SUPPORTING EDUCATIONAL USES
OF TELECOMMUNICATION IN THE
SECONDARY SCHOOL:
PART II STRATEGIES FOR
IMPROVED IMPLEMENTATION

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ABSTRACT
Telecommunications as a medium offers many educational possibilities in the secondary school. In the first article in this two-part series, various experiences with the educational use of "computer-mediated communication" (CMC) and with on-line data bases were summarized from the perspective of increased understanding of the problems that prevent telecommunications use from being more widespread in secondary education. In this, the second article in the series, various strategies for better support of telecommunications implementation in secondary schools will be examined and predictions concerning the likelihood of these strategies leading to increased and effective use of telecommunications in the secondary school will be offered.

Introduction

What is telecommunications?
In Part I we defined telecommunications in a simple way, as meaning "communicating across distances" ([1], p. 4). We also limited our analysis to two general categories of currently available applications of telecommunications in secondary schools: (a) for computer-mediated communication (CMC), and (b) for access of off-site collections of electronically stored information (on-line data bases). We noted that there may often be overlap in these categories. Students may, for example, use CMC to cooperate in the development of a data base that can then be accessed on-line by themselves or others, for social or scientific investigations. CMC can involve one-to-one communication through informal messaging using "e-mail"; or through teacher-to-student exchanges, perhaps informally, using e-mail or electronic "bulletin-boards". There can also be "many-to-many" communication: informally, for example, through bulletin boards or student created joint reports or more formally, through teleconferenc-
ing. The central idea in each instance is that individuals do not have to be in the same place as other individuals or groups or sources of information in order to make educationally oriented contact through electronic means.

**Current trends**

In the analysis of the literature in Part I we summarized various trends about CMC and on-line data base use in secondary schools. The major points of this summary were that (a) some educators are highly enthusiastic about the use of telecommunications in secondary education, but the majority of educators are as yet showing no interest in it, and (b) although problems with hardware, software, telephone line connections, and network connections are serious deterrents to the spread of telecommunications use in secondary schools, less-tangible "second-order" factors also critically affect the educational use of telecommunications. These less-tangible factors relate to the many pedagogical and managerial challenges associated with the use of CMC and on-line data bases in the secondary school setting.

In Part II we will examine various strategies for lessening the impact of these pedagogical and managerial problems, in particular, (a) suggestions to teachers for instructional management, (b) support resources for teachers, such as teacher-oriented bulletin boards and simulation software to help teachers become familiar with telecommunications software, and (c) inservice training for teachers. We will then conclude with a general prediction of the likelihood that various combinations of these strategies will indeed lead to more and better use of telecommunications in the secondary school instructional setting.

**Instructional Management of Telecommunications Use**

**Management strategies for CMC use.**

In Part I we saw that various pedagogical and organizational problems confront teachers who try to use telecommunications for CMC or on-line data base searching. With CMC, it was established that the communication needs a goal (seen as valuable by all those concerned) and a structure, and that there must be accepted leadership and procedures among those communicating. Coupled with this are problems of managing student access to telecommunications resources in order to do the communicating. Thus, CMC use in education involves much more than the "threshold" problems of giving teachers and students the computer-related knowledge and opportunity to use a CMC system. Technical support is a necessary but not sufficient condition—didactic, social, organizational, and even linguistic issues must also be addressed, especially if the communicating is to take place among students from different areas or countries. Given this, it is interesting that very little appears in the literature in the line of fully worked out, concrete suggestions for teachers relative to educational structuring of CMC activities. There are some practical guidelines available. For example, Andress-Syer and Jacks [2] give a global strategy for planning and implementing a "telelesson" involving CMC in the school setting and their suggestions include
pedagogical and social as well as technical considerations. Andres, the editor of a newsletter for members of the "Free Educational Electronic Mail Network" a network of over 90 educationally oriented electronic bulletin boards in the USA and Canada (with one node in Argentina) frequently makes practical suggestions for educational CMC users [3]. She recommends, for example, that valuable time in the classroom can be saved by:

1. Answering all but brief messages off-line; save to disk and upload the file.
2. Describing the subject of the message as descriptively as possible.
3. Indicating by name, who the message is going to, and from who and from where it was sent.
4. Restating the question being answered before answering.
5. Acknowledging each message you receive.
6. Checking your e-mail at least once a week.
7. Giving as much information as possible about the length and contents of files being sent so receivers can anticipate how long it will take to retrieve the file" (pp. 1-2).

As another example, the founder and U.S. director of an international telecommunications network ("Computer Pals") involving hundreds of schools in more than 20 countries has suggested a "code of ethics" for those involved in educational CMC partnerships [4]. The code includes the following:

1. Establish a strong relationship between the teachers involved... a solid understanding of each other's expectations and time lines, and
2. Make a commitment among participating teachers that they should be in contact with each other at least once per week and that they can rely on a certain day during each week when messages can be checked" ([4], p. 15).

Similarly, the director of Canadian participation in this same CMC network has identified "keys to a successful (CMC) project" as (a) well defined projects, selected as being meaningful, interesting, and real for the participants, and (b) having agreements among all involved to communicate frequently and at regular times [5].

The "Kids Network" [6] is a good example of how management guidance for teachers can be coupled with curriculum-relevant lesson ideas. The project is well moderated, builds CMC around curriculum-specific tasks (for example, measuring the amount of acid rain in the neighborhoods of participating schools throughout the world during a limited time period and communicating these data to a common collection of information), gives teachers carefully developed lesson materials, and even supplies especially designed user interfaces for the telecommunications software used in the project. However, even with this level of thoughtful (and expensive) central support, a field test in 32 Kids-Network schools in 1987 showed a wide variety of levels of "success" among the participating schools in terms of reaching the scientific goals of the CMC interaction (to contribute information about local acid rain conditions to a central data base and to make use of the information exchanged through the CMC in order to look
for trends or cross-site comparisons). The researchers concluded that "perhaps the most important finding was that there was a strong relation between the way teachers used the (lesson) material, and the extent of the students' interest, participation and learning" (in the CMC activities) ([6], p. 10). TERC is now developing a teacher training package that includes a video tape with ideas for a curriculum integration, management of cooperative learning, and strategies to obtain local support for participation in CMC activities. The implementation team however predicts that a major area of difficulty for sustained, meaningful use of the "Kids Network" CMC activities is the problem of how to supply sustained teacher assistance at the local and classroom level. How to handle instructional integration and student and time management will remain critical questions. Print materials or "one-shot" training sessions do not provide enough guidance when an educational innovation is involved ([6], [7]), for technical, psychological, and pedagogical reasons.

**Instructional strategies for on-line data base inquiries.**

We saw from the literature in Part I that it is difficult for students to make effective use of data bases, on site or on-line. Aside from the intellectual challenges involved in asking good and appropriately formed questions when confronted with large collections of information, organizational problems of how to manage multiple-student use of a single telecommunications system and a sometimes-costly connection to an on-line data base also make such activities very difficult for teachers. Some educators are developing lesson strategies for teachers, similar to those that Andres-Syer and Jacks [2] have done for CMC, to help improve both the pedagogical and organizational aspects of school use of on-line data bases. Teague, Teague, and Marchionini [8], for example, describe such a lesson in detail and conclude with various practical suggestions such as:

1. Make sure that the teacher him- or herself is "very comfortable" with the entire telecommunications system before guiding students in its use,
2. Provide extensive paper-and-pencil and blackboard simulations of data base searches and telecommunications use before real on-line access occurs,
3. Ensure that an uninterrupted phone-line will be available when searching will occur,
4. Demonstrate the actual searching to all the students, (preferably using a projector that can amplify what is on the computer screen through an overhead projector),
5. Organize students to work in pairs when they do their on-line search, in order that they can assist each other, and
6. If at all possible, have a trained aide available if the teacher is not present (p. 10).

Similarly, Dodge and Dodge [9] also give practical suggestions for "readiness activities" that can be done without a computer to prepare students for on-line searching (and for CMC activities). Lodish and Caputo [10] describe a similar, gradual development of ideas prior to an actual on-line search. However, such
practical but insightful lesson ideas are still very unusual in either the literature about telecommunications use in secondary schools or in the in service sessions which are occasionally available to teachers.

Teacher Support Strategies for Telecommunications Use

Providing teachers with models of how they can manage telecommunications use in their classrooms is very much needed, but little available. As noted, the Kids Network project has developed videotapes of classroom implementation ideas for the use of the Network [6] but little else of this type of management modelling seems to be available. There are, however, at least three other types of media-related possibilities for teacher support with regard to managing instructional telecommunications use. The first two—simulation software so that teachers (and students) can practice off-line before actually dealing with an on-line situation, and telecommunications software especially designed for educational use—offer nothing in themselves to help teachers deal with the organizational and pedagogical problems involved in trying to use telecommunications during instruction, but the third—electronic bulletin boards for teachers—can be a source of helpful ideas.

Simulation software.

A support strategy to help teachers and students new to telecommunications that is now found in a number of locations is the use of software that simulates telecommunications software so that teachers and students can, off-line, become familiar with the use and feel of telecommunications for either on-line searching or CMC [1]. Teague, Teague, and Marchionini’s ideas [8] for paper and pencil or blackboard simulations anticipate this kind of preparation, but a number of examples of electronic off-line simulations are now available. Andres-Syer [11] through the FredMail network offers a free “modemless CMS” to teachers, through which teachers and students can be trained how to log on and do some fundamental telecommunications maneuvers. Gittinger [12] describes in detail a simulation program, “SimuComm”, that simulates telecommunications software, an e-mail service, bulletin boards, and on-line data bases. There is also a tutorial available within the software. This simulation program has been extensively used in teacher training as well as in schools. Dodge and Dodge [9] describe several other simulation software packages: “Electronic Village”, “Electronic Mailbag”, “Kid Mail”, “ERIC MICROsearch”, and “Information Connection”. All are inexpensive and are publicly available. In The Netherlands, the Dutch telephone company has developed simulation software to be used by teachers participating in the “Computer Journal” multi-media activity so that they can familiarize themselves with the telecommunications software that has been especially developed for the activity before they attempt to use the actual software on-line [13].

User-Interface Improvements.

The Dutch example illustrates another approach to improving the ease with
which teachers and students can make use of telecommunications for educational purposes. The telecommunications software itself can be improved or redesigned so that the user interface better anticipates teacher and student needs. Many of the suggestions made in the literature regarding students’ use of on-line searching focus on improving the user interface of the software used for the search activity. Callison and Daniels [14] note that “the intent of end-user software is to give clear steps for conducting or developing a search...or restructuring the given terms from the searcher and formulating a search strategy” (p. 174). They then give a detailed description of the user interface for the “WiseSearch” menu-driven telecommunications software used in their study and conclude that this user interface was effective for their secondary-school student users.

In the framework of matching the user interface to the characteristics of the instructional user, Bork, Ibrahim, Laustsen, and Levrat [15] have developed a design for a three-level user interface for educational users of electronic mail — the complete novice, the casual user, or the experienced e-mail user. The same strategy could be applied to the design of a user interface for educational users of on-line data bases.

Some other specific suggestions have been made concerning the design of the user interface for educational use of telecommunications, both for CMC and for on-line data base searching. The Kids Network project reports good results from the use of an especially designed icon-based menu to support educational use of telecommunications ([6], pp. 15-17). McGraw-Hill, a U.S. company offering telecommunications services to schools, indicates that such telecommunication software should be menu-driven (so that commands do not have to be remembered), should have some macro-building capacity so that frequently-used commands can be quickly accessed, and should have a scrolling buffer is present, so that “backing up” to early screens is possible ([16], pp. 45). Doyen and Wheeler [17] studied the effectiveness, for on-line educational data bases, of an on-line subject-headings list, pop-up windows that contained system commands, and an on-line help system as components of the user interface for an online search system for educational use. They found that the on-line subject-headings help feature failed to be a help for the majority of their subjects, many of whom seemed to be confused by it. Also, most subjects failed to go deeply into a sequence of commands or help windows, and only minimal use was made of optional on-line help. “Apparently, users prefer to try self-generated alternatives rather than to access and read on-line documentation...They consider help a diversion from their goal” (p. 178).

In contrast to Doyen and Wheeler’s poor results with on-line help as a component of telecommunications user interfaces for educational use, other teams have found more positive results. Walker, Young, and Mannes [18], for example, in a yearlong study found users did take advantage of on-line help for an on-line data base, particularly to get overviews of information in order to help them judge if a section of information would be relevant for them to access (p. 13).
Teacher-focused networks.

Another way to help teachers develop confidence and competence with telecommunications use is through the strategy of providing them themselves with a CMC experience or access to an educationally pertinent on-line data base. Seguin [19], for example, describes a course entitled, “Using Electronic Mail in Education”, offered by the University of Alaska and offered to teachers through a distance-education framework that requires them to use telecommunications themselves in order to participate in the course. The topics around which the teachers communicate however seem to be focused more on technical familiarity with telecommunications than on addressing the organizational or pedagogical issues useful for effective CMC and on-line searching in schools.

Harasim and Johnson [20], in their study of the educational applications of telecommunications for Ontario teachers, give other examples of providing teachers with their own network and electronic bulletin boards as sources not only of personal experience but also as resource bases of lesson and management ideas relative to the use of telecommunications in secondary school instruction. They suggest that emphasis be given to the teacher’s initial use of the telecommunication medium for his or her own on-going teacher training and support rather than initially for student use, in that participation in this kind of “on-going electronic in-service” and conferencing could focus on disseminating ways in which teachers are integrating telecommunications (and other innovations) into their practice and at the same time help the teacher develop his or her own skill at handling telecommunications. Harasim and Johnson describe an online teachers’ “tool kit” offering resources such as a data base of curriculum suggestions and classroom-use experiences from other teachers; sample quizzes, tests, and exams; recommendations for software; locally available data bases and class management instruments, such as electronic agendas, class planners, or attendance recorders (p. 3). Use of this resource would be a valuable step in teachers’ familiarization with telecommunications use. They further discuss a sequence for exposing teachers to educational telecommunicating that includes the following two steps:

1. Before going on-line, provide (in print or in face-to-face fashion) an “accurate description of the system, the task, requisite skills and knowledge, an appraisal of the time and effort required, and some of the expected benefits” (p. 38)

2. Provide initial instruction that includes a demonstration of the telecommunications use, a model lesson “hand-out”, and simple and accurate system documentation manuals with step-by-step examples of telecommunications-use strategies (p. 39)

Jacks [21] adds to this by noting that “coaching is necessary to assure the implementation of telecommunication at the (classroom) site. Without coaching, only a few trainees will be able to implement the newly-learned skill” ([21], p. 9). She sees a “teachers-only on-line bulletin board as one way to provide this sort of targeted support and coaching to the teacher who is trying something out in her classroom and wants to talk about her
Teacher Training for Telecommunications Use in Instruction

General principles for training and in service.

Teachers, of course, need specific training as well as on-going support in order to effectively use telecommunications, or any computer-related innovation, in the classroom. The extensive literature on preservice and inservice training for computer use in education shows occasional success stories with computer-related in service but more often problems, difficulties, and lack of transfer [22]. Little has been specifically written about teacher training courses for telecommunications use in secondary school instruction, but a few examples can be found in the literature. Schrum [23] describes a teacher training institute focusing on educational telecommunications use sponsored by the State of California that did attempt to blend technical skills with “the effective integration and application of technology throughout the curriculum“ through the production of “model lessons” (p. 85). However, after the first time the course was offered, Schrum reports that very little use of telecommunications developed or was sustained among the participants, because “everyone had underestimated what would be needed in order to add telecommunications to the (training) program” (p. 86). During the second offering of the course, many changes were made, including practice with a simulation for bulletin board (CMC) use and some guided on-line practice. Schrum made the following observations:

1. Teachers frequently requested “off-line” information and help; however, teachers differed relative to their preference for this help, some preferring help in written form and some preferring it communicated in person through group discussions, and

2. Learning style differences among the teachers were important. Some teachers wanted to get instructions and then be left on their own to experiment; others preferred working in small, cooperative groups where they could continually turn to each other for support ([23], p. 88).

Schrum concludes by reporting that a “large majority” of the 200 participants of the second teachers’ institute have continued to use the telecommunications network after the training period ended, some for personal CMC interactions and sharing of ideas with other teachers, and others for student CMC projects as well as teacher-teacher communication.

Supporting teachers in general with computer-related innovation in education.

Various other teacher-oriented telecommunication networks are in operation in North America ([24], [25]), some within the context of teacher training courses, others informally available. This approach, focusing on the practical value of telecommunication for the teacher, is consistent with what has been shown more generally in many studies relating to teachers’ acceptance of an innovation in their teaching: “Unless training is geared to the specific needs of
the individual teachers involved, there will be little or no impact on their competency of use... if it can be demonstrated that use of the microcomputer can increase teachers' instructional effectiveness, then they will gladly embrace the innovation" ([26]; p. 5). The "teachers' tool kit" and teacher-focused telecommunication approaches may be ways to first personally convince teachers of the value of CMC and of access to on-line sets of information so that they subsequently will be more inclined to see those benefits as also valuable for their students.

This is consistent with the more general finding that as teachers begin the use of computer-related activities in their classrooms, they do so in the context of fitting those activities into the view of education to which they already feel a level of conviction, commitment, and comfort ([27], [28]). "All of the teachers set off to use the tool (computer) according to their own, already set, notions of what they were doing, exploring the innovations or implications only within that narrowed perception" ([28], p. 11). Thus it may be a particularly good strategy to begin teachers' acquaintance with educational uses of telecommunications by emphasizing first the benefits that can come to teachers themselves through CMC and on-line access of telecommunications mediated resources. Through this approach, teachers can develop their own skills and opinions about telecommunication use to a certain level before they have to add to their thinking concerns relating to the pedagogical and social management of student use of telecommunications and to the new and heightened attention to student communication and inquiry skills that will also be required if successful student use of telecommunications is to develop. And, in addition, as teachers communicate with each other or access data bases of instructional materials, they can begin to develop strategies to help them with at least two of the major concerns with which they will have to deal when they try to implement telecommunications in instructions:

1. Time problems, (particularly relative to the rigid scheduling typical in secondary schools); time for adequate preparation and for adequate student access, and

2. Assessment criteria, "Teachers wondered what their students were learning, how to make this determination, and how to conduct assessments" ([29], 1988, p. 11) in the telecommunications environment.

These two problems—time and convincing evidence of educational value—continue to frustrate most of the use of telecommunications in secondary school instruction, no matter what the level of teacher support, software design, or equipment availability [30].

Summary and Predictions

In Part I and Part II of this analysis we have seen evidence, or at least belief, on the part of a growing number of educators that the educational use of telecommunications can bring benefits to secondary school students and secondary school teachers. We have also seen that such profitable use does not occur easily. Our analysis shows that key aspects of successful telecommunic-
tions use in the secondary school include initial technical issues related to getting equipment, making connections, handling necessary software, and having regular access to necessary components of the system involved in the telecommunications access, but it also shows that social, organizational, and didactical planning also must be present, and must be done "effectively" in order for sustained and meaningful educational use of telecommunications to occur. As usual with computers in education, the importance, and complexity of providing appropriate and affordable teacher training and support emerges as a critical issue. We have seen suggestions to improve teacher support with respect to the use of simulations as preparation for telecommunications use, for the provision of "lesson plans" or models that help the teacher visualize the broad context of educational embedding of telecommunications use, and for improvement of the user interfaces of telecommunication software. We have noted the necessity of organizing and managing CMC and on-line data base usage and the importance of being sensitive to student (and teacher) difficulties with on-line searching and CMC use. We have seen, in general, the predictable difficulties teachers have in trying to integrate an innovation involving computers into their familiar routine.

In the face of all these difficulties then, how likely is it that telecommunications will become a well-used educational medium in the secondary school? On the basis of the literature and practical experience, (as well as information from a study recently completed about European experiences with telecommunications use in secondary schools [31]) the following predictions summarized in Table 1 seem reasonable: In summary therefore, a diversity of preparation and support will probably provide the best chance that telecommunications use will occur in the secondary school setting. As a minimal, it appears that (using the notation in Table 1) Conditions 1 and 2, at least two of Conditions 3.2 through 3.6, and Conditions 4.4 and 5.2 should occur in order to expect telecommunications use to occur, be sustained, and finally, to grow as an instructional medium in the secondary school.

In such a new field, where telecommunications is an innovation within an innovation in education, it is clear that much is required of the teacher. Without a systematic way to gather insights from the many exploratory activities going on with respect to telecommunications as an educational tool in the secondary school, progress in finding appropriate strategies for teacher support will be much less effective than it could or should be. The Dutch project described in Part I of this analysis is pursuing promising strategies; however, finding a way to combine their insights with those of the many others around the world involved with the stimulation of telecommunications use in education remains a considerable challenge for both researchers and practitioners.
### Table 1

**Predictions of Likelihood of Successful Use of Telecommunications in Secondary Schools**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Most Likely Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On-line data and CMC systems available commercially</td>
<td>1. Only a very few teachers will discover and use the systems.</td>
</tr>
<tr>
<td>2. Systems are available at special rates to education</td>
<td>2. The very few teachers who are interested will find it easier to proceed but little diffusion of use will occur.</td>
</tr>
<tr>
<td>3. Teachers receive training in telecommunication skills (technical):</td>
<td>3. With condition 3.1, technical problems will probably prevent use.</td>
</tr>
<tr>
<td>3.1 - No training</td>
<td>With increased availability of conditions 3.2-3.6, likelihood of use increases. Any one condition by itself is likely to be of little or no sustained value. Condition 3.6 seems to have the most long-term value, but is also most difficult to organize and most costly.</td>
</tr>
<tr>
<td>3.2 - Through print materials</td>
<td></td>
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<td>3.3 - Through simulation software</td>
<td></td>
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<tr>
<td>3.4 - Through one-time workshop</td>
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<tr>
<td>3.5 - Through on-line help</td>
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<tr>
<td>3.6 - Through on-going support</td>
<td></td>
</tr>
<tr>
<td>4. Teachers receive support in educational, social and organisational issues</td>
<td>4. Conditions 4.1 and 4.2 will probably not be sufficient to stimulate implementation. Condition 4.3 increases the probability considerably. The addition of conditions 4.3 and 4.4 is even more promising.</td>
</tr>
<tr>
<td>4.1 - No support</td>
<td></td>
</tr>
<tr>
<td>4.2 - Educational idea</td>
<td></td>
</tr>
<tr>
<td>4.3 - Educational idea with lesson strategies</td>
<td></td>
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<tr>
<td>4.4 - Educational idea with preliminary activities for student preparation</td>
<td></td>
</tr>
<tr>
<td>5. Students:</td>
<td>5. With condition 5.1, initial attempts at use will likely abort in frustration and wasted time. With condition 5.2, probability of success is considerably improved.</td>
</tr>
<tr>
<td>5.1 - Have no particular preparation</td>
<td></td>
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<tr>
<td>5.2 - Participate in simulation of telecommunications activity before it occurs</td>
<td></td>
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</table>
References


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