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ABSTRACT

The ways that early adopters of electronic messaging have used electronic mail (e-mail) in the schools were studied using the Unified Network for Informatics in Teacher Education (UNITE) system at the Instructional Technology Center of the University of Kansas. At the time of the study, UNITE was operating in 6 school districts and 16 schools. The UNITE system provides other services of access and planning, but the e-mail functions were the focus of the study. A network analysis was conducted of one-to-one messaging on the e-mail system, with the permission of 65 volunteer users. The largest group of e-mail users was the science teachers (36 percent of the users). The most avid users were the librarians, representing about 24 percent of the users, who corresponded with more individuals and sent more messages. It was evident that constraints on the time of teachers limited their uses of the system. Time, accessibility, and existing routine discouraged teacher use of e-mail and must be considered in any strategy to promote its use. (Contains 22 references.) (SLD)

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Networking on the Network: Teachers and Electronic Mail

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The new communication technologies of computer-mediated communication (CMC), including electronic messaging (commonly called E–mail), are now coming into the early stages of adoption in elementary and secondary schools. Initially computers were often adopted for instructional purposes, and now their instructional use is becoming extensive (Cuban, 1986). They are increasingly finding a new use: communication networking. (See McCarthy, 1989, for a discussion of student networking; West, Inghilleri, McSwiney, Sayers, & Stroud, 1989, for a technical report on an electronic network for teachers; and McAnge, 1990, for a directory of computer networks and networking projects for teachers.) As with many new electronic technologies, there is little if any argument that their eventual widespread use is inevitable (Huber, 1984), partly because within organizations, use of computers for one purpose encourages further computer use (Salem and Gratz, 1989).

Schools and computer communication

The school culture into which CMC is being introduced is one that faces numerous and profound difficulties of communication. Jackson (1968) found that many teachers had "a desire to draw more heavily than they presently do on the services of other specialists within the system--such as music and art teachers" (p. 133). Some social or institutional barrier against a greater degree of interchange and collegiality is implied by this desire--and its lack of fulfillment. Feiman-Nemser and Floden (1986) found that teacher isolation was a reality, and teachers' interactions seldom included discussions of work or collaborations on shared problems. Lortie (1975) described schools as having "separate cells" (p. 14) in which teachers worked, with "gaps in interpersonal support" (p. 73). Almost half (45 percent) of Lortie's respondents said they had no work-related contact with other teachers, and nearly a third (32 percent) had "some" (p. 193). Teachers spend inordinate amounts of time compartmentalized away from other adults, surrounded only by students (The Holmes Group, 1986; Sarason, 1982). Cusick (1981) noted that teachers were isolated in their classrooms and lacked common values regarding student behavior; he found that the schools had no force serving to build consensus.

Some of the above communication inadequacy would seem to be particularly susceptible to solution by electronic mail. E–mail is fast. Even relatively slow E–mail systems that "store and forward" messages, resulting in overnight delivery, are much faster than hard-copy personal letters and memos. E–mail is asynchronous, meaning it can function when communicators are separated by distance and are not attending to the exchange at the same time (Rogers, 1988), unlike other rapid forms of electronic media such as the telephone. Computer networks have already had demonstrable effects on business, including encouraging communication between individuals who are in dispersed locations; they have the general effect of overcoming the limitations of time, spatial distance, and interaction with the organizational hierarchy with which communication media must deal (Rogers, 1988). Taylor (1986) theorized that CMC would encourage horizontal contacts (those outside the normal superior-subordinate relationship within departments), and would fundamentally challenge and change organizational structure, creating a freer, less hierarchical organizational structure. Communication mechanisms such as electronic mail, which help overcome the logistical difficulty of teacher interpersonal communication, may

have a considerable impact on the overall type and quantity of communicating teachers do with each other.

Information potential of communication

Generally, people who are homophilous (belong to the same group, as in religion, ethnic background, profession or other categorical variable) have stronger relationships with each other than those who are heterophilous (not alike on the categorical variable of interest) (Granovetter, 1973; 1982). According to the theory of the "strength of weak ties," there is a price to be paid for having strong ties: They do not allow for as much transmission of innovative and novel ideas as weak ties (those between individuals who are less similar).

Granovetter argued that a person ("Ego") will have friends (to whom Ego relates closely) who are more likely to know each other well than are Ego's acquaintances (to whom Ego relates less closely) -- and therein may lie a type of social inbreeding of ideas. Ego's close friends form a relatively dense clump, but Ego's acquaintances probably have their own close friends, and thus their own dense clumps of social ties different from Ego's. People with few acquaintances, under the theory of the strength of weak ties, get less information and input from people other than their close friends, and thus may have a more provincial store of news and opinion to draw from (Granovetter, 1982).

Put in more formal terms, the strength of weak ties means there is a higher information-exchange potential in dyadic communication when the communicators are heterophilous (Rogers & Kincaid, 1981). People are more likely to find out something new and useful from someone who comes from a bit of a different background.

Within the world of education, then, contacts should be encouraged between teachers who come from different content areas, since contacts within content areas have less information potential than those that are cross-disciplinary. For example teachers in English or foreign languages should derive utility from ideas and methods used in science, methods they are unlikely to encounter without contact with science teachers. But teachers' personal communication networks, according to the above-cited literature, do little to encourage or accomplish much interchange at all, and Rohland (1985) found teachers interact most often with those who are nearby, and in the same teaching content discipline -- in other words, most relationships are homophilous in terms of teaching content area.

Research questions

Since adoption of electronic messaging has begun in schools, the time was ripe for a study of the uses to which early adopters put E-mail. Early adopters of new technology can play a very influential role in the ultimate uses to which the technology is put. The study looked for evidence that electronic mail encouraged contact between teachers in different content areas, indicating the potential for a change in the personal networking patterns of teachers that would ease the transmission of novel ideas and teaching approaches.

- Who were the early users of E-mail among teachers and how were they using it it?
- How did the amount of usage break down by teaching content area?
- How much messaging went on within and between content areas?

UNITE System

The system studied was UNITE, the Unified Network for Informatics in Teacher Education (UNITE) system at the Kansas University Instructional Technology Center, a computer-mediated communciation system involving hypertext. UNITE, at the time of this study, was operating in six school districts and

16 schools in eastern Kansas. In nearly all cases, there was one UNITE terminal in each school. Most of them were located in the school library, a department office, or some work area accessible to numerous teachers.

UNITE is written in HyperCard and has two major components: an electronic mail system, and what are called dynamic resources, which take the form of a hypertext shared database of administrative information, computer courseware, lesson plans, and research in a broad spectrum of academic content areas. The system's original design was primarily centered on making the dynamic resources available to teachers, and the electronic mail component was added to the system to make communication easier between users of the resources and between users and system developers.

Teachers can access information in the dynamic resources, add lesson plans and evaluations, and contribute abstracts of pertinent articles and research, but it is the electronic messaging system that is of interest to this study. Teachers can use the E–mail system to send one-to-one messages (identifying other specific individuals on the system), or one-to-many messages. One-to-many message senders may identify either the members of special interest groups (SIGs) (for example, Science Teachers or Message System Critics), or they may send a message "to all," which targets everyone who has a UNITE electronic mailbox.

It is important to note that, while the UNITE E–mail system was originally intended to play a subordinate role to the development of the dynamic resources, it took on a life of its own very early in system development, and many if not most of the messages posted (including general one-to-many and individual one-to-one messages) concerned topics divorced from dynamic resource development. This substantiated E–mail's ability to serve a need and fill a niche in educational communication.

A further important descriptive point about the UNITE environment: The communication that took place on the system was almost entirely ad hoc, since no formal structures or training for using the system were implemented. UNITE's graphical user interface was designed for ease of use (in stark contrast to most mainframe electronic mail systems such as run E–mail at most universities); technical support and training for new users was minimal, and many users simply logged themselves on, followed directions to establish their own password, and used the system on their own. Some support was clearly available from teachers who got involved in the project early on and encouraged others to join in, but that support was entirely informal and in many schools virtually nonexistent. Thus, electronic communication on UNITE was virtually unguided and uninfluenced by any particular networking strategy beyond a desire to provide an environment in which teachers could easily get E–mail messages to each other. (See Aust, 1991, April; and Aust and Klayder, 1990, February, for discussions and descriptions of UNITE by the system's developers.)

Method

A network analysis was conducted of one-to-one messaging on the UNITE E–mail system. A core of volunteers was recruited and their permission obtained to study to whom they sent messages and from whom they received them. The researcher was not given access to the actual content of the messages, but all volunteers answered a questionnaire that characterized their contacts as professional or social in nature. The who-to-whom messaging data were gathered electronically and unobtrusively from the hub of the UNITE system according to guidelines and procedures suggested by Danowski (1983).

The amount of messaging was measured; the emergent (informal) communication groups that formed on the system were identified using a computer program called NEGOPY (Richards & Rice, 1981), which has been recommended

as a de facto standard for cluster analysis (Rogers & Kincaid, 1981). Where messages moved in only one direction, resulting in an unreciprocated communication relationship, the program dropped links to force reciprocation. The messaging within and between teaching content areas was compared using chi–squares with links formed as dependent variable.

Finally, subjects in the study filled out a questionnaire that included closed-ended items about user demographics, computer literacy, and access to the system, along with open-ended items concerning why they used the system and what they got out of it. These responses were analyzed somewhat informally, but produced some useful information in light of the communication structures identified by the network analysis.

Results

Sixty-five UNITE system users agreed to participate in the study; 42 of them (65%) used the E–mail system either to send or receive one-to-one messages; 32 (49%) were message senders.

Content areas: The largest group of E–mail-using teachers was the science teachers (15 or 36%), with a substantial contingent of librarians and educational communication specialists (10 or 24%); there were also university/adult education teachers (6 or 14%), general elementary teachers (5 or 12%), and 6 (14%) miscellaneous others.

Messaging sending: Easily the most avid users of the E–mail system were the librarians. They corresponded on the system with more individuals than non-librarians (an average of 4.8 links per librarian, compared to 2.5 for all other E–mail users) and sent more messages (an average of 56.6 compared to 8.5).

Those who had a UNITE terminal on their desk, in the same room, or in a nearby room ($n = 21$) sent significantly more messages than those for whom the terminal was not so close ($n = 21$) (Mann-Whitney test, $U = 145.0$, $W = 376.0$, $Z = 1.9212$, $p < .05$).

Cluster analysis: Two groups of ad-hoc communicators emerged on the UNITE E–mail system. The larger group was fairly heterogeneous while the smaller was entirely made up of librarians.

GROUP ONE (N=14)		GROUP TWO (N = 5)	
Science	5	Library/Ed Comm	5
University/Adult	4		
Gen'l Elementary	3		
Library/Ed Comm	1		
Other	1		

Crosstabulation: A content-area by content-area chi-square of links formed found that teaching content area was a significant constraint on communication. The chi-square value (124.47, df = 30) was significant at the $p < .01$ level. The adjusted residuals for the cells denoting communication by librarians with librarians, and elementary teachers with elementary teachers, were significant at the $p < .05$ level. In other words, librarians formed more links with librarians and elementary teachers formed more links with elementary teachers than would be predicted by chance.

Discussion

Message sending, the emergence of informal groups, and communication between members of pre-existent groups all indicate that librarians were at the center of electronic messaging on the UNITE system, and most communication

occurred between teachers who came from the same teaching content area. This study does not provide evidence that the communication networks teachers form on an electronic mail system will differ significantly from teachers' face–to–face communication networks, both being dominated by contacts with other teachers in the same content area. Networking itself did not appear to encourage an increased volume and richness of information flow between teaching content areas. To accomplish that goal, deeper, underlying strategies to encourage cross-disciplinary communication appear to be needed.

As a basis for future studies to establish appropriate strategies for improving the educational communication process, it is useful to look at three factors that emerged from the network analysis and from teachers' responses to open-ended questions about their use of the UNITE E–mail system.

Time: From open-ended responses to the questionnaire, it was apparent that constraints on teachers' time put constraints on their use of the system, even though the system's dynamic resources component is designed to save teachers time and effort in the long run. Overall, teachers and librarians expressed frustration with the lack of time they had to take care of their normal duties, let alone familiarize themselves with the computer system. Many simply did not see what they would get in return for time and effort invested in using UNITE. Librarians have greater leeway in how they structure their time, with less of it devoted to direct, disciplinary supervision of classes, and thus were better able to devote attention to UNITE than were classroom teachers. This, in part, explains the higher levels of use of the E–mail system by librarians than other teachers. They simply had more time available for attending to it.

Accessibility: This study was consistent with other research that showed that the physical accessibility of a terminal is a major determinant in who will use it (West, Inghilleri, McSwiney, Sayers, & Stroud 1989; Steinfield, 1986). The farther away the terminal, the fewer the overt opportunities to use it, and in some broader sense the less the encouragement to use it. The placement of shared hardware and resources such as UNITE terminals is clearly a major issue in designing instructional support systems.

Librarians again benefited from the way UNITE was implemented in the schools. Many UNITE terminals were located in school libraries as a compromise to allow as many teachers as possible to get relatively equal access, and a few others were located in departmental offices or elsewhere in the school building.

Routine: A clear factor indicated by librarians' responses to open-ended questions was the degree to which networking on UNITE fit easily into their daily routines, above and beyond the above-mentioned factors of time and accessibility. Several librarians (and other teachers) pointed out that librarians normally keep in touch with other librarians on a fairly regular basis to help locate and share instructional materials. The most common example was phoning around to locate books to request for interlibrary loan. Much of this activity translated directly to E–mail; E–mail probably encouraged an increase in communication in general among librarians because they were already in the habit of networking and UNITE gave them another mechanism for doing it. Librarians were among the early users of UNITE and some of them were the system's biggest boosters.

For other teachers, electronic mail did not fit into the daily routine with the same ease. While nearly all of the teachers who participated in this study were computer literate, hardly any of them indicated that they used computers for word processing, figuring grades, or other daily instructional management tasks. They had no computer on their desk. UNITE represented a form of computer that was "over there somewhere," not part of what they normally did to prepare lessons. The daily routine does not yet include the use of computers for familiar tasks, so the use of computers for relatively novel tasks remains unexplored. One of those

unexplored tasks is the use of computer-mediated communication for expanding teachers' personal networks beyond their usual spheres to include contacts from varying disciplines with potentially novel approaches to instructional tasks and problems.

In some way all three factors -- time, accessibility, and routine -- discouraged adoption of computer-mediated communication by teachers in general at the time of this study, while at the same time the use of the system by librarians demonstrated its promise and usefulness. At such time as teachers do become routinely familiar with computer use, electronic mail could play an expanding role in educational communication, and it may well yet encourage communication between teachers in different teaching content areas, creating a genuinely new and optimally useful set of professional contacts. But the introduction of computers for E–mail and other electornic communication in schools by itself may be insufficient to encourage cross-disciplinary communication. Specific strategies should be carefully considered prior to implementation of any electronic mail or other CMC system for it to reach its full potential in enriching the communication environment of the school.

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