be an important condition for network use. Those who adopt such networks later will most likely differ from the early adopters represented in the current study. Thus, additional research will be needed to understand later adopters and the conditions which facilitate their embracing of telecomputing networks. To insure equity, it is important to find ways to get less experienced and innovative individuals involved in using telecomputing networks. Concerns about the availability and cost of better network connectivity within schools and the lack of time and assistance for learning to use the network were identified as predominate themes in the content analysis of survey comments. Few phone lines in schools, lack of time, and inadequate financial support were also identified as barriers to telecomputing use in prior surveys (Broholm & Aust, 1994; Frazier & Frazier, 1993; Honey & Henríquez, 1993). Providing for adequate network connectivity from school classrooms and offices is one way to enable those without home access to participate in the network. Making more time available in the school schedule for learning and experimentation and encouraging peer interactions as a means of informal interpersonal assistance are other possible ways to facilitate network use.

Respondents to the current survey were generally active users. On the average, they used the network 4-6 times per week, with nearly one-third logging on once or more each day. In contrast, nearly two-thirds of the respondents to the previous TENET study logged on that frequently (Frazier & Frazier, 1993). Electronic mail was the most often used network function. This was also true for two other large-scale surveys (Frazier & Frazier, 1993; Honey & Henríquez, 1993). Respondents to the current study, as well as in the study conducted by Broholm and Aust (1994), read electronic mail more often than they sent it. After electronic mail, reading newsgroup messages was the next most popular network activity, followed by accessing Internet resources. Similarly, Internet resources and group discussions or conferences were rated as the second and third most useful TENET resources by participants in the previous TENET evaluation (Frazier & Frazier, 1993).

TENET clearly provides benefits to educators who use the system. Respondents felt overwhelmingly that TENET had been useful to them. This was also true of those who responded to the earlier evaluation of TENET (Frazier & Frazier, 1993). Most felt that it had provided them with opportunities to access information and communicate with people that would otherwise be difficult or unlikely to occur. These benefits were also the most highly rated incentives for using telecomputing as a professional resource by respondents to the Bank Street survey (Honey & Henríquez, 1993). In the current survey, outcomes from using the network were mainly centered around accessing information, exchanging ideas, and discussing issues. Such professional development activities were also most frequently reported and rated as most effective by respondents to the Bank Street survey. Similarly, Broholm and Aust (1994) found that educators' online interactions were predominantly (77%) professional in nature, with the other 23% of network interactions containing personal or social content. Respondents to the current survey also reported outcomes of an interpersonal or social nature Three-quarters indicated that TENET was useful for keeping in touch with family, friends and/or colleagues. In addition about half perceived the system as being "sociable." Finally, most respondents indicated that TENET served a diversionary purpose. Nearly 60% reported engaging in entertaining conversations or activities and indicated that using TENET provided a nice break from work.

Student-oriented benefits were not as frequently reported as other types of outcomes. Many of the survey comments indicated that improved access for students was desired. Nevertheless, about 40% of the participants seemed to have found ways to use the network for activities that benefitted their students. Similarly, respondents to the Bank Street survey reported using networks less regularly for student learning activities than they did for professional development purposes. In addition to access issues, it is likely that involving students in telecomputing activities is a more complex endeavor, and thus it may be more difficult to implement than professionally-oriented activities. Educators may need not only improved access for their students, but also improved assistance for using networks in instructional ways.

This study has demonstrated an effective method for collecting data about use of telecomputing networks with a lengthy, broadly applicable, theory-based instrument. In order to corroborate the results of the current study and determine the generalizability of the findings, similar research needs to be replicated on other systems. However, it is not safe to assume that such networks and their users will remain constant over time. Educa-

tional telecomputing networks are constantly evolving and growing. The user population will also change, as less "innovative" adopters begin using telecomputing networks. Thus, ongoing research is needed to further our understanding of network use over time. In addition to descriptive research, as reported in this paper, research on factors associated with network use would be helpful. This type of data analysis for the current study, will be reported in an subsequent publication (Anderson & Harris, in press). More studies of this nature, particularly those that build upon the theories generated by communication researchers, or those that attempt to develop new theories, would help to further understanding of educators' network use. Such knowledge will help to guide the development and implementation of educational telecomputing networks, as well as provide a basis for improving strategies for helping educators learn to use and effectively apply online resources for professional and instructional purposes.

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Acknowledgements