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CORRELATES AMONG TEACHERS' ANXIETIES, DEMOGRAPHICS, AND TELECOMPUTING ACTIVITY

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Abstract Are educators' anxiety levels or demographics related to their voluntary use of networked resources? In this study, one year of logins and online time for 189 randomly selected educators with accounts on Tenet (Texas Education Network) were correlated with six interval-level subject attribute variables: (a) writing apprehension, (b) oral communication apprehension, (c) computer anxiety, (d) age, (e) teaching experience, and (f) telecomputing experience. The usage data were also correlated with three nominal-level subject attribute variables: (a) gender, (b) professional specialty, and (c) teaching level. Results indicated that writing apprehension was significantly and negatively correlated with network use, and that telecomputing experience and online time were significantly and positively correlated. No other subject attribute variables were found to be correlated with logins or time spent online. These results, and the lack of significant relationships for computer anxiety and oral communication apprehension, lead the authors to suggest that writing apprehension be addressed within the contexts of initial telecomputing training, and increased access to telecommunications tools be made available as users' online experience increases. (Keywords: anxiety, teachers, telecommunications, writing.)

Speaking to communications industry leaders in 1994, Vice President Al Gore stated the following:

Today, we have a dream for a different kind of superhighway that can save lives, create jobs, and give every American, young and old, the chance for the best education available to anyone, anywhere. I challenge you ... to connect all of our classrooms, all of our libraries, and all of our hospitals and clinics by the year 2000. (National Institute of Standards and Technology, p. 57)

The Global Matrix is an international network of information networks that serves more than 27 million users (Quarterman & Carl-Mitchell, 1995a) in more than 155 countries (Quarterman & Carl-Mitchell, 1995b). It is rapidly finding its way into businesses, homes, and precollege classrooms, growing at a rate of approximately 100% per year (Quarterman & Carl-Mitchell, 1995a), or one new host every 30 min (Calcari, 1994). The Matrix was used by more than 12 million employees of commercial firms in 1994, and that number is expected to increase to over 27 million by the time this article is published. More than a sixth of all American homes now have a modem connection.

In late 1994, 35% of a weighted random sample of American educators reported having access to telecomputing facilities somewhere in their school buildings, with 3% of that sample having access in their own classrooms (Heavyside, Farris, Malitz, & Carpenter, 1995). Clearly, there is a good chance Vice President Gore's challenge to go online will be met by the deadline he

imposed. But will the teachers and students in the schools with access to the national information infrastructure know how to locate and apply online resources for instructional and professional development purposes by the year 2000?

It can be assumed that part of the answer to that question will lie in the level of each classroom's access to networked resources. It is probable, though, that more of an accurate response will take into consideration the types and quality of preparation that teachers and students receive in the use of telecomputing tools. The results of the research presented here suggest that knowledge of the characteristics of teachers who currently use online tools can help teacher educators better plan and offer effective, time-efficient telecomputing training.

The more we know about network users in K-12 contexts, the better able we will be to help teachers acclimate to, navigate among, and apply online resources for educational purposes. Little has been discovered about teachers as users of computer-mediated communications (CMC). What user characteristics might be associated with more or less exercise of telecomputing access? Might these correlations change as telecomputing experience increases? The present study explored possible relationships among nine user attributes (writing apprehension, oral communication apprehension, computer anxiety, telecomputing experience, gender, age, instructional position, teaching experience and telecomputing experience) and one behavior pattern (network use frequency). It is similar to two earlier studies (Harris & Grandgenett, 1992; Grandgenett & Harris, 1994) that examined five of the same user attributes, but differs considerably from those efforts because the sample for the present study is much larger, was randomly selected, and represents voluntary use of telecomputing facilities.

RELATED LITERATURE User Characteristics

In a nationwide survey of 550 elementary, middle, and high school educators who were active users of CMC tools in 1992, Honey & Henriquez (1993) found that their sample was comprised of experienced, highly educated "pioneers" who had been integrating educational technology into their classrooms for more than eight years, and who worked in schools relatively well-endowed with technological tools. These educators were older than the national average (44.9 versus 40.2 years) and almost entirely Caucasian. There were almost twice as many men and a third fewer women in this sample of telecomputing teachers, when compared with national statistics on all teachers. Nearly half of the group had been using computers for more than nine years, and the majority had been using computers for more than five years. Nearly all of the respondents (91%) had access to telecomputing facilities in their homes. Although many teaching specialties were represented in the sample, members of the largest subgroup, comprising more than 23% of the respondents, were working as computer specialists. The second largest group (20%) was comprised of elementary school teachers, and the third largest group (.14.4%) was library media specialists. In a later, smaller study of 65 educators who used a regional electronic mail system to collaborate professionally and share instructional resources, librarians made the most extensive use of the system (Broholm & Aust, 1994).

Evidence from studies of electronic mail users in primarily corporate settings indicates that age, educational level (Kerr & Hiltz, 1982), and amount of prior experience (Grantham & Vaske, 1985) are positively associated with telecomputing use. Highly visual and abstract learners may

use electronic mail with greater ease (Sein & Bostrom, 1989). Users with perceptive attitudes, rather than judging attitudes (Myers & McCaulley, 1985), favor use of "rich media" (Schmitz & Fulk, 1991) like electronic mail (Trevino, Lengel, Bodensteiner, Gerloff, & Muir, 1990). Higher-status workers tend to use text-based electronic media less frequently (Komsky, 1991). System use was negatively correlated with amount of communication with subordinates in one study (Grantham & Vaske, 1985), but it appears that such patterns are, in part, determined by the nature of the tasks to be completed (Huber, 1983; Russ, Daft, & Lengel, 1990).

Frequent network users, who access telecomputing facilities at least once per day, are most often those who perceive telecomputing to be part of their job responsibilities (Komsky, 1991) and who associate with colleagues who have favorable perceptions of telecommunications media (Schmidt & Fulk, 1991). They also tend to be more tolerant of technical problems associated with telecomputing than are less frequent users, and see electronic mail as an alternative and supplement to telephone use (Komsky, 1991).

The strongest predictor of login frequency is user attitude toward the electronic communications system (Grantham & Vaske, 1985; Komsky, 1991; Schmitz & Fulk, 1991). Frequent users are more satisfied with computer-based communications media, and they perceive personal benefits from using the network to a greater extent than do occasional users (Komsky, 1991). One might wonder, then, whether anxiety about writing, oral communication, and/or computer use, all of which are directly related to telecomputing, might affect login frequency.

Writing Apprehension

Writing apprehension is "a situation and subject-specific individual difference concerned with people's general tendencies to approach or avoid writing" (Daly, 1979, p. 11). Daly and Miller (1975a) developed and validated the Writing Apprehension Test (WAT), a questionnaire designed to measure writing apprehension attitudes. Higher scores on the WAT indicate greater writing apprehension. Lower WAT scores have been correlated with better performance on tests of grammar, writing mechanics, and general writing success (Daly, 1979); longer texts and use of less neutral written language (Daly, 1977); more positive perceptions of past successes with writing (Daly & Miller, 1975b); better narrative or descriptive essay writing (Faigley, Daly, & Witte, 1981); better standardized achievement test scores, both generally and particularly in English (Richmond & Dickson-Markman, 1985); better grades in undergraduate composition classes (Powell, 1984); and higher tolerance for ambiguity. Writing apprehension has also been shown to have no statistical relationship to "locus of control, dogmatism, Machiavellianism, and achievement motivation" (Daly, 1977, p. 567).

Shaver (1990) demonstrated that his Attitudes Toward Writing with the Computer Scale yields concurrently reliable and valid writing apprehension scores when compared with results from the WAT. It would appear, therefore, that attitudes about writing in telecomputing contexts can be measured reliably with the WAT.

Writing apprehension can be reduced with the use of planned writing instruction, delivered in either a teacher-centered (i.e., lecture, discussion, writing exercises, question-answer sessions, teacher evaluation of writing) or peer-directed and collaborative (i.e., language problem solving,

free writing, practice response writing, structure peer response to writing) mode. The anxiety reduction rate of the latter method has been shown to be more rapid, however (Fox, 1980).

Only two studies were found to address possible relationships between writing apprehension and network use. In a study of the effects of using computer network technologies on teacher-student and student-student interactions in an undergraduate composition course, Hartman et al. (1991) showed that writing apprehension was negatively related to frequency of teacher-student interaction in both traditional and electronic communication modes, although the relationship was weaker for electronic communications. Mabrito's (1991) qualitative study of high-apprehensive and low-apprehensive first-year college writers indicated that "high apprehensives exhibited different strategies than low apprehensives for informing group members about writing during both face-to-face and e-mail sessions" (p. 509). The students with high levels of writing apprehension also participated more frequently in electronic writing revision sessions than in face-to-face sessions. It is clear that much more can be learned about the relationship between network users' writing apprehension levels and their use of electronic tools for which writing is necessary for communication.

Oral Communication Apprehension

Oral communication apprehension is one form of communication apprehension, which has been defined as "an individual's level of fear or anxiety associated with either real or anticipated communication with another person or persons" (Richmond & McCroskey, 1992, p. 41). Oral communication apprehension has been correlated with adult unemployment (Conner, 1987). General communication apprehension has been negatively linked with self-efficacy (Colby, 1993), student motivation to study (Frymier, 1993), and cognitive performance (Bourhis, 1992). There is disagreement as to whether it is correlated with lower grade point averages (McCroskey, 1986; Ericson, 1992). Communication apprehension has been found to be positively correlated with both high school (Monroe, 1992) and college dropout rates (McCroskey, 1986; Ericson, 1992). It also appears to be interpreted in culturally specific ways (McCroskey, 1990), and has not been shown to be related to self-worth (Colby, 1993) or performance orientation (Booth-Butterfield, 1993).

Effective treatments for communication apprehension represent both instructional and psychological approaches. Visualization has been used successfully by one researcher with at least two different samples (Ayres, 1990; Ayres, 1992). Performance-based communication training, or rhetoritherapy, was used by another investigator with similar success (Kelly, 1990). Two studies reported the successful use of introductory-level oral interpretation or public speaking courses designed to lessen levels of communication apprehension among undergraduates (Carlson & Wright, 1993; Rose, 1993). Interestingly, one of these showed a "small but significant positive relationship between computer anxiety and communication apprehension" (Carlson & Wright, 1993, p. 329).

Computer Anxiety

Computer anxiety is an example of a concept-specific anxiety; anxiousness that regularly occurs in a specific type of situation (getting, 1983). Concept-specific anxieties differ from state

(transitory) and trait (personality aspect) anxieties. Although there is no general agreement upon an exact definition of computer anxiety, its presence in educational research literature implies that there is tacit agreement as to its existence (Jones & Wall, 1989-1990).

Computer anxiety and attitudes toward computers appear to be separate constructs (Rosen, Sears, & Weil, 1987; Kernan & Howard, 1990). There is some evidence that computer anxiety correlates with math anxiety (Gressard & Loyd, 1986; Rosen, Sears, & Weil, 1987; Kernan & Howard, 1990), but conflicting reports as to whether it is demonstrated to greater extents in women (Gilroy & Desai, 1986; Jones & Wall, 1989-1990), with methodological mistakes in this voluminous literature causing potentially generalizable results to be questioned (Kay, 1992).

Similarly conflicting results have been published concerning correlations between computer anxiety and age (Rosen, Sears, & Weil, 1987; Jones & Wall, 1989-1990; Dyck & Smither, 1994). The authors of a meta-analysis of 81 research reports on computer phobia concluded that computer anxiety is not significantly related to either age or gender (Rosen & Maguire, 1990). Another research team suggested that amount of computer experience may mitigate the relationships between computer anxiety and gender or age (Dyck & Smither, 1994).

Computer anxiety levels have been found to be better predictors of success in using computers than extent of prior computer experience (Marcoulides, 1988). There are conflicting reports as to whether computer anxiety scores are inversely related to amounts of computer experience (Rosen, Sears, & Weil, 1987; Marcoulides, 1988; Dyck & Smither, 1994). It is possible that computer anxiety influences computer achievement despite amount of experience (Marcoulides, 1988). Computer experience appears to affect attitudes about computers to a greater degree than computer anxiety (Gressard & Loyd, 1986; Igbaria & Chakrabarti, 1990; Dyck & Smither, 1994). Although computer experience alone does not eliminate computer anxiety (Rosen & Maguire, 1990), there is some evidence that computer anxiety does decrease with structured, practical computer use in educational contexts (Cambre & Cook, 1987; Gilroy & Desai, 1986; Lambert & Lenthall, 1989) or regular computer use at home (Colley, Gale, & Harris, 1994).

Potential relationships between computer anxiety levels and frequency of telecommunications tool use have been addressed in only one located reference, other than previous studies completed by the authors (Harris & Grandgenett, 1992; Grandgenett & Harris, 1994). In a study of traditional-mode and electronic communication among undergraduate writers and their teachers, computer anxiety was found to be a significant negative predictor of frequency of electronic teacher-student interaction. Computer anxiety was also negatively related to frequency of traditional-mode interaction about writing (Hartman et al., 1991). In two studies of graduate students enrolled in courses on Internet-based telecomputing, computer anxiety and writing apprehension were negatively correlated with network use, and teaching experience was positively associated with network login frequency, respectively (Harris & Grandgenett, 1992; Grandgenett & Harris, 1994). It should be noted, however, that results were dissimilar between the two studies, the sample sizes were small ($N = 20$ and $N = 23$), and the teachers in each group were required to use telecomputing tools at two very different levels of intensity. Most importantly, although participation in these studies was optional, the respondents were required to use online resources as part of their teacher-evaluated work for the courses in which they were

enrolled. What might be discovered about a larger, randomly selected sample of educators who use telecomputing tools voluntarily?

SUBJECTS AND DATA COLLECTION

The participants in this study were drawn from a group of approximately 8,000 educators on Tenet (Texas Educational Network), who had previously agreed, while updating account information online, to consider participation in future network-related research. A simple random sample of 300 network users was chosen from system records to form the mailing list of educators who received paper-based surveys by surface mail. A second mailing was sent to those potential participants who did not respond within 15 weeks of the first mailing. Participants were asked to respond to questions on a machine-readable answer sheet, and identify themselves by their Tenet account names only. Survey items generated demographic information about the respondents and asked them to self-report levels of writing apprehension (Daly & Miller, 1975a), oral communication apprehension (Richmond & McCroskey, 1992), and computer anxiety (Mauer & Simonson, 1984), using a collection of three Likert scale instruments. Although a total of 195 surveys were returned, only 189 were considered valid, with responses entered for all items, for a final response rate of 63%. All participants who returned a survey received a diskette containing lists of Internet-based resources of interest to educators. Network use statistics in the form of network logins and online time, recorded automatically by the Tenet system, were then obtained for the user account names associated with the completed and returned surveys.

-METHODS

The study investigated statistical correlations between subject attribute and network use variables. Subject attribute variables consisted of three apprehension or anxiety measures: (a) writing apprehension, (b) oral communication apprehension, and (c) computer anxiety; and three measures of experience: (a) teaching experience, (b) age, and (c) telecomputing experience. Data available to represent network use included total network logins and total network online time for a 12-month period beginning in September 1993 and ending in August 1994. All six of these variables were represented by interval level data. Various subgroup analyses were also completed using nominal level demographic information--such as gender, professional specialty, and teaching level--to investigate any relevant patterns related to network use.

The three apprehension variables were measured using well-accepted, reliable, and well-validated instruments. Writing apprehension was measured using the Daly-Miller Writing Apprehension Scale (Daly & Miller, 1975a). This instrument produces a score that can range from 26 to 130, with larger numbers reflecting greater levels of writing apprehension. The scale consists of 26 statements that reflect apprehension toward the writing process and asks respondents to mark their level of agreement with each statement on a five-point Likert scale.

Oral communication apprehension was measured using the Personal Report of Communication Apprehension (PCRA) developed by Richmond and McCroskey (1992). This instrument consists of 23 statements related to a person's oral communication apprehension, such as "I'm afraid to speak up in conversations." Respondents indicate their level of agreement or disagreement on a

five-point Likert Scale, to produce a score ranging from 23 to 115, with higher scores representing greater oral communication apprehension.

Computer anxiety was measured using the Computer opinion Survey (Mauer & Simonson, 1984; Simonson, Mauer, Montag-Torardi, & Whitaker, 1987). This instrument produces a score ranging from 26 to 156, with higher scores representing greater levels of computer anxiety. Respondents indicate on a six-point Likert scale their level of agreement or disagreement with 26 statements that reflect their personal levels of anxiety about the use of computers.

RESULTS

The 189-subject sample participating in this study showed relatively high levels of network use, with means of 186 logins and 2,528 min for the year. The variance within each use category was also large, with a standard deviation of 360.3 for network logins and 4,844 min for online time.

The analysis of statistical correlations between network use and subject attribute variables was conducted using an eight variable matrix of correlation coefficients (Pearson's Product Moment correlation). This matrix consisted of pairwise correlations for all eight interval level variables, including the two network variables of total logins and online time; the three apprehension variables of writing apprehension, oral communication apprehension, and computer anxiety; and the three experience-related variables of teaching experience, age, and telecomputing experience. The pairwise correlation matrix, with individual significance levels, is provided in Table 1. Descriptive statistics for these variables are provided in Table 2.

Correlations with the three apprehension variables indicated that only writing apprehension was significantly related to total network logins, $r = -.19$, $p < .009$, and total online time, $r = -.15$, $p < .046$. Both correlations were negative, meaning that higher apprehension scores were associated with lower login frequency and online times. Writing apprehension was also significantly correlated with oral communication apprehension, $r = .52$, $p < .001$, and computer anxiety, $r = .17$, $p < .023$. As would be expected, total network logins and total network online time were strongly correlated with each other, $r = .78$, $p < .001$.

Like the teachers responding to Honey and Henriquez's (1993) survey, the general experience level indicated by this sample was relatively high, with a mean age of 44.5 years for the group, and with 51% of the sample having more than 15 years of teaching experience. Seventy percent of the sample had two or more years of telecomputing experience. However, telecomputing experience was the only experience-related variable to be correlated with a network use variable (total online time: $r = .16$, $p < .034$). As might be expected, a significant pairwise correlation was also found between teaching experience and age, $r = .45$, $p < .001$, indicating that more years of teaching experience were generally associated with older subjects. The significant correlations (at $p < .05$ levels) first presented in Table I are illustrated in Figure 1.

Additional subgroup analyses were also conducted, related to the three apprehension variables, to further examine trends within that data. The range of possible scores on each instrument was divided into thirds, representing relatively high, medium, and low apprehension or anxiety levels. Subgroups of subjects in each third were then examined both descriptively, by use of means

related to network logins and online time, and statistically, generating additional pairwise correlation matrices within each subgroup, and checking for significance with ANOVAs. No subgroup correlations inconsistent with the full group analyses were revealed by these calculations. The means of each subgroup for each of the three apprehension variables are presented in Figures 2 and 3.

Subgroup patterns illustrated by Figure 2 (network logins) and Figure 3 (online time) are consistent with each other and further illustrate the negative correlation that exists for this sample between writing apprehension and network use. The graphs show a general increase in network use as writing apprehension declines. However, the differences between the means of the three groups, as examined by analysis of variance, were not significant at the .05 level for either network logins, $F = 2.32$, $p < .1014$, or for online time, $F = 2.45$, $p < .0893$. An examination of differences among the three writing apprehension subgroups were complicated by the relatively different sample sizes in each (e.g., high writing apprehension, $N = 5$; medium apprehension, $N = 69$; low writing apprehension, $N = 109$), and by writing apprehension's relatively high overall correlation with oral communication apprehension, $r = .52$, $p < .001$).

A first-order partial correlation analysis was conducted to examine the relationship of writing apprehension to network use after controlling for differences in the oral apprehension levels of the subjects. Partial correlation analysis controlling for subject oral apprehension showed significant correlations of writing apprehension with both network logins, $r = -.14$, $p < .034$, and online time, $r = -.17$, $p < .009$. Additional partial correlation analyses showed the reverse was not significant, verifying that when subject writing apprehension was controlled, oral communication apprehension was not significantly related to either network logins, $r = .021$, $p < .42$, or online time, $r = .02$, $p < .41$. Similar results were found for computer anxiety, with a significant relationship identified for writing apprehension, when controlling for computer anxiety, with both network logins, $r = -.18$, $p < .007$, and online time, $r = -.14$, $p < .01$. Again, no significant correlations were found for computer anxiety when subject writing apprehension was controlled, with either network logins, $r = -.06$, $p < .217$, or online time, $r = -.05$, $p < .242$.

Auxiliary analyses also investigated potential differences in other attribute variables, including gender, teaching level, and teaching area. Approximately equal network use means were found for teaching level and area, but gender-related means were different. Males in this sample showed an online time mean of 3,235 min and a login mean of 205 logins per year, as compared with means of 2,135 min and 186 logins for females. However, an analysis of variance showed that this difference was not significant for either network logins, $F = .7310$, $p < .119$, or online time, $F = 2.1578$, $p < .144$. Finally, because data were available for monthly use as well as yearly totals, monthly online time and login means were also examined, indicating relatively consistent use by the subjects during the 12 months for which data were gathered.

DISCUSSION

One of the more interesting results of the study was the relationship between subject writing apprehension and network use. The negative correlation with total network logins suggests that subjects reporting higher levels of writing apprehension tended to log into the network less often. In addition, the negative correlation for total network online time would also suggest that higher

writing apprehension was related to less online time. This trend was not suggested for either of the other two apprehension or anxiety-related variables, with no significant correlations found for either oral communication apprehension or computer anxiety with network usage.

The login variable would seem to be the more important variable to consider when examining network usage. Some of the participants in this sample have "direct connect" network hookups (often in the form of LAN-to-T1 or 56 kilobyte-per-second dedicated line connections), as contrasted with voice line and modem hookups. Subjects with direct network connections to Tenet may have stayed online longer than subjects using modem connections (which automatically terminate on this system after 5 min of keyboard inactivity), while not actively using the network. Thus, this variable may be artificially inflated by the direct connection work habits of some users.

Although correlational analysis showed that oral communication apprehension and computer anxiety were both related to writing apprehension, the data in this study do not suggest that they were directly related to network usage. First-order partial correlation analysis, in addition to the correlation matrix shown in Figure 1, suggest that writing apprehension is the main apprehension variable examined that affected network use. It is interesting to note that, unlike the results reported here, another study observed a small but significant positive relationship between oral communication apprehension and computer anxiety among undergraduate students (Carlson & Wright, 1993).

The correlational and partial correlational patterns found within the study's results confirm the relative independence of the three apprehension or anxiety constructs examined: (a) writing apprehension, (b) oral communication apprehension, and (c) computer anxiety, as measured within this study. The fact that only writing apprehension was related to the two network use variables, and that first-order partial correlational analysis was able to confirm the relative independence of these variables, suggest that they are each indeed different constructs. This conclusion was also reported by Daly (1977), who found that writing apprehension was factorially separate from trait anxiety, receiver anxiety, and oral communication apprehension.

The observed relationship between writing apprehension and network use, in contrast to no observed relationship for oral communication apprehension, may support the findings of previous research that showed that people using asynchronous telecomputing tools (such as electronic mail and computer conferencing) consider their communications to be more similar to writing notes than to talking face-to-face (Severinson-Eklundh, 1986, cited in Lea, 1991), but less formal than communication that occurs via written memos and documents (Murray, 1985). It may be that in this particular study, the volunteer subjects viewed their telecomputing experiences as more similar to writing than talking. This would seem particularly possible because of the relatively high levels of teaching experience of the subjects (with 51% having had more than 15 years as an educator), which may have helped facilitate a perception of telecomputing as a substantially different task than the usual oral communication in which teachers daily engage.

It should be noted, however, that the more recent assertions of communications researchers identify telecomputing as a "hybrid" communications medium, located somewhere in the middle

of continua that range from formal to informal and oral to written characteristics. Real-time "chatting" facilities, with which participants can "talk" synchronously by typing, rather than vocalizing, are seen as being more oral and less formal than electronic mail or computer conferencing, which are seen as more formal and more like traditional written communication (Murray, 1985). Yet in one carefully executed study, corporate employees even construed the exchange of electronic mail messages as follows:

being similar to written activities (such as note-writing) on some dimensions (e.g., asynchrony, emotional quality) but similar to spoken, face-to-face communication on other dimensions such as spontaneity. The results suggest that the group of users construed CMC mainly in terms of its attributes as a medium for conversation and social interaction. (Lea, 1991, p. 153)

From an anthropological perspective, this is not surprising. Oral traditions, which typically precede literate traditions, "place emphasis on shared knowledge and the interpersonal relationship between communicator and audience" (Tanner, 1982, p. 2). Literate traditions, in contrast, emphasize the use of words to convey information in a logical manner. When literacy is introduced into a culture, orality is not replaced; the two complement each other, with people using techniques associated with both in different settings. Practices associated with literacy are passed on specifically within the school environment, and in Western societies, literate techniques have been adopted for use in public setting communications (Tanner, 1982). Therefore, it is quite possible that the teachers within this sample--immersed in Western, literate, school-based environments each day--using an education-related network to communicate publicly, see their online activity as more similar to writing than to talking.

Implications

In general, the results of this study point to a relatively high overall use of the Tenet network by the relatively random sample of educators examined in this study, which could paint an encouraging picture for the successful diffusion of such networks in K-12 settings in the future. The results included a mean network use by individual respondent of over 15 logins per month, and a mean online time of over 3.5 hours per month. Such a large number of logins and lengthy online time, from a random sample of 189 users, would suggest that the network is indeed being used actively and frequently by account holders overall.

The lack of an observed relationship with network use for both oral communication apprehension and computer anxiety variables could be perceived as relatively good news, especially to network training specialists, because these variables don't appear to be directly related to subjects' online time and frequency of logins. It may be that adult educators need not be as concerned about a person's computer anxiety or oral communication apprehension as they are about their level of writing apprehension. Such results suggest that structured instruction in online writing fundamentals and/or "netiquette" may merit further investigation and consideration when planning to prepare people to communicate using telecomputing networks. Because high writing apprehensives have been shown to encode messages with weaker intensity, less persuasiveness, and lower perceived quality than low apprehensives (Daly, 1977), attention to the details of communicating online (such as the importance of appropriate tone, use of communications conventions, and message clarity) during training sessions may be well advised.

According to Fox (1980), these aspects of online training would be most efficient if they were designed to be student-centered and collaborative in nature.

The lack of observed relationships between network use and teaching experience or age variables is also worthy of noting. It would appear that neither of these variables have much relationship to the amount of network activity in this volunteer sample. This is in contrast to the correlates with network use of subjects telecommunicating in more structured or restrictive environments, such as semester-long graduate classes (Harris & Grandgenett, 1992; Grandgenett & Harris, 1994). Such a lack of relationship for this set of volunteer users might suggest that, because most educators are now using telecomputing networks voluntarily, rather than as a part of a structured instructional experience, network trainers need not to be overly concerned about the relative teaching experience or age of the individuals being trained as potential contributing factors to their eventual network use. However, telecomputing experience was found to be positively related to greater online time in this study, perhaps reinforcing the notion that providing novices with as much hands-on experience with telecomputing tools as possible is a wise training strategy.

Results of this study would suggest that, with teachers who volunteer to be trained to use computer-mediated networks, initial writing apprehension is an important concern. It would be interesting to examine the relationships among writing apprehension and use variables with an equally large, but less volunteer-oriented, sample than this one, in which the subjects perceive their use of the network to be "imposed" upon them by either work-related or more informal pressures. Results from such a study might provide interesting comparisons with the patterns presented here.

It is apparent that more studies need to be completed to examine the dynamic interplay of personality variables and telecomputing behavior that may evolve as networks become more commonplace in our society. There is little doubt that a new way to communicate is emerging, seemingly substantially different from those of the past. Perhaps as we learn to use such networks, we can also learn a little more about ourselves and how we interact with each other, using the rather remarkable tools of the information age.

Contributors

Judith Harris is an assistant professor of instructional technology in the Department of Curriculum and Instruction at the University of Texas at Austin. Her current teaching and research interests include instructional applications of and professional development with Internet-based telecomputing for educators, the analysis of online conversations among adults and children, and emerging trends in the design of contexts and roles for computer-mediated teaching and learning. Dr. Neal Grandgenett is an associate professor of mathematics education in the Department of Teacher Education at the University of Nebraska at Omaha. His research and publication interests include teacher characteristics related to telecomputing and the support of mathematical reasoning through technology-based activities. He is currently directing several grant projects that are examining the use of the Internet in K-12 schools in Nebraska. (Address: Judith B. Harris, Department of Curriculum and Instruction, 406 Sanchez Building, University of Texas at Austin, Austin, TX 78712-1294; e-mail: jbharris@tenet.edu; ph. 512/471-5211.)

Table 1
Correlations Among Study Variables

	Total Logins	Writing Apprehension	Communication Apprehension
Total Online Time	.7795 [*](p<.001)	-.1480 [*](p<.046)	-.0617 (p<.407)
Total Logins		-.1939 [*](p<.009)	-.0878 (p<.237)
Writing Apprehension			.5528 [*](p<.001)
Communication Apprehension			
Computer Apprehension			
Subject Age			
Teaching Experience			
	Computer Apprehension	Subject Age	Teaching Experience
Total Online Time	-.0734 (p<.323)	.0572 (p<.443)	.0292 (p<.771)
Total Logins	.0861 (p<.247)	.0521 (p<.485)	.0278 (p<.725)
Writing Apprehension	.1661 [*](p<.023)	-.0721 (p<.328)	-.1198 (p<.123)
Communication Apprehension	.1066 (p<.146)	-.1257 (p<.087)	-.1284 (p<.098)
Computer Apprehension		.1024 (p<.134)	.0142 (p<.856)
Subject Age			.4520 [*](p<.001)
Teaching Experience			
	Telecomputing Experience		
Total Online Time	.1606 [*](p<.034)		
Total Logins	.1129 (p<.138)		
Writing Apprehension	-.1208 (p<.108)		
Communication Apprehension	-.1373 (p<.068)		
Computer			

Apprehension	-.1419 (p<.059)
Subject Age	.0121 (p<.873)
Teaching Experience	-.0526 (p<.510)

Table 2

Descriptive Statistics for Study Variables

	Total Online Time	Total Logins	Writing Apprehension	Oral Apprehension
Mean	2,556.78	186.91	59.32	54.71
SD	4,844.02	360.33	18.21	15.06
High	44,038.00	2,825.00	112.0	92.00
Low	0.00	0.00	26.00	23.00
Range	44,038.00	2,825.00	86.00	69.00

	Computer Apprehension	Subject Age	Teaching Experience	Telecommuting Experience
Mean	43.01	44.53	12.95	2.17
SD	13.46	8.54	4.46	1.59
High	92.00	67.00	16.00[*]	8.00[*]
Low	26.00	22.00	0.00	0.00
Range	66.00	45.00	16.00[*]	8.00[*]

Note: [*] Indicates an actual range possibly higher than shown, due to survey item texts. Total online time is measured in number of minutes. Total logins are measured as number of logins. Writing apprehension, oral apprehension, and computer apprehension are measured by text scores. Subject age, teaching experience, and telecomputing experience are measured in years.

DIAGRAM:Figure 1. Relationship Among Variables

GRAPH:Figure 2. Mean logins by apprehension subgroup

GRAPH:Figure 3. Mean online time by apprehension subgroup

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