CANADIAN JOURNAL OF EDUCATIONAL COMMUNICATION

Volume 16, No. 2, Spring 1987
ISSN 0710-4340

Special Issue: Computer-Mediated Communication

An AMTEC Publication

Canadian Journal of Educational Communication

Volume 16, Number 2
Spring 1987

ISSN 0710 - 4340

The *Canadian Journal of Educational Communication* is published quarterly by the Association for Media and Technology in Education in Canada, 500 Victoria Road, North Guelph, Ontario N1E 6K2, Attention: Ron Eyre, Secretary / Treasurer. Notification of address change should be sent to the above. *CJEC* is indexed in the *Canadian Education Index*.

Second Class Mail Registration No. 6956

Special Issue: Computer-Mediated Communication

In Future Issues

Continual Response Measurement in TV Research
Jon Baggaley

Facilitating 'Extended Campus' Graduate Education Through Electronic Communication
T. Craig Montgomerie

Resistance to Planned Change: A Training Design Case Study
Lynn McAlpine

Communications Technology in Higher Education in Alberta: Policy Perspectives
D. G. Crawford

Towards Knowledge-Based CAL
Philip Barker

All correspondence should be addressed to:

Dr. Robert M. Bernard, Editor
Education Department
Concordia University
1455 de Maisonneuve Blvd. W.
Montreal, PQ, Canada H3G 1M8

CJEC is typeset on an Apple Macintosh™ in PageMaker™.

Galley proofs to authors are output on an Apple LaserWriter™ and final camera-ready impressions are output on a Linotronic 300™ typesetter.

Typeset Facilities: McGill Instructional Communication Center
Printing: McGill Printing Services

CJEC ORDER FORM

CJEC is free to members of AMTEC. However, many prefer to order the journal separately, and may do so by completing the form below:

_____
(Name)

_____
(Address)

_____

_____

_____

☐ $ 40.00 (CAD) annual subscription

☐ New Subscriber

☐ Renewal

☐ Please send me information about AMTEC and a membership form.

CHANGE OF ADDRESS

_____

_____

_____

_____

_____

Send this form to:

Mr. Ron Eyre
AMTEC
500 Victoria Road
North Guelph, Ontario N1E 6K2
Canada

Introduction to the Special Issue on Computer-Mediated Communication

Computer-mediated communication (this generic term includes computer communication, e-mail, bulletin board systems, etc.) is in its infancy, and as such, is attempting to find its way — its most effective educational application and its ideal placement as a facilitator of the teaching-learning process. In the short span of ten years, computer-mediated communication has been applied, misapplied and modified on the basis of faith, trial and error and quasi-research, so that now there are a number of operating educational computer facilities in existence which offer this form of discourse and still more being developed.

As communicating via computer plunges headlong into the future, some have come to realize that its full potential is not being reached. Rather than seeking its own unique niche, many applications, such as computer conferencing, often function as surrogates (in many cases improved surrogates) for other more conventional delivery systems (e.g., face-to-face conferencing, the postal system, the phone company). This is due in part to limitations of the existing hardware and software. Another more substantial part is based upon the limitations of current conceptualizations of its educational potential.

This special issue, devoted to addressing the educational potential of computer-mediated communication, is presented in sequentially arranged sections designed to bring the reader to the point of active participation in the restructuring and refocusing of thought about this medium. The first section presents an overview of past and present applications, using these as a springboard to future applications which may more fully realize the potential of computer applications *(The Potential: Beckwith — Group Problem-Solving via Computer Conferencing: The Realizable Potential)*. The second section features a descriptive analysis of two current applications of computer-mediated communication *(Current Applications: McCreary & Van Duren — Educational Applications of Computer Conferencing; and Harasim — Teaching and Learning On-Line: Issues on Computer-Mediated Graduate Courses)*. This provides a bridge to the third section in which you will find two cutting-edge applications, illustrating constraints and suggesting ways of overcoming them *(Next Steps: Hart — Towards a Third Generation Distributed Conferring System; and Kaye — Introducing Computer-Mediated Communication into a Distance Education System)*. Section four focuses on a much-needed theoretical perspective that may be useful in bringing together some of the seemingly disparate strands from previous literature *(A Theoretical Perspective: Boyd — Emancipative Educational Technology)*. Finally, section five, in the form of a computer conference between the six authors of the first four sections, attempts to build from the multiple perspectives expressed in individual papers to a reconceptualization *(Towards Reconceptualization: An Edited Transcript of CoSy 'bcjec')* — the authors' view of the current nature of computer-mediated communication, what could be possible as it enters its second decade and discussion of the educational potential of this medium.

It is hoped that the reader, following the progression from the ideal, through the problems that have been encountered with established and not-so-established applications, to the

CJEC, VOL. 16, NO. 2, PAGES 87 - 88, ISSN 0710 - 4340

proposed theoretical orientation and then into the forward reaching discussion, will be able to enter the collective mindset of the authors and share in the reshaping of computer-mediated communication for education.

The editorial staff of *CJEC* would like to express sincere appreciation to the authors for their hard work and perserverance in writing to our deadlines and conferencing as vigorously as time would allow. As a result of the conference we have come to know them as individuals in a way that could never have occurred through the mail or on the phone. Gary Boyd, Don Beckwith and Jacques LeCavalier added many thoughtful suggestions and are as responsible for the overall conceptualization of this issue as is the staff. Jacques kept up with the details of the conference and spent many hours entering and editing papers and comments. In addition, we would like to thank Bob McQueen and the staff at CoSy for generously donating two trial CoSy accounts for the purposes of this conference. Without these partners, all working together to consider the reshaping of computer-mediated communication, this special issue of *CJEC* would not have been possible. Finally, we would like to apologize to the authors and columnists whose valuable contributions, that are so necessary for the on-going success of *CJEC*, were delayed to the next issue as a result of this special issue.

As a final note, if you care to explore the world of on-line conferencing via CoSy, contact: CoSy Systems Group, University of Guelph, Guelph, ON N1G 2W1 Canada (519) 824-4120 Ext. 3068.

Robert M. Bernard, *Editor*
Steven Shaw, *Assistant Editor*

The Potential

Group Problem-Solving via Computer Conferencing: The Realizable Potential

Don Beckwith

Abstract: While computer conferencing has been in vogue for a number of years, its most promising potential — group problem-solving — has yet to be realized. Instead, the medium is used almost exclusively for electronic mail (the transmission of private messages between users), electronic bulletin boards (the public dissemination and discussion of information and ideas), and topic discussions. Though the research and experience-based literature offers — in bits and pieces — relevant suggestions to overcome this problem, still needed are a) a model of group problem-solving, b) a set of comprehensive, testable principles designed to facilitate group problem-solving, and c) an interaction process analysis instrument that could be used in research of a group problem-solving technology appropriate to computer conferencing. This paper attempts to satisfy such needs.

INTRODUCTION

The realized and unrealized potentials of computer conferencing are many. In its chameleon-like, distance-limiting applications it can be used as: a) a fast, private message system between two or more users; b) an updatable, public information dissemination and exchange system; c) a closed or open electronic forum for discussions of issues and interests; and d) a means of bringing together diverse and dispersed elements of a collective intelligence to create original processes and solutions to substantial social problems.

Computer conferencing has the capability of bringing like-minded and not so like-minded individuals together for a variety of socially worthwhile interactions which can range from information exchange, through social interaction, to purposeful change through group problem-solving.

THE PROBLEM

In all applications of newer media those potentials that are easiest to implement receive the highest level of realization. Just as CAL and interactive videodisc have gravitated

Don Beckwith is Visiting Associate Professor of Educational Technology at Concordia University, 1455 de Maisonneuve Blvd. W. Montreal, PQ H3G 1M8. His research and teaching interests include the process of learning, instructional design, problem-solving and interactive technologies. Reprints may be obtained from the author at the above address.

CJEC, VOL. 16, NO. 2, PAGES 89 - 106, ISSN 0710 - 4340

to the more easily applied programmed learning model rather than to the more difficult-to-apply learner-creative and learner-controlled interactive applications, so too has computer conferencing, thus far in its short history, allowed the easier applications to predominate. The predominant applications, while easier to implement, are obviously fulfilling needs. Three of the largest computer conferencing networks boast impressive usage figures: The Conferencing System (CoSy) at the University of Guelph has 400 off-campus users, subscribers in 28 countries, and about 250 active conferences; the Electronic Information Exchange System (EIES) at the New Jersey Institute of Technology has 2500 worldwide participants; and the PARTICIPATE system at the New York Institute of Technology has 60 faculty members who use computer conferencing to tutor external students (Kaye, 1985).

But to limit the medium primarily to electronic mail, bulletin board-type information exchanges, and topic discussions is perhaps to divert energies from the development and application of a unique potential of computer conferencing, namely creative group problem-solving. While electronic mail, bulletin board and discussion applications (as their names suggest) are improved variations of existing technologies (cutting through time and distance constraints), the type of group problem-solving that could be effected via computer conferencing could go beyond merely providing an improved variation of existing problem-solving technology, to the creation of an original problem-solving technology.

The ease or difficulty lies not in how complex or simple the various applications are. Rather, it is a matter of whether or not preliminary ground work has been done. If an application of a newer medium is just a new form of an old technology, the implementation is rather simple, for the operating principles and procedures have already been worked out and debugged. For example, a computerized mail service (electronic mail) will tend to follow such established older technology principles as addresses, mailboxes, filing by classification, private reading, return addresses, and so on. Similarly, when putting a bulletin board on a conferencing system, we know from experience with the older technology to make the information readable, classified by topic, updatable, and scanable; and to provide mechanisms for keeping track of read messages, responding to messages, and so on. Likewise a computer conference discussion tends to follow the established guidelines of the older technology of face-to-face meetings, such as having moderators, leaders, rules of appropriate interaction, and summaries.

The process of putting an old technology into a new medium is simplified because we can concentrate on including all the good elements of the extant technology and at the same time look for ways in which the new medium can improve upon these. Thus the computer conferencing applications of electronic mail, bulletin boards and discussions can provide the same services as the established media, only faster and with a greater capacity for manipulatable information. When an older medium (e.g., the postal service, bulletin boards, newsletters, face-to-face meetings) is satisfactorily providing a service, a newer medium can focus its energies on improving the existing service. When an older medium, however, is not providing a satisfactory service, a newer medium must focus its energies on creating an original means to satisfy the desired ends. The newer medium of computer conferencing may be the only current means for effecting satisfactory group problem-solving. Group problem-solving may very well be the unique application of computer conferencing.

The forces mitigating against successful group problem-solving using older technologies are many, not the least of which is the almost impossible task of assembling all of the people with the required expertise for as long as the process takes. Even more difficult is structuring the interchange of ideas so that: a) early ideas are not lost; b) ideas are

meaningfully built upon; c) more forceful individuals do not monopolize the focus, content, and solutions; d) the appropriate expertise is tapped at the appropriate time; e) there is a systematic and systemic building of successive approximations to the problem solution; f) creativity is not lost to rationality; and g) there is time to digest, rethink, reword, and restructure emerging ideas and information.

WHAT IS PROBLEM SOLVING?

Since the term *problem-solving* has been used to describe a host of activities, from simple arithmetic sums and moral dilemmas to world peace efforts, with its critical attributes and potential applications changing according to the level and intensity of purpose, the following operational definitions are offered. It is suggested that yet a higher form of problem-solving may be effected through computer conferencing.

Traditional Definitions

One of the earliest definitions of problem-solving still has validity: Dewey (1910) describes problem-solving as a procedure that includes a) presentation of the problem, b) problem definition (distinguishing essential features of the situation), c) hypothesis formulation, and d) successive hypothesis verification until one is found that achieves the problem solution.

While this definition implies creativity in the product of problem-solving, more recent definitions imply creativity in both the product and the process of problem-solving. For example, Gagné and Briggs (1979) offer that problem-solving is the ability to solve real or intellectual problems by applying complex rules created from simpler rules. In perhaps a more elegant definition, Gagné (1985) suggests that, "problem-solving may be viewed as a process by which the learner discovers a combination of previously learned rules and plans their application so as to achieve a solution for a novel problem situation" (p.178).

Toward a Potential Definition/New Definition

Though the above-mentioned definitions sufficiently describe problem-solving behavior conducted by the individual with access to the older technologies, they cannot begin to describe the type of problem-solving that is possible through groups with access to the newer technology of computer conferencing.

Example. To illustrate the type of group problem-solving that might be possible through the imaginative application of a potential technology for computer conferencing, the following account is offered (Beckwith, 1986b): A few years ago I was teaching a graduate course in Interactive Technology, designed to analyze some of the newer media's potential for facilitating learning. The course concentrated on the newer media of videodisc, computer conferencing, teleconferencing, and video conferencing. With a limited (next to nonexistent) budget, I had to come up with ways of simulating each of the newer media so that the learners could experience them enough to analyze and evaluate their potential worth and application to the teaching-learning process. How to simulate computer conferencing, with no computers that could be inexpensively or quickly networked, was causing a problem. At that time the primary application of computer conferencing was that of an asynchronous bulletin board through which participants could send and receive messages. The idea of using a real bulletin board was suggested. From a cluttered storage area came an

old, portable 4 x 6 ft. bulletin board on wheels. This was positioned in a hallway corner, giving access to the students before, after and during class. A stack of 3 x 5 index cards and thumbtacks were provided.

The assigned group problem-solving task was to create appropriate and innovative applications of the newer technologies in order to improve learning in formal and informal settings. The task was to be completed by the end of the semester. Within a very short time the bulletin board was rapidly being covered with cards, each card with a number, a topic, a message/comment, and a signature. Some cards were addressed to the writer of a prior message. These responses, if space allowed, were positioned next to the the message being responded to. When space did not allow such positioning, some of the students connected the related messages (cards) with red cardboard arrows. Experts were introduced through citations and quotes. From time to time someone would rearrange the cards by topic areas, using arrows to cross-index related comments between topics.

While the messages were interesting, with most of the ideas contained within coming from the students' outside readings, they didn't seem to be leading toward task completion. Rather, by the end of three weeks we had a bulletin board filled with disparate bits of information, all related in some way to the educational potential of the newer media, but with no creative focus. There it sat for two weeks — a seeming eternity. Occasionally a student would reread the cards, attempt a partial rearrangement.

Then it happened. The cards disappeared, being replaced by a large sheet of paper that covered the entire bulletin board. An idea, unsigned, unnumbered, without a designated topic, was written near the middle. Then it happened again. Someone crossed out part of the idea, substituting other words and adding another idea. From that point on the bulletin board was never the same; group creativity and problem-solving had taken over, had replaced information exchange. Some ideas were cut out, others edited, others repositioned, still others partly or completely covered up by clean paper or other ideas. The size of the bulletin board expanded by using the adjacent walls and by tacking or taping ideas to the frame so that they dangled to the floor. Some ideas were added marginally, others on huge sheets of added paper. Ideas were cut, spliced, edited, amalgamated, expunged (some to reappear time and again in different form or in a different location). Most of all, ideas were being built upon. A group focus and purpose took hold. Information explosion was replaced by idea implosion.

What emerged, in a very short time, was a very sophisticated story board for a video production dealing with the issue at hand. Taped to the floor was a production schedule and roles assigned to each class member. The group had successfully created an original process to effect an original product. It is hoped that this example illustrates, albeit in a crude way, how a new technology applied to computer conferencing (if only a simulation) may be capable of effecting an innovative type of problem-solving. It is further hoped that the example will provide a sufficient context for the proposed definition that follows.

A definition of group problem-solving. Group problem-solving is the mutual creation of an original, synergistic and synectic process — using relevant media and human and nonhuman resources — that will yield an original systemic product specifically designed to satisfy a substantial and verified social need that has not been sufficiently satisfied through traditional means.

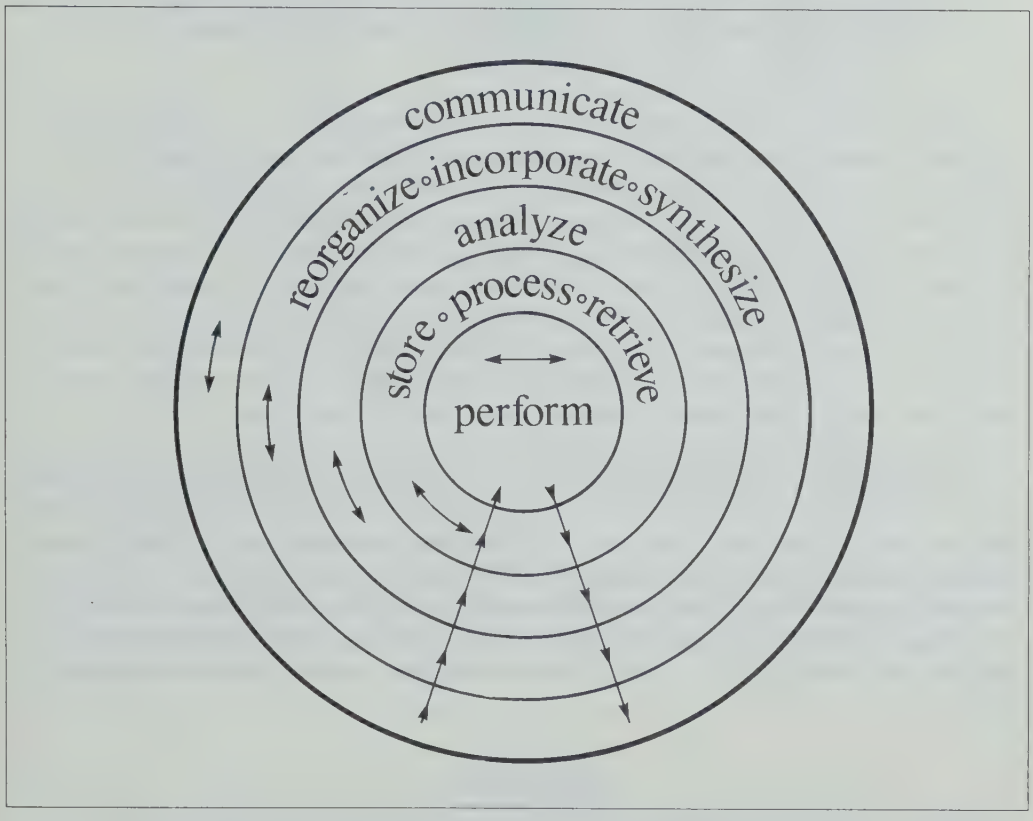
It is this type of group problem-solving that computer conferencing may have the unique potential to effect. The types of problems to be addressed by group problem-solving are not those that can be solved with existing problem-solving technologies. Rather, they

are the types of problems that the older technologies have been unable to satisfactorily resolve.

A Model of Group Problem-Solving Behavior

Group problem-solving is, of course, an interactive process. The interaction takes three forms: between group members, between individual members and information (in this case, the information inputted to the computer conferencing system), and within each member of the group. Beckwith (1983, 1984) has developed a model to depict these interactions. Within the interactive process five behaviors — a) performing, b) storing/processing/retrieving, c) analyzing, d) reorganizing/incorporating/synthesizing, and e) communicating — must be successfully integrated by each individual within the group (see Figure 1).

FIGURE 1. *The Interactive Group Problem-Solving Process: The Individual.*



The interaction may occur between any two or more of the five behaviors, or within a single behavior, or both within and between simultaneously. This same range of interactions may also occur within an individual, between individuals, and between individual and information simultaneously. During the group problem-solving process the interactive behaviors may take a variety of forms. Some examples follow:

1. *Performing* — a) absorbing and manipulating new information; b) learning interactive skills; c) imitating others' modeled performances; d) trying out new and

modified cognitive and valuing strategies; e) effecting temporary closure on successive approximations to the problem solution;

2. *Storing/processing/retrieving* — a) controlling and applying information related to the process of problem-solving; b) absorbing and manipulating new information; c) absorbing and manipulating feedback on performance;
3. *Analyzing* — a) discovering the interactive and interdependent components of performances of self and others; b) studying current thinking and introspective processes;
4. *Reorganizing/incorporating/synthesizing* — a) piecing together seemingly unrelated bits of information from performances, storage, analysis, or communication; b) building, from extant and potential information and process bits, toward a problem solution; and
5. *Communicating* — a) sharing successful and unsuccessful strategies; b) reacting and responding to others' strategies; c) verbalizing thinking and introspective processes; d) imaging potential realities.

If the problem-solving process is complex for the individual, it is even more complex for a group. During the process the group is trying to create a purposeful system (i.e., a solution) from a set of existing and potential components. This involves a number of sophisticated procedures. The group must be able to: a) image a purposeful system from any set of given and potential components; b) analyze relationships between components (at their interface points) in order to determine the status quo (an analytical/deciphering procedure) and the ideal (an imaging procedure); c) develop, test and modify hypotheses about existing and potential relationships between components; d) analyze relationships within components (e.g., humans, resources, information); and e) build successive approximations toward this ideal (i.e., the problem solution). (See Figure 2 on next page).

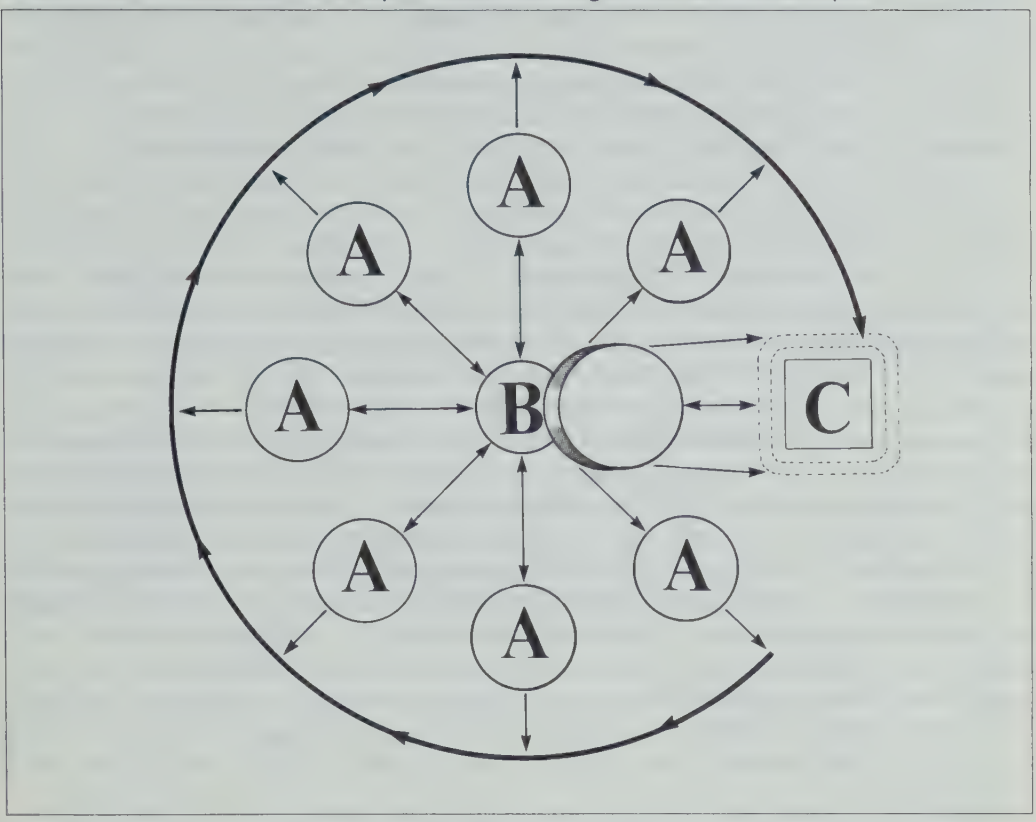
Just as within the individual, these procedures, or parts thereof, may occur simultaneously. The benefit of group problem-solving is that not every member of the group must be a master of each procedure. In fact, even the behaviors that interact within the individual during the problem-solving process may be learned and/or fine-tuned as the group proceeds toward its goal. With the appropriate group membership and appropriate use of computer conferencing, worthwhile, efficient and effective group problem-solving (the type of problem-solving that is a transfusion of the ideal into the status quo rather than a series of band-aids, each attending to the seeming most pressing need of the moment) can become reality.

TRANSITION

Thus far this paper has attempted to look generally at the unrealized potential of computer conferencing; and, specifically, at the nature of group problem-solving, an application that could prove to be the unique potential of computer conferencing.

Using this as a foundation, the paper will now present a) the ideal (i.e., how the researchers and developers in the field of computer conferencing envision the ultimate potential of this newer medium); b) the status quo (i.e., where we are now in relation to the ideal); and c) constraints (i.e., possible human and system obstacles that lie in the path leading from the status quo to the ideal). Finally, the paper will present d) a set of principles

FIGURE 2. *The Interactive Group Problem-Solving Process: The Group.*



Note: A = Each member of the group. B = The status quo at any frozen point (the problem state and relevant information. C = The ideal at any frozen point (the evolving solution).

for computer conferencing, designed to facilitate passage from the status quo; over, around and through the constraints; to the ideal; and e) an interaction analysis instrument, designed to operationalize the principles and serve as a research tool to aid in the further study of group problem-solving through computer conferencing.

THE IDEAL

We have a medium in front of us that is capable of bringing together large numbers of uniquely-held individual skills, ideas, abilities, attitudes, and values, and affording those participating the opportunity to collectively and purposefully manipulate, build upon, create from, collapse and expand those abilities, skills, ideas, attitudes, and values; this in order to, in a relatively short period of time, create viable and acceptable solutions to social problems, be they local, national or international. Regardless of the nature or size of the problem to be addressed, the necessary expertise in theory, practice, leadership, subject matter, catalysis, moderation, idea generation, creativity, politics, experience, realism, idealism — from wherever — can be brought together. Regardless of the size of the

participant input to the problem-solving conference, the capacity to purposefully control, govern, edit, manipulate, keep in manageable communicative form, build upon, direct and focus is all there. Regardless of the type of problem addressed, the results will more than compensate for the technological expenditure, for computer conferencing applied to collective problem-solving offers the opportunity for users to link their own uniqueness with that of others in order to achieve some mutually satisfying, worthwhile, altruistic goals.

The realization that computer conferencing is not achieving its potential has been shared recently by a number of devotees. It has been said that this newer medium has not yet found its proper niche (Humphrey, 1986) and that its best advantage must be exploited for its potential unique educational applications (Kaye, 1985). Boyd (1986) has suggested that such an advantageous exploitation might be epitomized by a cooperative search for truth (as described by Habermas, 1973), a democratic experience enjoyed by geographically separated adult learners. This type of application could yield a collective wisdom through the non-simultaneous interactions of computer conferencing participants (Stevens, 1986). A particular desirable outcome has been predicted by Kott (1986) who suggests that computer conferencing could be applied in business and industry to create a new corporate paradigm, one in which authoritarian management would yield to a networking, people-oriented management, thereby increasing the probability of the organization reaching its goals and objectives.

Two comments on a recent CoSy conference suggest some computer attributes which are essential for outcomes such as these to be realized: "I am looking forward to the system that makes intuitive leaps with a bunch of material and helps the thinker look for new patterns, new relationships, etc." (A. Augur, computer conference comment, April 19, 1985); "What I'm looking for is a computer programme that helps me perceive — or think in a fashion — things I have never seen before" (C.S. Hunter, computer conference comment, April 19, 1985).

THE STATUS QUO

While the group problem-solving ideal has been clearly envisioned, the status quo reflects only limited success toward this goal. The fact that the three most difficult applications of computer conferencing to implement — i.e., group product creation community decision-making, and inter-community networking (E. McCreary, computer conference comment, September 24, 1986) — happen to be the three applications which come closest to reflecting group problem-solving, provides little comfort, especially when the evidence suggests that the major efforts in computer conferencing are going into the easier-to-implement applications. In reporting on the proceedings of a recent computer conferencing workshop held at the University of Guelph, Humphrey (1986) relates that one critic compared current applications to those found in citizen band radio discussions and pen pal letters. Nevertheless, there has been some progress made toward the ideal.

Limited Success Toward Group Problem-Solving

There appears to be a general satisfaction with efforts to incorporate aspects of group problem-solving, among those few who have ventured toward the ideal. The International Institute for Applied Systems Analysis, for example, has created some successful group projects (e.g., experiments and reports) via computer conferencing (Umpleby, 1986c). EIES developers are satisfied that achieving consensus and joint preparation of working group

reports are facilitated by computer conferencing (Kaye, 1985). Qualitatively-based research conclusions have been offered as guidelines by those who have attempted to achieve group problem-solving through computer conferencing structures. According to Turoff and Hiltz (1983) successful reaching of consensus has been facilitated by a) the election of a leader, b) the continued suggestion of compromises, c) leadership attempts at getting the group's ideas and focuses together, and d) a pushing toward research-based decisions. These suggestions, however, tend to imitate some of the successful methods applied in face-to-face meetings and may be seen as methods which foster efficiency rather than effectiveness. The researchers also feel, by insisting upon participant anonymity (in the form of a real or pseudonymous first name only), that the EIES computer conferences have been successful in reducing the common biases toward age, ethnicity, physical image, political status, sex and social class, and thereby increasing the focus upon important social goals and how the group may work together for the achievement of these goals. They have found, for example, that comments and suggestions by experts and novices within a given field receive equal attention and are judged on their intellectual and/or practical merits alone.

In exploratory studies designed to compare the abilities of face-to-face meetings and computer conferences to effect consensus decision-making, Hiltz, Johnson, & Agle (1978) reported significantly higher incidence of "tension release", "agreement" and "disagreement" behaviors in face-to-face participants, and significantly higher incidence of "asking for opinions" behavior in computer conference participants. The results may suggest that a more cooperative type of problem-solving may be required in computer conferencing. The researchers also note that members of a computer conference cannot so readily impose sanctions against deviant or unpopular comments as can their counterparts in face-to-face meetings. This minimization of sanctions would appear to be essential if all necessary components of the collective intelligence are to provide their unique inputs.

In the opinion of Umpleby (1986b), some of the techniques used by Turoff and Hiltz in their EIES course *Human Communication and Computers* seem to offer the promise of facilitating group problem-solving behavior. For example, the course includes: a) interactions between two instructors holding differing opinions and/or representing differing disciplinary backgrounds; b) downloading of comments by alternative authors in the guise of guest lecturers; c) inputting a wide range of views in order to provoke comments; and d) relating a course topic to a current controversy in order to stimulate discussion.

Stevens (1986) reports that new capabilities such as branching topics into sub-topics and further branching into sub-sub-topics (which may then be selectively and productively joined) is already yielding increases in productivity, innovation and personal satisfaction in trial groups.

While these guidelines will be helpful in achieving closer approximations to group problem-solving, there are many constraints yet to be overcome.

Constraints

Constraints seem to fall into two categories: constraints of inappropriate or insufficient technological structure, and constraints of human habit, fear or limited perception.

Constraints of human habit, fear or limited perception. One persistent human habit that can have a deleterious effect on group problem-solving is that of calling in an expert for the "right" answer or solution. This may take the form of inviting an expert to participate and set things straight, the downloading of "correct" answers or viewpoints from a printed source, or referring other participants to a source that contains the "appropriate"

conclusions. Almost invariably, the act of calling on an expert seems to have a stultifying effect on the open, democratic process, and by giving credence to one participant (the expert) over others, a false sense of closure and a deadening of interactivity ensue (Beckwith, 1986a). Anonymity, on the other hand, enables the quality of ideas, rather than the status of the sender, to be fairly assessed (Beckwith, 1986b; Boyd, 1986; Turoff and Hiltz, 1983).

The notion that whatever we input to a computer conference is our own property, not to be violated (Turoff and Hiltz, 1983), is an idea that when implemented may very well preclude group problem-solving or a collective intelligence, but, as Vinson (1986) relates, participants seem to worry about others stealing their ideas. Vinson concludes that until copyright issues to determine who owns what are worked out, few scientists will be willing to take part in serious computer conferencing work. On the other hand, it seems reasonable to suggest that a collective intelligence can only become reality if all ideas belong to the collective, not the individual.

Vinson (1986) tells of a computer conferencing application that failed because more attention was paid to how the hardware works, rather than to how people work. Fear and paranoia led to its demise. Conclusions include, for example, that putting all participants on equal footing (be they managers or line workers) may cause discomfort to those near the top of the pecking order. So too may the appearance of information overload (since computer conferencing produces so much paper) fuel paranoia. Vinson notes that there seem to be strong indications that people are demonstrating a fear of losing control of: a) ideas; b) a power base; c) the rate at which they process and deal with information; and d) the process of change.

Constraints of inappropriate structure. An analysis of computer conferencing attempts at group problem-solving shows that appropriate principles and heuristics are not being applied to the task. Instead, often the principles and heuristics appropriate for electronic mail and/or bulletin boards are applied. For example, the linearity of sequentially numbered and displayed messages, which is appropriate to electronic mail, reduces the type of manipulative information control necessary for users to perform problem-solving tasks.

In a recent investigation (Beckwith, 1986a) of a large number of CoSy conferences purportedly designed to effect problem-solving, it was found that: a) the goals of the conferences were rarely met, and the conference efforts would almost invariably devolve to information exchanges, often at a very low or superficial level; b) almost without fail, messages, once followed by five or more additional entries, were lost or forgotten, never to be incorporated; c) because of an unsuitable structure for building solutions, the focus of a conference was easily shifted, often going completely off-task; and d) the labelling of participants (CoSy is not an anonymous or pseudonymous system) as illogical, extremely counter-productive, obscene, and so on, would tend to curtail future participant involvement. In a typical linear discussion, analysis is limited to: a) superficial, out-of-context reactions (often of an emotional or biased nature); and b) after-the-fact analysis, (i.e., analysis of the finished product [which often leads to a positive evaluation simply because *a* product has been created, the assumption being that it is the best that one could have hoped for]).

While more emphasis is needed on the social and organizational structures needed to support computer conferencing-based productive communication than on the hardware (Johansen, Vallee & Spangler, 1979), time and time again in our attempts to create social and organizational structures to support communication, we tighten the rules, thereby inhibiting productive communication rather than increasing it. If we are to facilitate

applications such as group problem-solving, we must loosen the existing, hardware-based structures to the point where users will be able to create their own appropriate structures. As Sprigge (1986) suggests, no computer conferencing structure is suitable for all situations. The structure appropriate for electronic mail, for example, is not appropriate for problem-solving. It should be up to the individual user to decide which of the many potential structures or combination of structures are optimum for a desired purpose. A conference designed, for example, for information sharing should not have the same structure as a conference designed for product development. But there are still computer conferencing application potentials that do not have structures yet; instead, users must make do with a structure designed for some other application. What is needed, if group problem-solving is to be realized, is a structured storage of comments that reflects how, *from each user's viewpoint,* the comments relate to each other.

For a newer technology to be qualitatively different from an older technology, it must permit its users to do new things (Kaye, 1985). Computer conferencing, using a newer technology, has the potential for being qualitatively different if it is applied as a means for satisfying a need such as group problem-solving, a need that is not currently being satisfied by older technologies.

While successful group problem-solving is a rare commodity at best, it would seem that it could be achieved via computer conferencing. What is needed is: a) an operational definition of successful problem-solving; b) a set of principles and heuristics to be followed in the application of computer conferencing to group problem-solving; and c) suggested ways of researching the effectiveness and efficiency of computer conferencing-based group problem-solving.

PRINCIPLES TO EFFECT GROUP PROBLEM-SOLVING

The Principle of Dynamism

Successful group problem-solving depends upon a dynamic (ever-changing) exchange of ideas. The interactivity of communication allows one the opportunity of modifying what someone else has said by building upon it, emphasizing some aspects, or deemphasizing others. It is this feature of a flexible, purposefully evolving language that gives the process of communication a greater importance than any single or combination of interim products. That is, the individual statements, or even groups of individual statements, sequentially strung together, become less important than the process of minds coming together through idea modification. The interim communication products (i.e., statements, questions) are only there to be changed by the process of communication. Successful communication is not, then, a frozen record of sequential ideas. Deemphasizing the notion of communication as a frozen record can facilitate the desired, dynamic interchange. (This does not, however, preclude having a frozen record in memory.) Those aspects of face-to-face communication that allow for easy idea modification and building are essential to the brainstorming and problem-solving processes.

The Principle of Anonymity

The notion of individual ownership and responsibility for ideas can foster competition, secrecy, or a fear of sharing. Anonymity, on the other hand, can promote joint ownership, positive sharing of responsibility, and the potential for group problem-solving. Individual

ownership and responsibility can inhibit secure and informal interaction, as well as preclude involvement, productive change, and group creativity. Anonymity, by contrast, especially when one is communicating in unfamiliar areas, can increase involvement and cooperation.

The Principle of Accessibility

The easier the access to ideas (communication attempts) and information, the higher the likelihood of potential user involvement. A successful communication system is user-friendly, in that if facilitates information retrieval, modification, exchange and sharing. For group problem-solving to be viable, ideas and information must be accessible to the group in *any* desired format.

The Principle of Control

Successful communication is more apt to take place if participants have a large measure of control over the communication medium. A user-oriented communication system — having a flexible format which reflects user needs — will tend to create a higher level of participation and involvement. Involvement in structuring and restructuring formats creates more of a sense of belonging. Thus an evolving system (evolving from user needs) ensures continued interest and participation.

If one can interact with information (regardless of the format) one can control that information. If one can control information, one can learn from and apply that information. The more interaction potential is inherent in the format, the more meaningful learning and application is likely to take place. Through control, a purposeful building incorporation of ideas and information is possible.

The Principle of Catalysis

In order for dynamism, anonymity, accessibility, and control to be maintained as an interacting set of principles, an omnipresent catalyst is necessary. At any given time the catalyst may take the form of one of the first four principles. For example, control might serve to ensure accessibility, which might serve to ensure anonymity, which might serve to ensure dynamism, and so on. The catalyst may also take the form, as needed, of any member of the problem-solving group, or any resource, information or idea provided by an individual or the system.

In an ideal group problem-solving enterprise the five principles enjoy complete, self-sustaining, systemic integration. To operationalize these principles into such an interactive system, some essential computer conferencing capabilities must be present.

Essential Capabilities of the System

These capabilities are suggested only as a starter set. If the principles are operating as intended, the addition of other essential capabilities will be directly proportional to the imagination and needs of the user group.

1. *On-line editing capability for all users, allowing the user to add to, subtract from, or otherwise modify (e.g., elaborate, emphasize, condense, rearrange, exemplify, and retransmit) any user's entry.* In other words, a user's response to a prior entry can take the form of a changed entry, in any desired format, to include text formatting, text mobility, text retrieval and linkages, branching of topics into sub-topics, and then selective topic joining and transfer of files to and from other systems.

2. *Anonymous entries or, if the user prefers, a self-selected pseudonym signature.* (Entries directed to particular pseudonyms should be possible.)
3. *Editing capability for all users, allowing them to modify the nature of the conferencing process.* For example, a user might institute a more appropriate menu or key word access system or stretch the maximum of lines allowed for an entry. In short, any system change, in an attempt to improve communication, should be encouraged.
4. *An evolving coding/classification system of key words, treed menus, and so on, to facilitate access to information of potential interest.*
5. *An on-going analysis of the types of entries that elicit the highest levels of interaction/communication/cooperation — translated weekly into revised user guidelines.* These may include voting or polling methods, assigning specialist roles to various group members, activities to increase interactive participation, user simulations, tutorial scripts to practice or imitate, and summaries.
6. *Synchronous communication.*
7. *Text search and retrieval by any access system.*

While the principles and system capabilities are deemed essential to the realization of group problem-solving, alone they are not sufficient. Also needed is some kind of formative evaluation mechanism to be used during the problem-solving process to ensure, through dynamism and catalysis, the most productive interactions. The mechanism offered is an interaction analysis instrument.

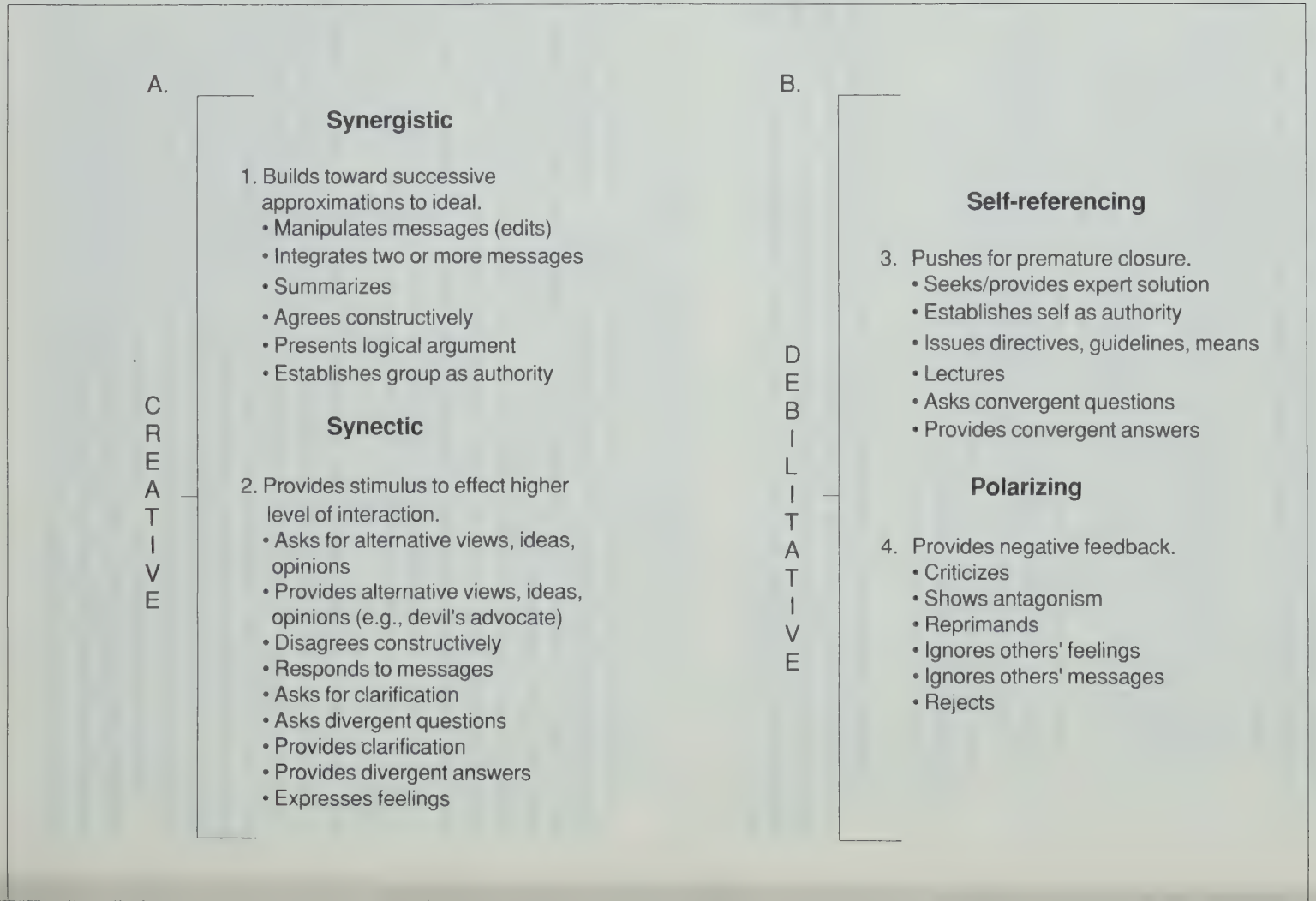
INTERACTION ANALYSIS INSTRUMENT

In order to create an interaction analysis instrument, other such instruments — namely those by Bales (1950), Flanders (1961), and Weilanders (1971) — were analyzed for their applicability. While none of the three instruments is designed specifically for computer conferencing or group problem-solving (Bales' is designed for face-to-face meeting interactions and both Flanders' and Weilanders' are designed for teacher-student interactions), each contains some classes of interactions appropriate to group problem-solving. By and large, however, since this instrument is designed specifically to analyze the process of group problem-solving, it is only tangentially comparable to other instruments (see Figure 3).

The interaction analysis instrument is divided into three categories of group interactive behaviors, labeled as creative, debilitative, and facilitative. In an ideal world only the creative category (A) — comprised of two sub-categories, synergistic and synectic behav-iors — would be necessary. The synergistic behaviors (i.e., those behaviors which converge toward consensual solution) play with and against the synectic behaviors (i.e., those behaviors which diverge toward alternative possibilitlies), thus ensuring that the group problem-solving process is dynamic and comprehensive as well as being on-task and integrative. In the real world, however, there are individual actions which tend to have a debilitating effect on creativity.

The debilitative category (B) — comprised of two sub-categories, self-referencing behaviors and polarizing behaviors — represents such individual actions. The self-referencing behaviors (i.e., those behaviors which direct individual angst and insecurities toward premature task resolution) play with and against the polarizing behaviors (i.e., those

FIGURE 3. *Categories in Interaction Analysis of Group Problem-solving Process.*



C.

FACILITATIVE

Group-referencing

5. Creates/maintains a problem-solving environment.
   - Focuses attention on relevant concerns
   - Rechannels off-task behavior
   - Provides positive reinforcement for creativity
   - Requests appropriate system changes to satisfy group process needs
   - Maintains open forum until full exploration has been achieved
   - Abates/reduces tension
   - Accepts others' feelings
   - Interjects humor
   - Releases tension

behaviors which tend to effect group dissolution through individual isolationism), thus ensuring that the group problem-solving process will not be successful.

The behaviors of the facilitative category (C), however, may be implemented to counterbalance or nullify the effects of debilitative behaviors. The facilitative category is comprised of one class of group-referencing behaviors (i.e., those behaviors which may be applied to transform debilitative behaviors into creative behaviors). Used appropriately, category C is the fail-safe mechanism.

This interaction analysis instrument may be used by a problem-solving group to provide feedback on their process toward problem solutions and to suggest possible means for removing obstacles as they arise. Applied as a formative evaluation tool, the instrument may be used to monitor, control and improve group progress. The individual group members, by focusing upon their and others' behaviors and the real and potential effects of these behaviors, will advance the proactive metacognition abilities of the group, thereby increasing the likelihood of reaching desired and desirable goals.

Seen as a testable hypothesis, the instrument may be used to research the group problem-solving process. Ethnographic research (naturalistic inquiry) might use the instrument as a coding tool to classify individual behaviors and analyze recurring correlations between behaviors or sets of behaviors. Action research might assign a group member the role of catalyst, whose task would be to use category C behaviors to transform category B behaviors to category A behaviors. Experimental design research might use category C (a set of behaviors) as an independent variable. These suggestions are put forth only as a few research possibilities, among many, that may further understanding of the group problem-solving process and the role of computer conferencing within this process.

CONCLUSION

The unique and ideal application of computer conferencing-based group problem-solving is yet to be realized. It is suggested that through the rigorous application of: a) the operational definition of group problem-solving, b) the group problem-solving models, c) the principles to effect group problem-solving, d) the essential capabilities of the system, e) the interaction analysis instrument, and f) the suggested research approaches, the unrealized ideal may become reality. A type of problem-solving that is at best rare in today's world could become a regular occurence.

REFERENCES

Bales, R. F. (1950). *Interaction process analysis: A method for the study of small groups.* Reading, MA: Addison-Wesley.

Beckwith, D. (1983, January). *Interactive technology: Capitalizing upon and promoting natural learning and communication styles.* Paper presented at the annual international convention of the Association for Educational Communications and Technology (Division of Information Science and Computers), New Orleans, LA.

Beckwith, D. (1984, April). *Facilitating learner control of the learning process through interactive technology.* Paper presented at the Educational Technology International Conference, Association for Educational and Training Technology, Bradford, England.

Beckwith, D. (1986a). *Analysis of participant interactions on CoSy conferences.* Unpublished manuscript, Concordia University, Montreal, PQ.

Beckwith, D. (1986b, June). *Distributed learning spaces: Principles for effecting group problem-solving through computer conferencing.* Paper presented at the 16th National Conference on Instructional Technology, Association for Media and Technology in Education in Canada, Toronto, ON.

Boyd, G. M. (1986, April). *Flexible learning through computer mediated communications: Opportunities and limitations.* Paper presented at the annual Educational Technology International Conference of the Association for Educational and Training Technology, Edinburgh, Scotland.

Dewey, J. (1910). *How we think.* Boston, MA: Heath.

Flanders, N. A. (1961, December). Analyzing teacher behavior. *Educational Leadership,* 173-180.

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York, NY: Holt, Rinehart, and Winston.

Gagné, R. M., & Briggs, L. J. (1979). *Principles of instructional design* (2nd ed.). New York, NY: Holt, Rinehart, and Winston.

Habermas, J. (1973). *Legitimation crisis.* Boston, MA: Beacon Press.

Hiltz, S. R. (1982). Evaluation and impacts. In *Telecommunication in higher education: Conference briefs.* Newark, NJ: New Jersey Institute of Technology.

Hiltz, S. R., Johnson, K., & Agle, G. (1978). *Replicating Bales' problem solving experiments on a computerized conference: A pilot study* (Research Report No. 8). Newark, NJ: New Jersey Institute of Technology, Computer Conferencing and Communications Center.

Humphrey, C. (1986). *Experiences in managing and evaluating a computer conference* (CSR Working Paper No. 86-2). Edmonton, AB: University of Alberta, Centre for Systems Research.

Johansen, R., Vallee, J., & Spangler, K. (1979). *Electronic meetings.* Reading, MA: Addison-Wesley.

Kaye, T. (1985). *Computer-mediated communication systems for distance education: Report on a study visit to North America* (Project Report CCET/2). Milton Keynes, England: The Open University, Institute for Educational Technology.

Kerr, E., & Hiltz, S. R. (1982). *Computer-mediated communication systems: Status and evaluation.* New York, NY: Academic Press.

Kott, S. (1986). Think tank on marketing computer conferencing. *ENA Netweaver, 2*(2), Article 6.

Sprigge, B. (1986). Info overload & CC summaries. *ENA Netweaver, 2*(2), Article 10.

Stevens, H. (1986). The business culture of computer-based communications. *ENA Netweaver, 2*(2), Article 4.

Turoff, M., & Hiltz, S. R. (1983, May). Feature interview: Murray Turoff and Starr Roxanne Hiltz on electronic publishing and people. *TSEVI,* pp. 8-13.

Umpleby, S. (1986a). Online educational techniques. *ENA Netweaver, 2*(1), Article 6.

Umpleby, S. (1986b). Desirable features for computer conferencing systems. *ENA Netweaver, 2*(1), Article 9.

Umpleby, S. (1986c). *The international network of systems theorists. ENA Netweaver, 2*(2), Article 11.

Vinson, C. (1986). The other side of the business culture. *ENA Netweaver, 2*(2), Article 5.

Weilanders, D. E. (1971). Interaction analysis: A new dimension in student teaching. In J. A. Johnson & R. C. Anderson (Eds.), *Secondary student teaching: Readings*. (pp. 168-173). Glenview, IL: Scott, Foresman.

Current Applications

Educational Applications of Computer Conferencing

Elaine K. McCreary
Judith Van Duren

Abstract: Ten different educational functions of computer conferencing have been identified at the University of Guelph. Each requires different skills from teachers and learners and each achieves a different educational purpose.

Student conferencing behaviour was examined at the level of simple attendance, as well as for rate and type of active participation. Given adequate orientation and training along with a compelling reason to use the system, students will participate despite inconvenience of hardware location; whereas convenience of hardware does not seem to compensate for inadequate training or a marginal reason for system use. Rate of activity tends to rise with academic level. Academic level has a pronounced effect on the type of student interaction. Differential status of participants does not seem to lower the rate of commentary, but can cause conferees to become guarded in their remarks.

Recommendations for successful academic conferencing emphasize the importance of training prior to implementation and of providing several forms of printed and on-line assistance during the academic conference. In particular, those experimenting with academic applications of CoSy at the University of Guelph foresee adaptations of the moderator's role in facilitating the various educational functions of computer conferencing.

The following paper is based on applications of the CoSy conferencing system at the University of Guelph. Conferencing situations were established to support education for undergraduate and graduate students. They were used in conjunction with on-campus and distance education modes. Some conferences were directly course-related, while others were educational but independent of course work.

The paper addresses the following three objectives:

Objective 1 - To define a range of functions that computer conferencing can fulfill in support of education;

Elaine K. McCreary is Assistant Professor in the Department of Rural Extension Studies at the University of Guelph, Guelph, ON N1G 2W1. Her research interests include educational foundations and information science studies. **Judith Van Duren** is a CAL Analyst with Academic Computing Services at Athabasca University, Athabasca, AB. This article is based in part on a paper presented at the annual conference of the Association for Media and Technology in Education in Canada, Toronto, ON, June 15-18, 1986. Reprints may be obtained from the authors at the above address.

Objective 2 - To identify influences on student behaviour and assess their respective impact; and

Objective 3 - To propose guidelines drawn from experience for successful use of computer conferencing as an educational medium.

TYPOLOGY OF EDUCATIONAL FUNCTIONS

Educational techniques are structured activities for engaging learners with their object of learning. Computer conferencing is a medium of interaction that accommodates a variety of structured activities and thus is remarkably versatile in the educational functions it can fulfill.

Ten distinct uses of conferencing are identified here, each of which serves a separate educational function. Where one course may use its support conference to fulfill only a single function, another course may incorporate several functions into a complex conference with various topics serving the different purposes. Functions are listed more or less in order from least to most difficult to implement.

FIGURE 1. *Educational Functions of Computer Conferencing.*

1. The Notice Board
2. The Public Tutorial
3. The Individual Project
4. Free Flow Discussion
5. The Structured Seminar
6. Peer Counselling
7. Collective Database
8. Group Product
9. Community Decision-making
10. Inter-community Networking

The Notice Board

Conferences may fulfill the same function as announcements made in class. For example, the instructor can advise about office hours, advance reading for classes, due dates for assignments, material on reserve in the library and important points to review for exams. The electronic notice board is permanently displayed, printed, dated, equally accessible to those who attended class and those who missed. It is also interactive thereby allowing for clarification of announcements. For administrative details, the on-line notice board offers advantages over the teacher's class announcements or hand-outs, and the students' phone calls or visits to the professor's office.

The Public Tutorial

It is generally accepted that if one student has a problem of understanding or

interpretation then a number of others will likely share this problem. Accordingly, conferences have been used as a forum to answer questions, clarify issues and expand on material presented in-class in order to benefit not just the inquirer but all conference readers. When points are raised by a student on-line, the faculty member is undoubtedly more inclined to produce a detailed discussion knowing that it won't be necessary to repeat this same explanation many times during subsequent office visits from other students.

The Individual Project

The *conversation* mode has served as a conference-between-two for situations such as rewriting a term paper, guiding an independent reading course, or thesis writing at a distance where close supervision is neither possible by direct visit, nor convenient and affordable by telephone. In one sense on-line supervision is slower than direct spoken consultation, but it can also be more thoughtful and the exchanges more productive for the amount of contact time.

Free Flow Discussion

Free flow discussion is a type of conference used by both students and teachers to continue and supplement the interaction begun in class. It extends a virtual meeting place over time so that people can pursue ideas between classes after they have had time to read further and reflect on issues. For example, it has been used successfully for speculation on a *futures* theme, and may work best when it is no more formalized than conversation in the local coffeeshop or pub. However, it need not be aimless or inconclusive since any participant can focus attention on a series of comments and test group consensus.

The Structured Seminar

The *structured seminar* is a conference in which sub-topics have been matched to units of course material. This is particularly useful when distance students are involved, or if individuals will be covering material at different times. The structure permits participants to access early topics in the course and thus reactivate discussion on them without having those themes lost in intervening material.

Peer Counselling

This type of conference is primarily for student-to-student interaction and provides a place for giving support and advice on academic matters such as exam preparation, administrative details concerning fees or registration procedures, existential crises related to thesis proposal writing, and the general disadvantages of being a part-time student. While peer counselling has been observed interspersed in conferences with other purposes, it is an important enough function to merit a separate topic in a course conference, or separate conference for the student body of a department.

Collective Database

Computer conferencing can facilitate the creation of a collective database such as a student listing of journals, annotated bibliography, directory of sources for scholarships or a calendar of events. The conferencing system provides a means to both solicit and collect the offerings from individuals. Information can either be left on the system as conference messages or can be transferred to a word processing file where it can be sorted, edited and

formatted. From here it can be returned to the system as a long but organized input or be distributed in paper form.

Group Product

A conference system can facilitate course related group work such as case study preparation, team presentations and project development. It can provide a forum in which to pursue the analysis of the problem, coordinate individual efforts and proceed with review and revision. Used in conjunction with a word processing package the conferencing system can enable the preparation of group papers.

Community Decision-making

An open forum established for all faculty, staff and students can address more than minor decisions such as a date for the department picnic. It can discuss management of audio-visual equipment and the reading room, procedures for comprehensive exams and thesis defenses, curriculum topic additions and deletions or preferences among nominees for visiting faculty. Especially at the graduate level, shared decision-making is beneficial for all and appropriate to building a true academic community.

Inter-community Networking

Linkages have been attempted between similar academic groups at different universities in an attempt to promote common research and scholarly interests. This seems to work best among people who have already established some degree of mutual familiarity through shared study, on-site conferencing or exchange of papers.

INFLUENCES ON STUDENT CONFERENCING BEHAVIOUR

As with traditional modes of learning, student behaviour in course-related conferencing can be examined at the level of simple attendance (logging in or not) and for the quality of participation they exhibit once present.

Initial Participation of Students

Students log into course conferences in direct relation to the strength of two factors:

1. They have to be able to (accessibility); and
2. They have to see a reason to do so (perceived benefit).

Accessibility

For the student, accessibility is comprised of several things: reasonably located equipment, familiarity with a short list of essential commands, and a grasp of the conceptual model of computer conferencing. Between hardware convenience and software comprehension, the latter seems to be the more decisive influence — underlining the necessity for pre-enrolment training; while the importance of convenient access to hardware has been seen to vary with the second influence, perceived benefit.

Perceived Benefit

Enthusiasm or curiosity on the part of a faculty member will not necessarily transfer to students who have pressing demands on their time and learning capacity. Intrinsic motivation does exist in the form of enjoyment of conferencing and desire to use the system; and students who have already had a successful experience of conferencing tend to be voluntary users at the next opportunity. But external motivators are usually necessary when a course is the first exposure to the conferencing medium.

One incentive is to make certain that important information such as the answers to assignments, the domain of a quiz, or the response to an in-class question, is available only on the conference. This will at least encourage students to follow the conference in a read-only manner. A more compelling incentive for active participation is to assign a portion of the final mark to conference contributions. If a course conference does not offer some unique benefit, then students will not even go next door to a terminal; yet a part-time graduate student was known to drive 20 miles to a terminal in order to conference regularly with the supervisor of his individually tailored reading course.

Influences on Type and Rate of Conference Activity

Getting students to come on-line is only the first of the teacher's new hurdles -- similar to earlier programs of educational outreach that had to actively enlist reticent populations. Once on-line, the student may act as a *read-only* participant, never venturing a comment. To some extent, individual participation is determined by the personality, degree of confidence and level of interest in the subject matter of each student, much as in the classroom situation. However, observations reported on nearly 20 academic conferences indicate that student conferencing behaviour in general may be influenced by academic level, curriculum area, and relative status of conference participants as illustrated in Figure 2.

FIGURE 2. *Situational Influences on Observed Conference Activity.*

	Academic Conference Observations	
Situational Influence	Rate of Participant Activity	Type of Educational Activity
Academic Level	√	√
Curriculum Area	- -	?
Relative Status of Participants	√	√

Note: √ = apparent influence; - - = no apparent influence; ? = unknown influence

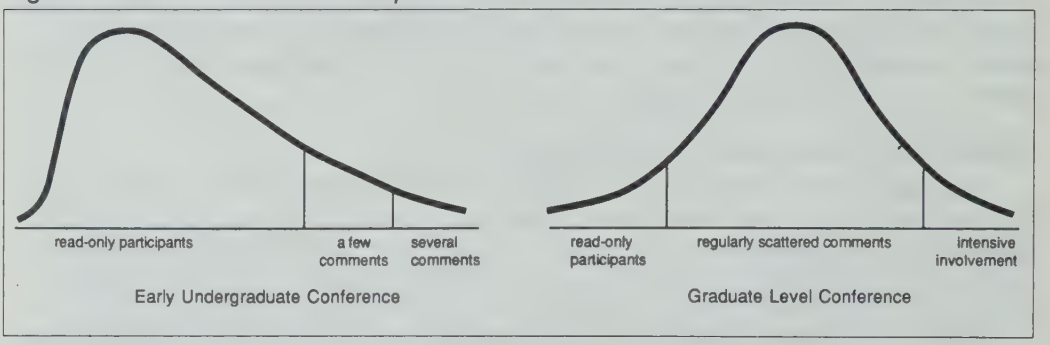
Academic Level

With the progression from introductory courses to senior undergraduate to graduate

courses, class size can dramatically decrease from a full theatre of several hundred to a small seminar of a dozen or less. At the same time, Perry (1970) has claimed that a progression in cognitive maturity takes place whereby student thinking tends to move from: 1) "give me the right answer," through 2) "we all have different and equally good answers," to 3) "there must be some criteria for judging relatively better answers." Class size and cognitive maturity combine in academic level to produce a noticeable influence on both the rate of conference activity and type of educational function it fulfills.

Rate of conference activity naturally varies among students in a given class, but the distribution curve of student participation also tends to change with advancing academic level as illustrated in Figure 3.

Figure 3. *Rates of Student Participation.*



With early undergraduate conferences the majority of students are likely to be read-only participants, while a small proportion add one comment or question, and an even smaller number become actively involved. For more senior student populations where faculty expectations are higher, course evaluations encourage demonstration of individual creativity, and student dialogue is part of the learning process, the rate of participation more nearly resembles a normal distribution. The majority of students will be likely to contribute regularly, while the exceptions are read-only or intensely involved.

The nature of educational activity on conferences also tends to vary with academic level. Typically a large introductory course has a rather simply structured conference in which the input primarily originates with the instructor. The teacher acts as the information provider and the students act as the information consumers. There is a definite feeling of vertical organization with problems being addressed upward and advice coming top down. With graduate level courses the conference becomes a vehicle for the type of student interaction that often occurs outside class. There is a greater feeling of control and ownership of the conference and an increased sense of responsibility for its success. At this level peer counselling and the higher functions of conferencing as defined earlier, begin to occur.

Curriculum Area

Adoption of electronic communication has been uneven across colleges at the University of Guelph. To date the College of Family and Consumer Studies leads with 40% of its faculty at least having membership on the system. The Ontario College of Agriculture has 29% of its faculty signed on, College of Social Sciences 25%, with Physical Sciences at 20%, Arts at 14%, Biological Sciences at 12% and the OntarioVeterinary College 8%. Within those college averages are contained some departments with no faculty using

interpersonal computing, and one only, the Department of Rural Extension Studies, with 100% of its faculty (and graduate students) on-line. These figures report only a recognized membership on the system; regular usage for mail or managerial conferencing is undertaken by a combined average of only 14% of the faculty and administrative staff. Since administrators contribute a much higher proportion of their membership to the combined average than do faculty, experimentation with teaching/learning applications of conferencing is being pioneered by a very small number indeed.

For this reason, it has not yet been possible to compare equivalent populations of students across the various curriculum areas. But observations to date suggest that there is not an appreciable difference between the rates of typical undergraduate conferencing behaviour across curriculum areas. What may vary and has yet to be ascertained is the type of conference function that is used in the several curriculum areas. Some curricula simply may not allow for evaluation of opinions and the student dialogue which makes that possible.

Status of Participants

Rate of participation in conferences increases with a feeling of security on the part of participants not only in regard to subject matter, but also in relation to the group. This feeling can be marred by the presence of high status participants other than the normal faculty member. With student conferences at any level it has been noted that the presence of outsiders of a high status has an inhibiting effect.

One of the phenomena of conferencing is the capability of sitting back and observing without having your presence known (except on the listing of registered participants). On the part of a peer this is acceptable behaviour and can be seen to be the result of shyness or some such factor. On the part of a superior it is more likely to be regarded as judgemental observation of unknown intent.

Consequently both the lowest and highest status participants have shown reticence to log into optional conferences. Reluctance has been expressed by system members of high institutional status to join a conference when even their read-only participation might inhibit the discussion.

For conferencing to achieve its democratizing potential, attention will have to be given to ways of mitigating the undersirable effects of differential status among participants.

RECOMMENDATIONS FOR SUCCESSFUL ACADEMIC CONFERENCING

We discovered with the introduction of slides, filmstrips, films and videocassettes into the classroom that there was as much to learn about preparing students for the activity and debriefing them afterwards as there was about actually using the medium. The same holds true for incorporating the computer conference into a course. It requires as much attention before implementation in the course as during. This section highlights several important points of intervention.

Preparation for the Student Participant

Intelligent, accomplished and valuable students are still arriving at the university with no experience of mediated communications. If we wish to optimize their training for an academic conference, it should be a thorough orientation to the medium that includes basics

of the machinery, the system commands and the conceptual model of conferencing.

Effective training requires small-group or even individualized attention that includes a practice hands-on session at the keyboard for each participant. No written instructions can anticipate all of the minor technical details that the novice user will encounter and can find seriously daunting. The presence of an instructor or experienced peer guarantees immediate assistance and feedback.

It should be remembered that a computer conferencing system is not only a tool but also a medium of communication. Although the unique potentials of the medium and the individual's style in using it emerge through experience, a student's cultural assimilation into conferencing will be made easier if direct reference is made to conventions of messaging such as writing in readably short paragraphs, acknowledging the contribution of other participants, and indicating affect in parentheses (groan) (sigh) (chuckle!).

On-going Advice and Assistance

In addition to pre-conference training a variety of assistance is recommended for successful conferencing. Written documentation should be available in several forms including the full manual, a step-by-step sample session, and a short list of the most commonly used commands.

On-line assistance can be provided as a feature of the software where a *help* command brings additional instruction at every possible juncture. On-line assistance can also be elicited through a system wide conference open to all system members and serviced by technical staff. One very successful approach has been to include in every academic conference a separate subtopic for dealing with technical problems. This can be serviced by the instructor/moderator, a teaching assistant, or other class members. Student participants enjoy sharing their new expertise with others and may in fact have more to offer other new users than longtime system members who really can't remember too well what it was like to be intimidated by conferencing.

Students at a Distance

Technical training will be most difficult for students working in isolation and the number and variety of problems that can be encountered should not be underestimated. A solitary novice user getting no response from the system may not be able to diagnose whether the problem is located in the machinery, the system, or their own actions. If they have no local technical advisors they must contact the host institution. If they are located in a different time zone from the sponsoring institution telephone contact becomes more problematic.

A suggestion arising from experience is that no distance student be considered actually registered for a computer conferencing course until they have made contact with the faculty member using the system as proof that they will be able to participate.

Preparation for the Instructor-Moderator

University faculty often discover the hard way that instructing requires another domain of skills beyond their subject matter expertise. By comparison, the move from classroom teaching to conference moderating is not such a major adjustment. It is an extension of the personal and social psychology of learning. It is also, however, a new medium with unique characteristics, and teachers should be assisted to achieve a degree of personal skill, familiarity and ease with the system prior to using it with their students. In theory such

professional development can occur in a small group, but experience indicates that those who have mastered an area of expertise prefer to do their groping with a new skill in an individualized tutorial, and even there the tutor needs to use tact and patience.

Moderating Academic Conferences

Situational leadership theories tell us that effective leadership means responding to the particular requirements of people in various circumstances. Similarly, people who have trained as educators realize that there are specific and varied techniques for achieving different sorts of educational outcomes with various kinds of learners. The distinctive character of the ten educational functions described here strongly suggests that specialized moderating skills will emerge for successfully conducting each type of conferencing activity.

REFERENCE

Perry, W. (1970). *Forms of intellectual and ethical development in the college years.* New York, NY: Holt, Rinehart and Winston.

CONFERENCE SEGMENT

(This section begins with a reference to the Introduction to this issue which was uploaded onto 'bcjec' for comment by the authors. Ed.)

==========
bcjec/discuss #66, from tkaye, 804 chars, Wed Mar 18 16:48:51 1987
This is a comment to message 56.

. . .yes, I like the Introduction, Bob. Although maybe the expression 'bleeding edge' rather than 'cutting edge' might be more appropriate for describing the things we're trying to do here. . .bruised fingertips, electrocution, tripping over the multiple strands of wire snaking out of the back of the equipment, eyestrain, and metabolic disorders caused by low-level penetrating radiation are all part of the price we pay for this liberating technology!

==========
bcjec/glossary #31, from elainemc, 1623 chars, Fri Mar 20 19:50:10 1987

TITLE: INTRODUCING C-M C INTO A DIST. ED SYSTEM

Ah, Tony, methinks thou doth protest too much! We've come
to count on you to tell it like it is with technology. Makes
me think back to two lines from a Beatles' movie — was it
A Hard Day's Night — there they are with two British scientists
with a room full of Japanese equipment that won't work. One of the
scientists is tearing his hair and waving about some electrical wires
crying "it's the British plugs! it's the British plugs!"
and the other scientist is in a corner mumbling "I could take
over the world if I could only get a government grant!"

All your disclaimers are taken as wise advice, honest
reporting and British modesty — and then discarded — we know
you are an incurable aficionado.

Current Applications

Teaching and Learning On-Line: Issues in Computer-Mediated Graduate Courses

Linda Harasim

Abstract: Computer-mediated communications introduce a new spectrum of educational options for educators and learners today. Among the most exciting are the "electronic campus" and "on-line courses" designed and delivered via a computer conferencing system. Computer conferencing enables the development of a time and location-independent learning environment which in large part and with sound design may simulate educational interactions, both cognitive and affective, that occur on-campus. Certain key access restrictions such as geographic location, scheduling conflicts, availability of classes, physical handicap, travel time and cost become redundant. Beyond enhancing and expanding educational access, computer-mediated communications suggest significant potential for effective new learning and research interactions. Such design options have particular significance for graduate-level learning: for increasing learning access and for providing quality group learning opportunities. However, regardless of the level of education, little is as yet known or understood about the nature of learning and teaching within an on-line environment. This paper offers a contribution in its analysis of how computer conferencing supported learning in graduate level courses and in its conclusions for future research.

INTRODUCTION: NEW EDUCATIONAL OPTIONS AND CHALLENGES

'Electronic education'[1] is becoming a significant force as schools, colleges, and universities in North America and Europe increasingly offer course activities and programs on-line, using the computer as the medium for group communication. While existing experience indicates significant potential for enhancing and changing teaching and learning, there is a critical need for research to inform future developments. The Office of Technology Assessment (U.S.A.) recently concluded that information technology will likely become a major vehicle for responding to the educational and training needs of society in the next few

Linda Harasim is the Computer Conferencing and Networking Coordinator at the Ontario Institute fo Studies in Education, 252 Bloor St. W. Toronto, ON M5S 1V6. Her research interests include educational applications of computer communications, computer-mediated collaboration in education and research, and gender equity issues related to computers in education. She also teaches courses on computer communications in education, women and computers in education, and adult education and community development. Reprints may be obtained from the author at the above address.

CJEC, VOL. 16, NO. 2, PAGES 117 - 135, ISSN 0710 - 4340

decades. However, "much remains to be learned about the educational and psychological effects of technological approaches to instruction. Not enough experience has been gained with the new information technology to determine completely how that technology can most benefit learners or to predict possible negative effects of its use" (1982, p. 6).

Existing research on electronic communication has been largely limited to analysing technology-based media as a substitute or surrogate for more costly media (such as face-to-face activities) (Feldman, 1986). Current use of the new media as electronic analogues to, or substitutes for, existing media may be emphasizing efficiency over the qualitative advances which these innovations could offer (Vallee, 1982; Harasim and Johnson, 1986; Kaye, 1986). Many researchers echo Feldman's proposition that "it is possible that the strengths of the new medium will be in other areas than the strengths of old media. The new medium may even be used in ways not envisioned by those who designed it" (1986, p. 74). Johansen (1984) similarly strongly encourages moving beyond "horseless carriage" thinking which casts new applications of computers in the image of their face-to-face precursor.

Analysis and discussion of the specifically *educational* value of computer-mediated communications is only beginning to emerge as a distinct arena of research (Quinn Mehan, Levin & Black, 1983; Kaye, 1985; Riel, 1986; Hiltz, 1986). However, preliminary data indicate interesting results.

Hiltz, reporting initial results from one of the first major studies of the virtual classroom, observes that not only does the use of computer conferencing introduce *new* educational options, but in some cases this medium may even be *more* effective than the traditional classroom. She concludes moreover that the potential value of on-line education may well rest upon the ability of educators to use computer communications to offer qualitatively new educational options. "One important requirement for realizing the promise of new educational technologies is to use them to create new learning and teaching environments that are more effective and exciting for at least some kinds of materials, rather than merely trying to replicate the traditional classroom electronically" (1986, p. 104).

The point that *new* learning and teaching environments should be created on-line is suggested in other case examples as well. Haile (1986) reports that applications of computer conferencing which employed a highly teacher-structured and teacher-dominated approach did not noticeably improve the attrition rates or student scores. While acknowledging the preliminary nature of her research, Haile suggests the possibility of a positive direct relationship between teacher behaviours which stimulate student participation and students' retention in distance learning programs (p. 13). The implication is that teacher behaviours and cc course designs which encourage more peer interaction and take overt advantage of the group communication potential may contribute to decreased attrition rates and increased learning effectiveness (p. 1). Related to this position is the view that "a computer teleconferencing system applied to a collegiate course permits the superimposition of an 'electronic classroom' onto the asynchronous time availability and location requirements of distant learners, with all the motivational, intellectual, and pedagogical (or more accurately andragogical) advantages that come along with the close-knit classroom environment" (Deutschman, Kramers, Richards, Spitzer, & Haile, 1985).

The electronic medium opens new educational options for both learners and educators,

---

[1] The terms "electronic education" and the electronic classroom are used interchangeably with other terms currently in use such as on-line education, the virtual classroom, and computer-mediated education.

not only in expanding educational access but also in redesigning teaching strategies and learning activities.

Since educational applications of computer-mediated communications are in their infancy, educators face both opportunities and challenges. We understand little about the new phenomenon of learning in an electronic space. There is as yet very little data describing or analysing teaching and learning within this asynchronous, text-based (screen) environment. What are the differences between on-line and face-to-face classes? What are the perceived advantages and disadvantages to teaching and learning in the on-line mode? Can we, in addition to improving educational access, improve the effectiveness of the educational interaction? Hiltz (1986) enquires whether computer conferencing, unlike many educational technologies, can contribute to preserving the advantages of interaction and fostering active learning while improving educational access and quality. She sets out a series of questions which provide a useful framework for this paper.

> How can we utilize computer-mediated communication systems to support effective, active learning? Can we provide facilities for the types of activities that usually occur outside the classroom, such as office hours, libraries, and even extra-curricular activities? Further, can the new technology-based modes of communication serve as more than an emulation of the process of face-to-face communication in the traditional classroom? Can they support a different, more active and involved style of learning on the part of the student? (p. 96)

The Focus for this Study

This paper addresses some of Hiltz's questions in its description and analysis of computer conferencing as a support for effective and active learning in graduate-level courses. Two explanations are relevant. The first is the view that graduate education has particular characteristics: contact between instructors and students should be frequent and intense; debate and dialogue should play a greater role (than in undergraduate courses) (Queen's University, 1975). Moreover, "students benefit greatly from the interaction with each other . . .studying alone in the library and talking individually with a professor are important but cannot replace the sharpening of skills among groups of students" (p. 31). Computer conferencing suggests itself as a potentially appropriate medium for a graduate level group learning activity.

The second relates to the understanding of effective learning. Effective learning can mean many things. In the Hiltz (1986) study, learning effectiveness was measured by "whether students take a more active part in the learning process and take advantage of the potential for more interaction with the professor and the other students, despite the absence of nonverbal cues to facilitate this interaction" (p. 100).

In this present study, the measures of effectiveness in learning were active user participation and user perceptions. This latter measure is in line with the growing recognition of practitioner wisdom which argues for the relevance and authority of feedback from the practitioner (Cook, 1985, p. 30). In the case described here, the participants were learners who have experienced a wide variety of learning environments (most are also experienced educators) and hence have significant experience as educational practitioners.

This paper reports on exploratory field research. In the tradition of qualitative research, the intention is to enhance the ability of the researcher to understand and ultimately devise an explanation which is consistent with occurrence in the social world (Cook & Reichardt,

1979; Patton, 1980). Qualitative and quantitative data were collected from participants in two graduate level courses which were offered entirely on-line. Data from students in both courses were collapsed for presentation in this paper. In a few cases, where appropriate, the data are distinguished as reflecting Course 1 or Course 2; in specific instances data from only one course were obtained.

Qualitative methods such as semi-structured interviews, participant observation, and analysis of selected conferences were employed to obtain user reactions to the use of cc as an educational delivery medium. As the interaction was entirely text-based, transcripts of the proceedings (of the course 'discussions') were available on-line and as printouts. Several on-line conferences, including course discussions, "Learning Log" (which recorded user impressions), and course feedback conferences (which solicited feedback on the experiences of learning on-line) were selected as key sources of data. Transcripts permitted the use of extensive quotation. A significant amount of participant experiences is provided here to show what it was like from the participants' point of view to be in the course.

Quantitative data in the form of usage statistics and responses to on-line polls and questionnaires were also gathered.

BACKGROUND

The Ontario Institute for Studies in Education (OISE) is a graduate school of education affiliated with the University of Toronto. Since 1985 OISE has used the Participate computer conferencing system in a variety of educational applications. The Participate system offers facilities for electronic mail, conferencing, real time (synchronous) messaging, electronic polling, editors (both line editors and the VAX EDT fullscreen editor) as well as search mechanisms whereby the users can locate conference items and topics. Additionally, Participate offers features valuable for designing an on-line educational environment. For example, the software has topic joining action which establishes a user record to keep track of what notes a user has seen in any topic joined; topic branching facilities that form groups easily as subsets of larger groups; access controls; and knowledge base editing which includes tools for moving subtopics so that they are better indexed, for modifying topic openers to summarize notes that follow, and tools for keyword search (Stevens, 1986). Advances in computer communications software are beginning to offer the possibility of a self-contained educational environment.[2]

The two graduate courses described in this paper were delivered entirely on-line, each over a twelve week period: Course 1 in the Winter Session, January-April, 1986; Course 2 in the Fall Session, September-December, 1986. Each course examined and analysed gender equity issues related to women and computers in education. Students were expected to log on at least two times per week, and to spend a total of 2-3 hours/week participating on-line.

The two courses had seventeen and twelve students respectively (in the former case, an additional 21 users participated as part of a non-credit professional development course). The majority of students were female; in each course there were three males. In both cases, there was a range of computer expertise: approximately 10% were novices, 20% considered

[2] OISE is moving towards the development of an "electronic campus" by offering courses, access to faculty and to learning peers on-line. It is also currently possible to access the OISE librarians, but the library catalogues and administrative services are not yet available within this electronic environment.

themselves experts; and the remainder were somewhat to quite comfortable with a computer.

Students were located in cities, towns, and remote areas around the province of Ontario and were linked with one another through their microcomputer, modem and a telephone line, whereby they accessed the Participate conferencing system housed on one of OISE's VAX 11/750 minicomputers. Through this link they participated in asynchronous conferences, sent and received electronic mail, used synchronous messaging, employed text editing, and participated in electronic polling.

Two instructors shared the tasks: one served as the principal course instructor while the co-instructor assisted. While in both courses the two instructors were the same, roles were reversed with the co-instructor assuming the principal role in Course 2.

Description of the On-line Course Activities

Design of the on-line course activities was considered the critical component since it would affect the quality of the learning environment. Two major factors influenced the course design: the features and character of the medium itself, and the learning situation.

Computer conferencing is essentially a group communications medium enabling groups of people to exchange ideas and opinions and to share information and resources. Conferencing systems typically provide opportunities both for *electronic mail* as well as for *conferencing* communication. Electronic mail by itself is a one-to-one, personal communication medium, while conferencing is designed to facilitate the interactivity of group communication, maintaining an ongoing transcript of the interaction among the many people discussing a topic. Additionally, the asynchronous nature of this medium allows for convenient access and some measure of control in interacting with and through the medium.

However, while conferencing facilitates and supports group communication, it does not guarantee it. Humphrey reports that "achieving an active membership appears to be one of the most difficult tasks confronting a conference organizer" (1985, p. 14). This difficulty seems characteristic of educational applications as well. Umpleby (1986) states that: "The most commonly discussed problem in on-line courses is how to keep students current with the discussion and active on-line". Haile (1986) describes the use of computer conferencing in distance education, but noted that there was little interaction among learners and that the conferencing activities were teacher-centered and teacher-dominated.

Our specific challenge then was to develop a design that was not only technologically appropriate and viable but also stimulated active participation and effective learning.

The course design built upon the distinctive character of the conferencing system to develop a learner-centered, group learning approach. The on-line educational environment was designed to take advantage of key features of the conferencing system (in particular, multiple conference spaces and branching capabilities) to create a rich and varied learning context. Rather than employ a single conference strand to house all the seminar sessions and learning activities, the branching facilities of Participate were employed to provide spaces for core and optional learning activities, for plenary, small group and working group discussions, and for informal (social) interactions. On-line polls were also employed to gather student reactions during the session. A number of educational activities were redesigned for the on-line medium, such as plenary discussions, debates, small-group discussions, working groups, class presentations, and group feedback and critiques. There were three phases to the on-line course: 1) four one-week "electronic" seminars; 2) on-line working groups and class presentations; and 3) final plenary sessions for feedback and reflection over the course topic

and process. While the course was carried entirely by computer conferencing, two face-to-face meetings were held to provide training, and a printed learning kit with course guides, readings, and technical documentation on computer conferencing was provided to each student at the outset (for additional information on the course design, see Harasim, 1986).

PRELIMINARY RESULTS

The results reported in this paper represent initial findings in an on-going study of computer conferencing and networking in education. Data on student participation, perceived effectiveness of learning, and advantages and disadvantages of on-line learning are presented here.

Rates and Nature of Participation

The goal of facilitating active learner participation was successfully achieved. Several measures (both quantitative and qualitative) were employed.

Analysis of usage data showed that students in the courses participated actively on-line throughout the session: averaging 4.2 hours/person/week in Course 1 (the range was 1.6 to 9.5 hours/person/week) and 3.6 hours/person/week in Course 2 (ranging from 1.4 to 7.4 hours/person/week). This rate was significantly higher than the required 2-3 hours/week or the 2.5 to 3 hours/week of classroom courses.

While time on-line provides some notion of the rate of participation, this measure became increasingly deceptive as students became increasingly adept at up/downloading conferences and working off-line. For example, the difference in time on-line/week between Course 1 and Course 2 may be partially explained by increased participation off-line. In Course 2 almost half the students reported downloading the discussions and doing much or most of their reading off-line.

Compared with time spent on a traditional-mode OISE course, in Course 1 100% of the students reported spending more time on the on-line mode, while in Course 2 50% of the students reported spending more and 20% approximately the same amount of time on the on-line course. In comparison with other OISE courses taken in the traditional classroom, the great majority of Course 1 students reported assuming *greater* or *much greater* individual initiative for the course as well as increased self-responsibility.

The rate of participation and interaction is also reflected in the number of messages and their volume (the number of characters) entered on-line. Examination of these factors indicates a high rate of student participation and a relatively equal correspondence between the student and the instructor.

Analysis of a representative core conference (a "seminar" on the same topic) in each course found that in Course 1 the principal instructor wrote 10% of the total number of messages, while in Course 2, the figure was 12% of the total number of messages entered. In relation to the volume of the messages (the number of characters written)[3], the principal

---

[3] While there was no control over the length of messages sent, participants were encouraged to limit each message to 1-2 screens (with the exception of the class presentations). The average length of Course 1 student comments (in core conferences) was less than one half screen (805 characters). The average length of instructor messages was just over a half screen (1220 characters).

instructor wrote 12.5% of the message volume in Course 1, and 10% in Course 2.

Overall, analysis of the rate and volume of participation indicates very active involvement of the students and relatively equal interaction between students and instructors. The instructor played an active part: introducing the discussions: *"Make sure to read section 2 of the Introductory notes. Then let's discuss what we've observed about this, what we've experienced, what the readings have to tell us about how gender domains work, and what we can do to change this."*; providing information: *"I'd like to take up some aspects of the learning environment at the adult level. There is an accumulation of studies which shows. . .*; probing: *"In note 140 of this conference, Jane Doe*[4] *raises an important point. . .but I'd like to question how these differences come about. Is it something to do with school policies? funding? the professional opportunities for students in a given school?*; raising issues: *"This note takes up the debate. . .The most recent contributions to this discussion have located a contradiction. . .But at a different level, are these examples really contradictory?"*; focussing: *"Our discussions already show what a rich topic this is and how important it is to our understanding. . .But I can also see that it's getting to be almost too broad. I think that's partly the reality — but I thought it might be useful to try to clear up one or two things and make one or two points to help focus the discussion."*; and most commonly, synthesizing points which students raised, building upon and developing themes which emerged in the on-line discussions and linking these to the literature and the topic.

The instructor was involved, but did not emerge as the dominant "voice" in the on-line discussions and seminars. A poll of student reactions in Course 2 found that 90% of the students felt that the amount of instructor input was just right (there is no comparable data from Course 1).

Student responses to open-ended questions on-line provides insight into their impressions of participation in an on-line medium. The great majority (both those who were highly verbal and those who were more reticent in face-to-face classes) indicated very positive experiences.

"One-to-one I am a fairly verbal person, but I do not participate well in a class situation and never have. This medium enabled me to participate far more than I would have in a regular class. I have taken other OISE courses with some of the participants in this course. My observation is that those who tend to participate double or triple their contribution on-line. Quieter students catch up to where those active participants were before."

"As far as communicating in courses goes, I can definitely say that I contribute at least 50% more frequently in this course than in regular courses. I definitely feel more comfortable writing rather than speaking to a large new group."

"Overall, I feel very positive about online learning: in fact I am taking another online course next term. I have been much more of an active participant in this course than in any other OISE course. As other students mentioned, actual hours spent on the course have certainly been greater."

Effectiveness

Student assessment of the effectiveness of learning in an on-line course was very positive. In a poll of Course 2 students,[5] 11 of the 12 respondents reported that they considered

[4] The student's name was changed for this paper.

[5] There is no comparable data for Course 1.

the on-line medium to be *more* effective than classroom situations for some applications;[6] 1 of 12 responded that on-line education can be *as* effective as classroom learning.

To explore fully the reasons given by the students for the perceived increased effectiveness of the on-line medium would be beyond the scope of this report and the present stage of data analysis. However, in the next section, some preliminary feedback from the students on the perceived advantages of on-line learning is reported to help illuminate the results just presented and identify issues for further research.

ADVANTAGES OF LEARNING ON-LINE AS PERCEIVED BY THE STUDENTS

Analysis of student reactions generated a fairly extensive list of perceived advantages. Overall, student reactions to on-line learning were highly positive. Responses to open-ended questions as well as unsolicited comments entered in various conferences led to the identification of several key themes or dimensions. These are:

1) Increased interaction: quantity and intensity;
2) Access to group knowledge and support;
3) Democratic environment;
4) Convenience of access: the "24 hour" class;
5) User control over the learning interaction;
6) Motivational aspect; and
7) Text-based communication.

In this section we explore those dimensions which appear to have had the greatest significance for the students (this list is not rank ordered). The data portray a depth and scope of experiences and reactions; however, given the nature of the data sources, there are no figures on response rates.[7]

---

[6] Two of these eleven specified they believed on-line education to be *more* effective than classroom education for adults but not, they felt, for children.

[7] The principal data source was comments (solicited and unsolicited) in various conferences. Computer conferences function somewhat like a conversation: this has the advantage of recording a variety of responses over a period of time and hence may reflect a greater range (and perhaps depth) of input. Conferences also have a disadvantage (for data-gathering) over questionnaires. Whereas each person responds to all appropriate questions in a questionnaire (thereby enabling the specification of response figures), a conference is often more like a conversation or discussion: after a certain point participants do not repeat a point made earlier by another person. One may add some remark to clarify her/his particular experience or perspective, but there is a sense that that position has been stated and now it is time to move onto a new point. Thus it is difficult to provide figures that accurately reflect student perceptions. The convention of using phrases such as "many students" or the "great majority" or a "few" has been employed to convey some indication of the weight of a particular position. Where available, quantitative data is presented.

Increased Interaction: Quantity and Intensity

Students were very positive about the rate and nature of group interaction facilitated by the conferencing system. The following comments reflect a general consensus: *"Interaction among participants: Superb!! The thoughts, ideas, suggestions, responses and support were greater in quantity and quality than I ever imagined or experienced in other courses".*

The branching capability enabled the design of a varied educational environment which facilitated both cognitive and affective communication. *"To me, the major success of this course has been the truly interactive involvement through the medium. There was always a large support group (including peers and instructors) to respond to technical, academic and even emotional (morale-boosting) needs. I've never been involved in a course in which I've learned so much from other students. This was the result that there was no competition for the floor [sic.]and therefore everyone was able to have her (generic use of pronoun) say. Also, as remarks were all documented, they were subject to more in-depth consideration than in the normal classroom".*

Not only was there *more* interaction, but students reported that the nature of the interaction was qualitatively different from classroom learning. Students experienced on-line learning as a more *intense* learning interaction. On-line learning had *"this continual sense of interaction. In the back of the classroom you can doodle quite happily; you're not expecting to be participating continuously. However, when you are at the computer, you are wasting your own time. You are either there to read notes, or to respond to notes. You are constantly required to be engaging with the computer, and that is very different from a classroom situation where, yes, you are supposed to be listening to a lecture but then you click off and draw a few circles and click on again. . ."*

Several students commented on this difference between learning on-line and graduate classroom lectures. *"There is a perception that you are on-going and active here; you're not sitting in any corner taking notes. It's not any external pressure, but I think it's the self-expectation".* This contrasted with face-to-face seminars as well: *"In seminars you can 'choose' to ignore discussions by assuming the 'graduate school stance': make like you are listening and ignore most of the conversation as 'white noise'. But online you cannot do that!"*

The text-based medium moreover, seemed to diminish shyness and fear of talking in large groups.

Access to Group Knowledge and Support

An interesting observation on increased effectiveness was the perceived opportunity to access a larger pool of knowledge and experience through the shared database. *"I learned much more than in a regular 3 hour course because of the interaction of all the students in the course. It is much more enriching this way. Through this medium we could tap the combined knowledge of the group".* The group interaction provided a greater source and scope for information: *"the information exchange is more diverse in that input is coming from everyone rather than only from the instructor".*

The value of the diversity of interactions was often expressed: *"I found it very interesting to be able to communicate with such diverse people and to be able to communicate with each of them. I mean, I minded about the lack of personal interaction, but in plain truth, when one thinks about it in a classroom situation, one tends to get to know maybe one or two people in that class and those people you go to coffee with or have a. . .(whatever forbidden fruit appeals to you). But in this situation there was a sense in*

which one was able to make communication with each person and that was interesting."

Students also noted an increased sense of group responsibility: *"I know one girl commented on line that whereas if she had enrolled in a class, she would miss the odd class and think nothing of it. If she didn't come on line for a period she felt very guilty and badly about it. As though she were letting people down. . .It's a perception that here is the whole group of which you are a part, attempting to do something. And, because you are a part of the group, if behooves you to participate in doing it."*

"I think it is somehow different from a classroom, because her feeling was that if she did miss a class or two, she was responsible to no one except herself. My interpretation of this is that in the classroom, that she was only impeding her own progress: she wouldn't get the information, or whatever. Sitting in a class she would normally not be a participant. The other members of the class would lose nothing by her absence. Whereas, online, in the the computer conferencing situation, since it's very much a group input at all times, then a sort of period of absence (I think she felt and I also felt) isn't just harming oneself. It's influencing the amount of information that's available and the amount of reaction that's available to the group."

Democratic Environment

Several factors contributed to the perception of electronic conferencing as a democratic environment. One in particular is the absence of physical or social status cues in the text-based environment. Students observed that in the cc environment, *what* was said becomes more important than who was saying it, thereby diminishing stereotyping associated with physical appearance. *"In on-line discussions, I think that there is a tendency to respond to content rather than to personalities."* This was deemed particularly important for over-coming gender and racial-based discrimination.

On-line education, moreover, was seen as promoting more equitable participation. *"Conferencing as a course vehicle promotes more equal interaction among participants, dropping barriers of geography, urban/rural styles, social skills, mannerisms."*

The lack of competition for air time was another important factor in encouraging more active participation. An advantage of computer conferencing is that everyone can participate to the degree that she/he wishes. Discussion is not limited to those who think quickly and have the verbal skills to participate in a class discussion. For those students by nature less assertive, on-line learning was found to be more conducive for self-expression. As one student observed: *"The nature of conferencing allows an individual to finish her thoughts without fear of interruption by some keen, more outgoing colleague. I feel that this is a great equalizing force in a group."* This sentiment was shared by students who were shy or more hesitant in group situations as well as by those for whom English was not their mother tongue and who often felt overwhelmed in a face-to-face class. In the regular classroom, they remark, it is often difficult to compete for "air time" with fluent English speakers.

Other differences between classroom learning and the on-line medium were noted: *"It has been very interesting to take a traditional course alongside this one. I have noticed that the time I spend interacting with students in my other class is severely limited. I have also noticed that there is a protocol observed to varying degrees in the classroom which directs all communication through the teacher. It is considered rude to ignore the teacher and discuss a particular point with another student. The result has been that I do not know the other students in the class very well. Again, I would like to know them better but I probably*

never will have the opportunity." While some students felt that heated discussion also can occur in a classroom, it was noted that even so *"the teacher has a good deal of responsibility for establishing, through body language and tone of voice, that such discussions are either OK or more suited for the cafeteria. I still see such discussion largely happening through the teacher. (On the other hand) although teachers can guide in this (on-line) medium, they simply cannot take a central role."*

Students also reported increased cooperation in the on-line environment. *"I think that this system is wonderful for communication and I can add that there is a lot more communication here than I can find in my on-site course. Also, I feel a greater sense of cooperation within this group."*

Motivational Aspects

The use of cc as a tool to overcome geographic and temporal boundaries to access a dynamic group communication proved highly motivational for several participants. *"The excitement of talking person to people through the screen is fascinating. It really stimulates the mind. I can foresee great possibilities for on-line courses."*

"Does anyone else find this addictive? Since getting this modem, I have spent more time than my husband or kids at the keyboard."

"I am cold. I need to clean my lenses and I'm thirsty. Yet, I'm still here. Know why this is better than tv--the anticipation of a good show, great cast of characters, fast-moving plot, thought-provoking and, like a serial, the end is not in view."

"Many have expressed the notion of getting "hooked" by on-line communication and I'm one who just had to read what's going on even though I am sick and should be in bed. I think we should give serious attention to health hazards of computer addiction."

Convenience of Access: the '24 hour class'

OISE's conferencing system, and hence the on-line classes, were open 24 hours a day, seven days a week. Students reported increased learning as a result of the availability and flexibility of the 'class': *"I find myself thinking about the ideas in the on-line class more because there is no 3 hour limit of class time."* The positive assessment of the '24 hour class' was common among the students. *"The school came to me as often as I wanted."*

"The amount of learning in this course for me has been more than any other course. You can't measure learning easily, but let me tell you that if exposure is an acceptable measure, I was at school almost daily. It was for me a much more than one 3 hour class per week and some reading at home."

Freedom from travelling was another important variable: *"I don't have to worry about traffic jams, road conditions, parking space, etc."* This factor has particular significance for part-time adult students who typically attend classes in the evening, after a full day at work. As a result they are tired, perhaps stressed, and often hungry, all of which detract from the effectiveness of their learning.

Another aspect of on-line learning was that: *"Being able to bring course material and participants into my own environment has allowed me to make it more a part of my life than one in which I participate at a great distance, in time and space, from my own setting. My reflections from the course are interacting constantly with my everyday life, at home and at the school where I teach."*

Increased User Control over the Learning Interaction

Many respondents commented that learning effectiveness was significantly enhanced because they felt some controls over the learning situation. *"It allows me to maximize learning because I can go on-line during my peak brain awareness period. I am not enslaved to rigid classroom attendance which most of the time may not fit my best learning time."* Furthermore, *"the format enables us to devote more focussed attention because we can choose times to participate when we will not be interrupted or disturbed."*

Another comment attributed wider personal significance to the experience. *"Never have I watched the end of a course with the sense of regret that I now feel. Yes, it took a lot of time but the pay-offs were wonderful. The availability of the conference almost whenever I wanted was worth everything. Lifestyles today are so fast-paced and stressful that having some control over when to get involved is a blessing!"*

A benefit of asynchronicity reported by many students was the control over the nature and time of interaction. This provided a measure of self-pacing in the learning interaction: the user could choose to reply immediately, to reflect before responding, or to compose a response. Students felt that this feature contributed to the quality of their interactions. *"I think that one of the most positive aspects of 'on-line' learning is that I am able to read and then have time to think over my response or whether or not I wish to respond. My thinking time can vary from two minutes to two weeks. I enjoy this flexibility of the medium almost as much as my access to OISE."*

Control over *reading* the discussions was also welcome. Participants appreciated the opportunity to 'catch thoughts as they fly by' on the screen. It was possible to let the comments/ideas scroll by or to pause and reflect upon one particular comment. Moreover since these 'thoughts' were stored in the conferencing database, it was felt easy to recall and review those that seemed particularly important.

A unique feature of computer conferencing, noted one student, is the ability to reflect back and locate oneself within the class discussions: *"It's really great to be able to read my own contributions to see where I fit into the chain."*

Text-based Communication

Several advantages are attributed to the text-based medium. Two which received particular attention were the ability to read the discussion and to maintain a written (and permanent) record of the interactions. *"My reading speed has probably increased 50% during the past months. I have always preferred to 'see' comments rather than listen and try to take notes. I never could write fast enough in lectures, so I generally listened and participated but ended up with no notes, or hieroglyphics which were undecodable next week."* Another noted that, *"the record of the conversation enables me to check and double-check, not to rely on memory. Moreover, now I don't have to spend time making 'memory joggers'."*

These factors contributed , some felt, to the effectiveness of the interactions. To excerpt from an earlier comment: *"As all remarks were documented, they were subject to more in-depth consideration than in the normal classroom."* Another noted *"I feel that I'm giving more ideas more thought because I'm seeing them rather than just hearing them."* Several students noted the advantage of *"being able to read a comment and get my head together before I respond."* This advantage also carried over, for some, to text-based responses: *"Conferencing has the major advantage for me in that I like to write out my thoughts rather than speak them in class."*

A final comment comes from the student who summed up her experiences by paraphrasing another writer: *"I don't know what I think until I see what I write."*

DIFFICULTIES REPORTED BY STUDENTS

This section considers some of the difficulties which students reported in relation to learning on-line. The themes which emerged in the on-line conferences were:

1) Information Overload;
2) Asynchronicity (delayed responses);
3) Inconvenience of increased access;
4) Following on-line discussion threads;
5) Loss of visual cues; and
6) Health concerns.

The majority of difficulties identified seem linked to the process of 'learning to learn' in this new and unfamiliar medium. It is not yet clear whether the problems reflect inherent disadvantages or are temporary; the result of other factors.

Information Overload

One of the major problems raised by students was 'information overload'. Given the high rates of participation (text-based discussion) together with the course reading list, the amount of reading became very heavy. The problem was particularly reported by course participants in the large group (40 members), in which number of on-line comments daily was significant. This group reported frequently feeling frustrated with the large number of notes in their inbox. Course 2 students had mixed reactions: about half reported sometimes feeling frustrated by the number of messages, while the other half reported enjoying finding lots of notes in their inbox.

Students in the on-line courses, moreover, were confronted with two dimensions of learning: the content and the context. Although 80% of students in both courses reported learning the basics of on-line communication (reading and writing comments) within 4-6 hours, the first days and weeks of using a new communication medium can be stressful. Students had to digest information related to both the course content and context.

Several students noted a negative side to high rates of participation and interaction, particularly in the case of a large group: a sense of guilt. *"Does anybody else feel guilty when you go to log off and the computer says: You have 100+ notes and you still want to quit?' One night I changed my mind and kept reading because it impelled me to keep on."* This remark generated two responses: *"I usually get bullied by that too. Mainly because of the daily volume of notes. If I log off and leave the 55 notes, I get the dreads about whether I will be able to take all that will be facing me next time I log on. Is anyone else feeling overwhelmed?"* This was exacerbated in the case of one who did not have adequate access to the necessary equipment. *"The major problem was the extensiveness of the information that had to be processed each week. Working with neither a printer nor a home computer (which I could log onto when I'd forgotten something) was a handicap."*

A few students observed, however, that information overload was typical of most courses. *"I too suffered from a little information overload during the first five weeks, but*

frankly I find that happens in any course I take. . .it's just that when the comments are on a screen rather than in spoken form, it becomes a visual reminder of how much I'm not understanding. I really think that the feeling of 'overload' is what creates the tension to begin action towards classifying information and attempts to clear out extraneous information."

Hiltz and Turoff (1985) observe that there are no easy solutions to avoiding the trade-offs between the value of open communication and the cost of information overload in computer-mediated communication. System solutions are imperfect and behavioural solutions appear to be the best strategy for dealing with this phenomenon at the moment.

And students did in fact begin to develop strategies to deal with the 'overflowing inbox'. Students reports of information overload were more pronounced in the first weeks of the course. As they became more adept at conferencing and familiar with the 'terrain', many students began to find ways to deal with the problem. Some strategies were individual, such as learning to read selectively, using the scan command, and commenting more selectively, while others were social, such as encouraging colleagues to write shorter messages. There were mixed degrees of success: what is clear is the need for research and development activities in order to understand and facilitate on-line learning.

Asynchronicity: Delayed Responses

While asynchronicity has many positive aspects for on-line learning, negative effects were also reported: *"The most frustrating point in our present mode is the delay in receiving feedback. One makes a comment and where normally there would be immediate verbal and non-verbal response, now there is only silence. It is like speaking into a vacuum."*

Another student found that although computer conferencing is asynchronous, a certain rhythm of interaction can occur. In the OISE courses, the majority of participants were part-time students (working full-time) and their most intense participation would frequently occur on weekends. On the other hand, a full-time student who used the OISE computer terminal around a five-day, 9-5 schedules felt 'out of sync' with the discussions. *"It means that when I come in on a Monday morning, I usually find a large number of notes to deal with. Then, during the week when I am regularly logging, I am not getting much reaction because we are out of phase."* This was particularly problematic during the phase of working groups: *"Throughout the working group I found I'm sort of sending messages out into the ether over the period of time when there isn't much response and then when I come in on Monday I find that some great quantum leap has occurred over the weekend."*

Inconvenience of Increased Access

While the overwhelming majority of students appreciated the ability to study on-line from home, one student reported that because she was at home, her children felt that could interrupt her study time. There was not the same demarcation between home/class as if she were travelling to school for three hours per week. While this was the only such situation reported, it may have important implications for others studying on-line in the future, particularly for women.

Another negative side to asynchronous learning is that *"the continuous nature of the course contributed to an excessive workload. I could never take a break because I felt that I could get behind."*

The increased accessibility and availability of the '24-hour' class also has the outcome that it never seems to end.

Following On-line Discussion Threads

Following the discussion threads in a computer conference is a difficult and almost inherent problem. Students experienced two problems in particular: keeping track of several on-going discussions; and deciding when to respond (whether to read all the comments first and then to respond to particular items or to respond as one reads along). *"Now as I feel more adept at using the system, I realize that it's not just the sheer volume of notes that's overwhelming, it's the strain of trying to follow ten or twelve conversations simultaneously. I have trouble keeping track of who said what, following a train of thought or the thread of the argument. I am torn between making an immediate response to a thought and the need to slowly figure out an integrated reaction. I wake up composing notes, I think about what has been said, I hash ideas out with my husband, I look forward all day to find out what others have said about some point or another."*

Commented another: *"I find. . .the business of trying to hold in my head what the notes are saying and how I may wish to react to them a little difficult. . .It's like trying to hold information from 9 or 10 screens of information, when really one's habit is not to hold all of it but just to hold what seems to be relevant at the time. Especially in the beginning, I found that I was going back and forward and back and forward, trying to form a coherent picture in my mind of what points the notes were making."*

Students sought ways to deal with this problem: *"Yes, it's hard to follow the conference as a 'conversation'. . .harder to pick up the threads. . . but it is like being in a classroom in some ways. Even in a classroom you can't interact with 40 people or 12 ideas at a time. It's better to pick up one or two of the ideas and people, at least that's what I'm finding."*

This experience returns us to a key issue: how students organize themselves to learn on-line. These students reported that the problem was greater at the beginning of the course. Presumably over time strategies were developed to deal with this issue, such as making notes, printing out particular discussions, focussing on one or two threads, using the search/find facility, and/or developing new ways to mentally record and organize the discontinuous information presented on-line. However, little (if anything) is as yet known or understood about this very important phenomenon.

Loss of Visual Cues

Physical and social status cues which typify face-to-face communication are absent in the text-based environment of conferencing. The absence of cues such as facial expressions, gesture, and voice inflection received a significant amount of comment at the outset of the courses. However, as the on-line activities and relationships evolved, these comments decreased.

The absence of visual cues was more important to some students than to others. In both courses, discussion about the significance of physical cues generated debate. When asked if having a photo of each student in the 'on-line class' would be helpful, there were mixed reactions. *"I don't think the image of a person's face helps conferencing. In fact, sometimes it may hinder because some of our prejudices are linked to visual cues. Not having an image means that we can step closer to on-line equality."* Others did not agree. *"I think that having a photo would help me form an impression about the ideas being presented when I can match my own interpretation of the individual who is saying it. In other words, I give value to the statements depending not only upon the ideas being presented but also on my own impression of the person who is expressing the idea."*

Some students wondered whether an inverse stereotyping, based on writing or perhaps even typing skills, might result in the on-line medium: *"Judging people only by their ideas and not by their looks is a real positive side of conferencing. However, the negative side is that we begin to judge people not only by what they say but how they say it. Personally, I do miss the nonverbal cues that go with face-to-face communication. I find it much easier not to misinterpret a point when I watch the speaker. Also feedback is immediate."*

"Another curious thing: you lose the nuances that come with voice delivery. Sometimes I feel sure that some on-line comment is tongue in cheek, but without establishing the personal rapport and knowing the personality of the person, it is hard to determine (brevity is the soul [or is it sole] of wit)." In an attempt to diminish such problems, some students began to experiment with typographical conventions such as **smile!** to convey a more subtle meaning in a comment and compensate for the lack of visual cues.

Health Concerns

On-line education is essentially text-based communication and requires sitting and reading a video display terminal for long periods at a stretch. This may create or exacerbate certain health problems. Two in particular were identified in this experience. *"I find it very difficult to read at the screen for long periods of time. . .physically. I find it's hard on the eyes for me. But then I'm older and my eyes are not particularly good. I think its partly because I have tri-focal glasses and the problem may be that because of the angle (of the terminal) I may be looking through the wrong strip. I become progressively more uncomfortable with it."* The second issue, as one person stated: *"I just hate sitting still that for that long."*

Other general concerns which were raised relate to potential long-term hazards of prolonged computer usage in general, such as eye strain, headaches, back problems, and exposure to radiation. Computer-related health issues are increasingly recognized in office environments and experts in ergonomics are developing solutions (i.e., quality monitors, radiation shields, ergonomically designed chairs). Such solutions are equally valid and important for the educational environment as well, particularly as computers become increasingly part of this milieu and, in the case of on-line education, the key medium of course delivery.

CONCLUSIONS

This paper explored a number of issues related to how computer conferencing can be utilized to support effective, active learning in graduate level courses. The first was to determine whether on-line courses could serve as more than an emulation of the process of face-to-face communication in the traditional classroom. On the basis of graduate courses analyzed here, the answer is 'yes'. The design of the on-line learning activities described in this paper was predominantly based on a learner-centered, group learning approach. Traditional classroom communication patterns typified by teacher-centered styles (such as the use of lectures) were not employed. While this reflects the teaching styles and perspectives of the instructors, it was also our impression from these courses that teacher-dominated techniques would not be very feasible within the electronic medium. Delivering a lecture on-line would be awkward, requiring instructors to input and students to read, screens of text on a video display terminal.[8] Such a design would not likely be attractive or acceptable to most graduate students or instructors. An authoritarian approach, moreover, is not easily viable

on-line. Whereas in the classroom situation the teacher is able to control (overtly or subtly) the flow, pace and direction of discussion, this is not the case on-line. Instructors do not have the same control over class activity on-line. Unless access is controlled, the 'class' is open 24 hours a day and users may enter and participate at will. Students 'have the floor' and control (to a considerable degree) how much they write and participate.

This leads to the second issue: can computer conferencing support a different, more active and involved style of learning on the part of students? An analysis of user rates and patterns as well as student reactions again strongly indicates the affirmative: computer conferencing has the potential to offer both quantitatively and qualitatively different and in many cases better learning experiences than that of the classroom. Students reported more active participation and interaction and more effective learning in the on-line course than in classroom courses.

Finally, we address the key question: how can we utilize computer conferencing to support effective, active learning? The conclusions that can be drawn from the case study presented in this paper are that one approach found very effective for achieving these goals on-line is the use of a collaborative group learning design. A collaborative learning design is based upon group discussions and interactions among learners, with the instructor as the learning facilitator. This design was reformulated for the on-line environment and the results were high rates of student participation and interaction and a very positive student assessment of the effectiveness of the learning experience.

There are, however, important design implications that need to be addressed in using a collaborative model on-line. Some of the more positive aspects of on-line learning can become 'double-edged'. For example, increased participation and interaction can lead to information overload, both in terms of the volume of input and discontinuity of discussion threads. Related to this is the need to manage and focus the discussions, particularly within the seminar activities, to avoid 'on-line brainstorming' — a situation in which comments do not relate to and build upon one another.

The courses analyzed here were based on a relatively short period of time: twelve weeks, in each case. It is both possible and likely that over a longer period of time individual practices would change as the students gain skills and develop strategies for learning on-line. Any novelty effect might fade as other pressures such as time constraints come to bear. Additionally, increased familiarity with and skills in on-line learning will likely affect the perception of advantages and difficulties which influenced earlier reactions.

Learning in a new medium does not appear to be simply a case of learning to use a new technology or using the electronic medium as a surrogate for other traditional modes of learning. Students in the courses invented new learning practices that facilitated effective and productive learning. The process whereby students adapt and create new learning practices has not yet been systematically investigated.

The experiences explored in this paper suggest many topics for future research. Given the early stage of our understanding of on-line education, there are almost endless possibilities. Research into design issues related to teaching and learning on-line is a major area requiring systematic study. What variables are critical (i.e., course design, teaching style,

---

[8] Stevens (1986), however, describes some innovative electronic lectures 'E-lectures', which successfully reformulated the traditional lecture mode using the facilities of the electronic environment.

characteristics of the learner, class size, cc features, etc.) and how do these relate and impact upon the educational experience? Are there learners (or instructors) for whom this medium would not be appropriate or desirable? Is on-line learning in fact appropriate for all levels of education (schools, undergraduate education, continuing education)? Is it appropriate to all subject matter?

Further analysis of the perceived advantages and disadvantages to learning on-line is also important. The list presented here provides a starting point: there is a need to identify additional themes and issues; test and measure those identified to ascertain their relative weight and importance to students; and correlate these with other factors. Another important area is the study of how students organize themselves to learn on-line.

The data in this study indicates that for the students, the benefits of on-line education outweigh the problems, and that on-line courses can offer new forms of active and effective learning. The electronic medium holds significant potential for new forms of learning interactions and activities that are only beginning to be explored, and the challenge for educational researchers and practitioners is to discover how to make the most effective use of this exciting new learning environment.

REFERENCES

Brochet, M. (1985). Computer conferencing: A tool to enhance student learning. *Computer Conferencing and Electronic Messaging: Conference Proceedings*, (pp.69-84). Guelph, ON: University of Guelph Institute of Computer Science.

Cook, T. D. (1985). Postpositivist critical multiplism. In L. Shotland and M. M. Mark (Eds.), *Social science and social policy* (pp. 21-62). Beverly Hills, CA: Sage.

Cook, T. D., & Reichardt, C. S. (Eds.). (1979). *Qualitative and quantitative methods in evaluation research.* Beverly Hills, CA: Sage.

Cross, T. B. (1983). Computer tele-conferencing and education. *Educational Technology, 23*(4), 29-31.

Deutschman, W., Kramers, M., Richards, A., Spitzer, M. , & Haile, P. (1985). *Computer conferencing: The next step in distance learning.* Unpublished manuscript, Kansas State University.

Eble, K. E. (1976). *The craft of teaching: A guide to mastering the professor's art.* San Francisco, CA: Jossey-Bass.

Feldman, M. (1986). Constraints on communication and electronic messaging. *Proceedings of the CSCW'86 Conference on Computer-supported Cooperative Work,* (pp. 73-90). Austin, Texas.

Haile, P. J. (1986, April). *An analysis of computer conferences supporting the distance learner.* Paper presented at the annual conference of the American Educational Research Association, San Francisco, CA.

Harasim, L. (1986). Computer learning networks: Educational applications of computer conferencing. *Journal of Distance Education, 1*(1), 59-70.

Harasim, L., & Johnson, E. M. (1986). *Educational applications of computer networks for teacher/trainers in Ontario.* Toronto, ON: Ontario Ministry of Education.

Hiltz, S. R. (1986). The "virtual classroom": Using computer-mediated communication for university teaching. *Journal of Communication, 36*(2), 95-104.

Hiltz, S. R. (1984). *Online communities: A case study of the office of the future.* Northwood, NJ: Ablex.

Hiltz, S. R., & Turoff, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM, 28*(7), 680-689.

Humphrey, C. (1985). Getting a turnout: The plight of the organizer. *Iassist Quarterly, 9*(2), 14-27.

Johansen, R. (1984). *Teleconferencing and beyond: Communications in the office of the future.* New York, NY: McGraw-Hill.

Kaye, T. (1985). *Computer mediated communication systems for distance education: Report of a study visit to North America* (Project Report CCET/2). Milton Keynes: Open University, Institute for Educational Technology.

Office of Technology Assessment. (1982). Informational technology and its impact on American Education. *Computers and Society, 12*(3), 7-13.

Osgood, D. (1986). The electronic university network, *BYTE, 11*(3), 171-176.

Patton, M. Q. (1980). *Qualitative evaluation methods.* Beverly Hills, CA: Sage Publications.

Queen's University. (1975). *A commitment to excellence: Report of a task force on graduate studies and research in the humanities and the social sciences.* London, ON: Queen's University.

Quinn, C. N., Mehan, H., Levin, J.A., and Black, S.D. (1983). Real education in non-real time: The use of electronic message systems for instruction. *Instructional Science, 11,* 313-327.

Riel, M. M. (1986, August). *The educational potential of computer networking* (Report No. 15). San Diego, CA: University of California, Center for Human Information Processing.

Stevens, C. H. (1986). *Electronic organization and expert networks: Beyond electronic mail and computer conferencing.* (Sloan School of Management Working Paper: Management in the 1990s). Cambridge, MA: Massachusetts Institute of Technology.

Umpleby, S. (1986). Online education techniques. *ENA Netweaver 2*(1), Article 6.

Vallee, J. (1982). *The network revolution. Berkeley:* And/Or Press.

CONFERENCE SEGMENT

==========

cjec/discuss #2, from garyboyd, 960 chars, Mon Feb 23 20:10:12 1987
This is a comment to message 1.
There is/are comment(s) on this message.

Linda: Your paper is full of hope and this is good because there seem to be major hurdles to be overcome with each new conference. What intrigued me most was your concept of 'THREADING'. If you could give us a little expansion on that — how does it relate to schema-building, or I wonder to the use of modelling tools?
The continual sense of interaction you mention on page 8 *(p. 128)* is particularly interesting when one thinks of the medium as a life-world building medium. The overload feeling is one that I have continually, and for me computer conferencing just adds to a chronic endemic state in that regard to such an extent that it is hard to empathize with people who are not communicatively overloaded. Your 5.7 *(p. 129)* section, mentioning the second face-to-face meeting's importance, perhaps leads to an interesting research question about how often and how long face-to-face meetings should be in adult distance courses?
All in all I enjoyed reading it.

==========

cjec/discuss #3, from lharasim, 1594 chars, Tue Feb 24 21:11:02 1987
This is a comment to message 2.

Gary: Thanks for your response. Your query, re: threading was in fact provocative, because I had in fact a more technical (or more limited) notion in mind. I was referring to a) the sequencing of comments in a conference and b) to the fact that inevitably 10 or more sub-themes or sub-discussions tend to develop. As students commented, they felt like they were juggling 10-15 on-going conversations simultaneously. I am intrigued by your use of threading as a schema building process. . .
About the info-overload, I can really relate to that. As I mention in the paper, one of the advantages of the 24 hour class is that it is always there. Well, that is also one of the disadvantages. While students mention it, I as the instructor also suffered from it. The students benefited from 7 day/week access to the instructor, but I soon realized that I needed to make some behavioural changes. The tension remains however, because I do find this form of information exchange and communication to be so dynamic and addictive, that despite my best intentions I find myself logging on just to see what's in my in-box (and then 3 hours later, I am still on-line). . .But then this may well be my personal idiosyncrasy . . .

Next Steps

Towards a Third Generation Distributed Conferring System

Roger Hart

Abstract: The first of the RAPPI projects enabled Grade 2 to Grade 12 students in over 60 schools in four countries to use a computer conferencing system to share information about themselves, their school, their community, their culture, and their curricula.

Evaluations confirmed the findings of Dubrov that it is not sufficient to simply provide the hardware and the software: major efforts must also be placed on teaching people to make effective use of the hardware and software ('teachware') and developing the organizational arrangements ('orgware') to ensure that the participants are able to use the hardware and software effectively.

Following the success of this project, it is intended to establish the design parameters for a third generation distributed conferring system. Such a system will be capable of providing students in the participating schools with the essential features of a virtual network, and thereby remove many of the frustrations which are endemic to any 'centralized' system.

MYTHS AND REALITIES

In November of 1986 Robert Bernard, Editor of the *Canadian Journal of Educational Communication*, wrote to the contributors to the special issue of the journal concerned with computer conferencing. In this letter he said that he would like to consider a deviation from the normal review policy, and arrange for a CoSy conference in which the authors themselves could engage in a discussion concerning the papers, since "the most qualified reviewers of a collection of papers on computer conferencing [are] the authors themselves."

By February 1987, Bernard was chastising some of the authors with the phrase "LET'S GET ON WITH IT!!!. . .Let me point out another thing which you may have forgotten," he added. "If you, as experts in computer conferencing, cannot make this simple little conference work, then your credibility and that of this medium is seriously in jeopardy. Need I say more?".

Similarly, Tony Kaye, whose paper describing the excellent plans of the Open University appears in this issue (*Introducing Computer-Mediated Communication into a*

Roger Hart is Vice-President for Research with the Open Systems Applications Group, 235-560 Johnson St. Victoria, BC V8W 3C6. His research interests lie in the area of open systems architecture, and knowledge-based computer-aided learning. Reprints may be obtained from the author at the above address.

CJEC, VOL. 16, NO. 2, PAGES 137 - 152, ISSN 0710 - 4340

Distance Education System), made the following comment on-line:

> ==========
> bcjec/kaye #6, from tkaye, 152 chars, Tue Jan 27 07:35:07 1987
> This is a comment to message 5.
> ----------
> . . .well. I give up. The text of my paper has been completely garbled
> in transmission into CoSy. I will post a printed copy to Concordia.
> regards, Tony.

If these were isolated incidents, it would scarcely be worth drawing attention to them at the beginning of this paper. Unfortunately, they are far too common, not just with computer conferencing, but with many new developments in educational technology. We devise elaborate plans for using these new media, and develop theoretical typologies. However, in the process we appear to forget that there is a wealth of established theory and praxis which we can draw on in *using* these new technologies. As with the very name *computer conferencing* we appear to be so seduced by the new potential, that we forget that a perfectly good word (conferring) has existed since 1528, and invent a new one which is neither as concise nor as attractive as the original.[1]

For any emerging technology, there are always people who immediately see its potential. There are also projects which succeed far in excess of the original expectations. On the other hand, there are projects which, despite massive injections of people and money, never succeed in getting off the ground, and result in the technology itself being dismissed as inappropriate or unworkable.

In this paper I want to continue the theme which Godfrey and I (Godfrey, Hart & Woolard, 1986; Cowper, Godfrey, Hart & Sterling, 1987) have explored in our analysis of the North Island and GOLDCOIN initiatives. That is: how do you effectively integrate educational technologies into the learning process? For the purposes of the present paper I shall focus on the RAPPI projects which began in May 1985 and which are still on-going. I believe that the successes and heartaches of this project reinforce conclusions reached by other educators and researchers for the successful integration of any new technology. Just as importantly, I believe that starting from the goal of integrating technologies into learning, rather than seeing them as a mere appendage, allows us to make the technologies more appropriate for learning; liberating and enhancing what is a quintessentially human activity, rather than constraining and limiting it. This is particularly important as we anticipate the third generation telematic technologies which are likely to be available before the end of the present decade.

Open Learning NOT Distance Education

Central to many of the initiatives which have been launched in B.C. in the last decade is the view that we are dealing with Open Learning, not distance education. This is not mere semantics, but results in a different paradigm. The RAPPI projects, for example, have

[1]Since the ugly word *conferencing* has gained a degree of currency to describe systems like CoSy, I shall continue to use it in the present paper. However, I shall identify the proposed third generation systems as *conferring*, since they should indeed allow people to *confer* rather than to *conference*, and should thereby remove many of the frustrations which Tony Kaye's comment so appositely captures.

involved children in regular classrooms, but squarely draw on the philosophy and epistemology of Open Learning. Opportunities for the children's learning are being opened in new and exciting ways, which would have been prohibitively expensive only a few years ago.

All too often, *distance* education implies that the learner is being presented with something which is second best to the teaching which currently takes place on campus. The latter is even referred to, quite incorrectly, as *traditional means of instruction*, and ignores the major problem which Hawkridge has identified, that failure rates would be unacceptably high in campus courses, if students were required to demonstrate a complete mastery of the subject matter (Hawkridge & Lewis, 1979). Institutions like the Open University in Britain, or North Island College in Canada have clearly demonstrated that Open Learning is *much* more than mere correspondence courses (even when correspondence is used as a delivery medium). It can be a desirable and attractive alternative means of learning, with a high degree of understanding achieved by a large proportion of the learners. On a purely subjective note, it has always seemed to me that those institutions which regard Open Learning as somehow *second best* manage to convey that impression to their students through their uninspired courses, and achieve dismal completion rates. Objectively, the Open University has demonstrated unequivocally that it is possible for tens of thousands of adults to achieve good quality degrees in a relatively short period of time using Open Learning.

What does this have to do with conferring by computer? First of all I would like to draw an isophor between *distance education* and *computer conferencing* vis-a-vis *Open Learning* and *conferring by computer*. Equally importantly, I want to suggest that if we approach conferring by computer from the ontology of Open Learning we can design systems which are much more appropriate for human learning, using technologies which, if not yet in widespread use, are either extant or emerging. This is not to say that current conferencing systems cannot be used for effective learning. However, I would argue that this is a reflection of the importance of conversation in learning (Pask, 1976) which, with adequate organizational arrangements, or *orgware*, (Tribus, 1979) to ensure that the learners and tutors alike are able to use the hardware and software effectively, can result in enthusiastic learning despite the inadequacy of the technology.

To illustrate this last point, and to set the scene for the directions we need to chart in designing a conferring system, I want to briefly describe the first RAPPI project, *Open House*, which was initiated in 1985, with support from the Department of Communications, Canada.

RAPPI —'An Electronic Open House'

RAPPI (réseau d'ateliers pédagogiques, pilote international) is an ongoing series of international projects which link approximately 75 schools in Canada and western Europe in an electronic network.

As is evident from the subtitle, the first project was not aimed at computer science students, but used computer conferencing and the international X.25 switched packet networks as tools to allow children to find out directly from each other what it is like to live in their culture and community. The project, therefore, squarely belonged in the *socials* area and involved many teachers who had never previously used a computer. The teachers participating in the project were selected for their interest and experience in teaching social studies. Although computer science teachers proved to be invaluable resource people in a number of instances, the schools were asked to ensure that the project did not become sidetracked into another *computer science* project.

It was originally envisaged that the participating students would be in the early grades of Junior High School, but experience has shown that a much broader range of children have been actively involved. One school's experience with Grade 3 students was so positive that Grade 1 children were introduced to the system in subsequent projects. The range of topics discussed was as broad as the geographic separation of the schools and the ages of the participants. Some were deliberately *open* so that any participant could respond; others were reserved for a pair or group of schools. Typical titles included:

Canadian/European Cultural Comparisons;
Cooperative Story Telling;
Géographie Urbaine;
Riverview Junior High - Liceo Fermi Bologna;
Priory School, Weston Super Mare — J.V. Clarke School, Yukon;
AIDS;
Abortions;
Libya;
Canadian Humour; and
Should Shorts be Allowed in School?

Teachers and students used the system to communicate, in a variety of languages of their choice, with other schools in Canada and in each of the other countries. They were able to join conferences on a given topic, respond to existing discussions, and set up new discussions specific to their own interests. Teachers and students suggested new topics, exchanged general information and selected sub-projects and joint lessons to undertake with specific schools or amongst other users of the facility. French and English classes across the country practiced their skills and answered questions for each other in both languages, and topics in history and geography got 'on-the-spot' commentaries from people who actually live in the regions under study.

RAPPI is already a network that never sleeps. As users in Vancouver, B.C. are asking about schools in London, England, Italian students are signing on and preparing to respond to last night's comments from Manitoba. Help is available on the system and additional instruction can be obtained from the RAPPI Manager, who handles concerns about subject matter, users' addresses, the technicalities of messaging and computer accounts, as well as users' suggestions and concerns. Largely as a result of the efforts of the RAPPI Manager and a large number of professional educators who have given their support on a purely voluntary basis, RAPPI can become functional on the first day. Teachers retain control over access and subject matter and their suggestions influence the direction and development of each project.

Michel Cartier (Cartier, 1986) has pointed out that there is usually a lag of about five years from the introduction of a technology until the increasing quality and quantity in the storage capacity and intelligence of telematics systems allow the developments of new types of services. Although RAPPI has been almost universally praised for its significant contribution to the use of computers in education (Penny, 1986), it is using what Cartier refers to as first generation telematics technology. The key technologies are the X.25 switched packet networks (the original standard was developed in 1976), and a computer conferencing program at the University of British Columbia called *FORUM. *FORUM was originally written by two systems programmers at UBC, Alan Ballard and Jon Nightingale. It was apparently put together at fairly short notice after the authors had seen a

similar system at the University of Michigan, and was intended primarily to allow programmers to discuss matters amongst themselves. The schools are almost all using 8 bit microcomputers and 300 baud modems. Even so, these modems were usually only obtained either after long discussions with administrative staff who could not understand why one would even want to link computers together, or by cookie sales, or other fund raising activities.

To access *FORUM, the school must typically load some terminal emulation/ communications software into their microcomputer, dial-up a public Datapac port (which will be long distance if the school is in a community such as Mayo in the Yukon, or Sturgeon Falls in Ontario), issue the Datapac access commands, enter the Datapac address of UBC, log-in to the UBC MTS system, use the commands to run *FORUM and only then begin to look at the new discussion and responses. For schools using the system from Europe there are additional complexities. For example, Italy did not have a nationwide X.25 service at the beginning of the project, and the school in Bologna had to dial long distance to France, access the French X.25 network and connect from there to the Canadian X.25 network.

Even though the students themselves only began accessing *FORUM in December, 1985, the quantity and level of discussion rapidly increased. Rather than attempting to read the recent responses at the dreadfully slow rate of 300 baud, many schools downloaded the discussions, so that they could either skim through them locally or print out hard copy versions. This, of course, added an extra level of complexity so that the school needed to either do a file transfer between two different operating systems or at a very minimum, a screen dump. Similarly, 300 baud is far too slow to allow a full screen editor to be used, so rather than struggle with the MTS line editor, many schools prepared their responses off-line, using a word processing package, and then uploaded these responses into the correct discussion. This meant that in order to use the system the students had to become familiar with a large number of application packages on at least two computers. They needed to master a word processing package, a file transfer package and a communications package on their in-house micro, with all of the attendant ramifications such as being familiar with the operating system, knowing of MTS (the UBC operating system), *FORUM, $MESSAGE, the MTS Editor, and the UBC portion of any file transfer software. This is a prodigious list, and it is indicative of the power of conversation that so many of them seem to take the mastering of these skills in their stride.

Even so, in 1987 there are good reasons to say that such contortions are no longer necessary nor desirable. Third generation telematics offers the possibility of making the technology virtually transparent to the users, while encouraging a much richer conversation.

The RAPPI Experience

Two formal evaluation reports were prepared for the first RAPPI project. One was prepared by Maria Cioni & Associates Inc. (1986) and the other by Catherine Williams (1986). The Cioni report was severely handicapped since that study did not commence until early summer of 1986 when most of the activity for the school year had already ceased. Only 18 out of the 95 teachers participating responded to Cioni's questionnaire. Williams, a teacher-librarian at Bishop Pinkham Junior High School in Calgary, was a participant-observer who had been involved in the project since late 1985. Although her report necessarily concentrates on the experience of the Calgary students it succeeds in capturing the educational aspects of the whole project.

Cioni notes that the financial resources *allocated* (it would be more accurate to say *available*) to this project were extremely modest — $14,500 excluding the evaluation studies — but seems to spend a disproportionate amount of time analysing the technical aspects of the project. While this is invaluable material for the present paper, it ignores the practical reality that something had to be done in order to demonstrate the educational opportunities. Had Cioni's advice been followed that "RAPPI should have been a small, adequately financed pilot project; a project where technical and administrative problems could have been ironed out" (1986, p. 32), it is likely that more than $14,500 would have been expended in planning, and the first children would not yet have actually used the system. One of the quite unexpected things that was learnt in the project was the total lack of understanding that many school administrators had in the advantages of linking one computer to another. For many schools, obtaining a one hundred dollar ($100) 300 baud modem was a major struggle. At least one school, which was intending to participate, was told that it could not acquire a modem since the district had an MS-DOS policy and signing-on to MTS at UBC would 'clearly' violate that policy.

Although that was the reality at the start of the project, by May 1986, Douglas A. Penny, Assistant Deputy Minister of Educational Technology Development in Ontario said, in a keynote address to the National Research Council's Symposium on Instructional Technology,

> I am particularly impressed by the RAPPI project. . .It is possible from our offices, to eavesdrop on the messages being sent, and they are fascinating. It is impossible to believe that students in Whitehorse in the Yukon, for example, sharing views with students in Milano, are not overcoming that provincialism which is so limiting and so dangerous to the development of a world society based on mutual understanding and empathy. (Penny, 1986, p. 6)

The significance of his remarks can be appreciated even more when it is realized that Penny's department had a budget of nearly $10 million per annum for the development of educational software for the Ontario public school system. Yet, up to the launching of RAPPI, it had not apparently even considered the possibility of children using a computer conferencing system, despite the outstanding work which the University of Guelph had already undertaken in the development of CoSy.

Penny's views are endorsed by both the Cioni and Williams reports. Cioni (1986) notes, almost with surprise, "The striking element about the students' responses is their lack of emphasis on computers and computing. They appeared to be more interested in the social communication, both within the context of the group effort of their class and the international communication with other students. . .Overall, the students were very positive and seemed willing to continue to participate in RAPPI. The [first] RAPPI project appeared to *concretize* academic work for the students and this perhaps is a major motivational factor that teachers could exploit further" (p. 31).

The Williams report reaches the same conclusion, though from the viewpoint of a teacher, rather than that of an information/communications consultant. She reports that Bishop Pinkham School felt strongly that it should have some educational objectives in order to integrate the project into the curriculum. As a result, the school established an advisory committee consisting of school personnel and specialists from the Calgary Board of Education and the University of Calgary.

By December, 1985, a few Calgary students had started to use the system, and this enabled the school to see what problems students would encounter when using the system. These, Williams (1986) notes, were the usual pen-pal correspondence. In order to bring the activities in line with the committee's goals, the sponsors of three school clubs, a social studies teacher with six different social studies classes, and a teacher who had bilingual students were all approached. By mid-January "students from social studies classes opened five discussions. . .and were elated when the first response appeared. Topics ranged from *Libya* to the *Chernobyl Incident.* Students were excited by the fact that they could enter into a discussion about the space shuttle explosion the day the incident occurred" (p. 4).

These observations are confirmed by the student reaction. Over 80% of the Calgary students said they would either be very interested in participating another year, or would like to be even more active in the following year, and 71.5% stated that they found the time allowed for participation to be too short. Such statistics, however, do not fully convey the enthusiasm which was expressed by the students themselves,

> 'The most positive aspects were that I got to know how kids in other countries feel about world issues.'
>
> 'It was fun, we learned how other people think.'
>
> 'I met people and learned a topic.'
>
> 'I feel that I learned more about what was going on in the world.'
>
> 'Yes, RAPPI has changed my attitudes. I now know how other kids feel about world issues.' (pp. 6-7)

the teachers,

> 'The value of the use of a new technology to enhance the learning process of students in a unique way cannot be emphasized enough.' (p. 11)

and parents,

> 'He (my son) states that the program is super, beneficial, etc.' (Williams, 1986, p. 12)

However, there were disappointments. Perhaps the biggest for the Calgary students was the lack of response with a school in Paris with which they had been *paired*, due apparently to lack of equipment and technological know-how. The class who were scheduled to converse with the Parisian students had planned extensively to share information, not only via telecommunications, but through yearbook exchange, letters, video tapes, etc. The resulting disappointment was obviously high. In addition, many schools in Canada and Europe were not able to achieve the curriculum integration which Bishop Pinkham had worked so hard to achieve, and sometimes responses could be slow in coming, or not be made at all. This could be particularly disheartening if a group of students had put a great deal of effort into developing a topic which they thought was interesting. This last point illustrates one of the biggest difficulties of this project: that of developing adequate *orgware*

in all the participating schools. In Canada, education is under provincial, rather than federal, jurisdiction and there is considerable autonomy at the local board of education. To have attempted to link a number of schools through a formal (governmental) process would have been a complex and painfully slow undertaking. And although every attempt was made to involve schools which appeared to understand the need to integrate the technology into the learning process, in the final analysis, the success of the project in an individual school depended very heavily on the commitment of teachers and volunteers, and the support they were able to muster locally.

Frustrations with the Technology

I will return to this key question of organizational arrangements towards the end of the present paper, but before doing that I want to focus on the comments made both by Williams and particularly Cioni on the technology which was available for this first RAPPI project.

As Cioni notes in her report, the events which led to the creation of RAPPI began in 1982 at the Versailles economic summit. As a result of that conference, an international working group was established to deal with the application of new technologies to education, vocational training, and culture (ANTEM). Although ANTEM is the formal coordinator of the RAPPI Project, it is fair to say that no real activity involving children had taken place until a meeting of the Inter-Provincial Association of Telematics and Telecommunications (IPATT) was held at TVOntario in March, 1985. That meeting took the view that the only way of demonstrating the potential of the new technologies was to initiate a pilot project. At the time *no* funding was available for such a project, but IPATT had been using the MTS system at UBC for communication amongst its members, and therefore, not only had a credit balance of computer dollars (CC$), but had a number of key educators from all across Canada who had used the system for computer conferences and electronic mail. Thus, the UBC system was chosen, not because of any inherent technical superiority, but because it was immediately available for the project, and had a number of people who were sufficiently familiar with it in virtually every region of the country, who could provide some training at the local level.

In general the children seemed to have less difficulty than their teachers. Although some of the problems faced by the users would have been ameliorated by a more recently designed system, such as CoSy, the most critical ones are endemic to any centralized service which has to be accessed through low-speed (4,800 baud or slower) lines. Cioni (1986) identified some of these problems in her report.

> - Editing was a problem; users knew how to use a full-screen editor but were unable to transfer the basics of editing to the more rudimentary line editor of the system.
> - Downloading and printing out or creating text offline and uploading caused problems chiefly because the word processing package and the communications package did not work together.
> - System glitches such as Datapac failure, noise on the line, system down for maintenance when some users tried to access the system. (p. 27)

The Williams report does not separate technical difficulties from other sources of frustration, but it is even more apparent from this report that a distributed, rather than a

centralized system would alleviate many of the difficulties, namely:

- Waiting for replies;
- Breakdown of computer lines to UBC;
- Print-outs;
- Delays;
- Slow turn-around time for response from other schools;
- More telecommunication lines (from the school) would open the system to more students; and
- Additional computer hook-ups and more time allowed for participation. (pp. 7, 9, 12)

Some of the other problems which Cioni describes have been solved, to some extent, by systems such as CoSy. For example:

- Less talkative and better-designed help screens;
- A new user-friendly interface is required;
- Extensive documentation and support are needed to develop the users' own editor-transfer facilities, thereby reducing time on the host computer and maximizing users' familiarity with their own systems;
- Ability to use diacriticals; and
- Ability to have real time, side by side messaging. (p. 29)

However, there can be no doubt that a distributed, third generation system could provide an order of magnitude improvement over the best centralized systems which are currently available.

Distributed Messaging Systems

Imagine a classroom where each student has access, either individually or in a small group, to a bit-mapped workstation which is able to do true multi-tasking. Even in the early eighties this would have been prohibitively expensive. In 1987, this is reality in many classrooms in Ontario which are using tens of thousands of ICONs™ connected to local fileservers by a high-speed local area network. Although it was the first microcomputer to be specifically designed for an educational setting, the ICON™ is by no means the only choice. Although the Apple Macintosh™, the Atari ST™ and the Commodore Amiga™ were all designed as stand-alone computers for the home market, they can all be used as intelligent workstations to a multi-tasking supermicro such as the VAX™, at prices which, in the U.S. at least, start at only $300.

Now imagine the process by which an individual student would handle a message. When the student logs-in to his workstation, the system will inform him (probably through a system window and a *beep*) that incoming messages are waiting for him on his workstation. The student would invoke the messaging system software by simply pointing to the appropriate icon (an incoming mail tray?) and another window would indicate diagrammatically the messages being transferred to various folders which the student has already set up. Once this is completed, a piece of software, technically known as a *user agent* (or UA), would list the new, unread messages in the various folders complete with other pertinent information, such as who was the originator, what is the subject, how long is the message,

is it confidential, urgent, etc. This information would also be displayed on windows, so that the student could see at a glance the details of all of the incoming messages.

Using a mouse or trackball, the student could quickly arrange these lists of unread messages in a pile, with the most important folders on top, and the less important ones at the bottom. This, of course, would be strictly a matter of choice and the student could spread all of the folders out in front of him if he wanted. The student could then begin to deal with his unread messages, again by simply using the mouse to pick up the ones which he felt required the most immediate attention. As each message was displayed and read, the student would have a number of choices: he could trash the message; archive it in one or several folders; set it so that it would automatically appear again at a certain time or under certain conditions. However, probably the most common action would be to *reply*.

A typical screen layout at this point in time would have the pile of unread messages in one window. Another, much smaller window would be used to advise the student of any newly arriving messages, and the contents of the *current* message would be displayed in a third window. Icons and/or pull down menus would appear at the edge of the screen as usual. In order to *reply* the student would point to the appropriate icon (a pen?) and this would automatically invoke a very fast, full-screen editor of the student's choice. Howéver, unlike most editors currently used on such workstations (e.g., MacWrite™) this would appear in a window alongside the original message, and the student could *cut and paste* items from the original message into his reply. Naturally, most of the header fields in the reply would be automatically set (subject, recipient, etc.) although the student could always choose to override these, and similarly linkages (one-to-one or one-to-many) would indicate the history of the discussion. Naturally, the student would have immediate access to spelling checkers and other writing aids if he needed to use them.

The student would also have his own private database of aliases for peoples' network addresses. Such a database is a cross between a personal address book and an automatic dialer for the telephone system, the main difference being that an alias could refer to one or *any number* of people, who could well be on different computers and on different networks anywhere in the world. Unlike the telephone system, or the regular mail, it is just as easy to send an electronic message to a hundred people as it is to send it to one. Having completed his reply, the student could then browse through his database of aliases (which presumably would be displayed in yet another window) and indicate who should receive 'carbon' copies. Posting the message would be achieved by simply pointing to the appropriate icon (a mailbox?), with the student being able to specify whether the message was urgent, confidential, required confirmation of delivery, etc.

Having posted the message, another piece of software, technically known as a *message transfer agent* (or MTA), would handle the myriad complexities of ensuring it is safely delivered to the recipient(s). Routing pathways would be established depending on whether cost or speed were the prime consideration. If a part of the physical network were tempoarily out of operation, the MTAs would seek another route or wait until the service were reestablished. Furthermore, each and every message would be monitored closely so that the student could be informed if it were not possible to deliver it, or if confirmation of delivery had been requested. As far as the student is concerned, all of these complexities would be of no consequence. The MTAs would make delivering messages to or from other students at the other side of the world just as simple as communicating with another student in the same classroom.

X.400

At the beginning of 1987, this imaginary scenario is becoming increasingly close to reality. The concepts of UA's and MTA's, for example, have been formally defined in a series of recommendations adopted by the CCITT (Comité Consultatif International de Télégraphiqie et Téléphoniqie) in January 1985. These recommendations, known collectively as X.400, are not intended to replace the X.25 switched packet network (*Datapac*) standards, but provide a set of standards for distributed messaging systems. These standards define a number of protocols which allow users on one computer to send messages to users on other computers, regardless of the make of hardware or the particular operating system being used.

Distributed messaging systems have been in existence since the world's first computer network, ARPANET, was launched in 1969. The UNIX™ community probably has one of the largest distributed messaging systems, with over 10,000 computers linked together using the UUCP protocol. *Netnews*, a world-wide combination of discussions and software distribution, has become such an indispensable part of the UNIX™ community that each host now receives 1-million characters of information each day. More recently, Mindflight Technologies have developed a similar system, RBCS™, for the ICON™. However, all of these systems share the major disadvantage that they are non-standard. Only sites approved by the U.S. Department of Defense are allowed to join ARPANET; only computers running UNIX™ can use UUCP; and RBCS™ is a proprietary product which is currently only available on the ICON™.

The most significant feature of X.400 has already been mentioned. It is an international standard and therefore allows a user on one computer to send a message to a user (or many users) on another computer (or many computers) without requiring either the sender or the recipient(s) to log-in to a different computer than the one they normally use. Obviously, for a message to be transmitted from one computer to another, something has to be responsible for establishing the pathway and transferring the message. In X.400, this is done by a sophisticated piece of software called the MTA, which automatically and autonomously transfers messages from one computer to another. A message is delivered from an MTA to a user, or vis versa, by another piece of software, the UA. X.400 essentially defines the protocols by which the UA's and MTA's communicate with each other.[2] Provided these protocols are implemented on different operating systems, messages can be exchanged between different machines in a way which is totally transparent to the user.

EAN, which was the world's first implementation of an X.400 system, developed by the Distributed Systems Research Group at the University of British Columbia, required 30,000 lines of code. Although implementing X.400 obviously requires a great deal of technical sophistication, the underlying concepts are deceptively simple. Reports in the technical press suggest that X.400 is being adopted much more quickly than any previous standard. In March, 1985, KDD, the Japanese Telecommunications Company successfully demonstrated that their implementation of X.400 could be interconnected with EAN. Since then many companies, including Digital Equipment Corporation, the twelve largest

---

[2] P1 is the Messsage Transfer Protocol (MTA to MTA), P2 is the Interpersonal Messaging Protocol (a virtual protocol from UA to UA), and P3 is the Submission and Delivery Protocol. When the UA and the MTA are on different machines, P3 specifies the protocol between the UA and MTA. An additional protocol, P7, can also be used between the UA and MTA.

European computer manufacturers, the European PTT's, Teleglobe Canada, and GTE Mailnet in the U.S. have announced their intention of implementing X.400 in the near future. The reason for its widespread adoption was put succinctly by Gord Farmer, Telecom Canada's manager of business development for Envoy 100: "Prior to the acceptance of X.400 each messaging system was developed on a proprietary protocol. When it came to interconnecting them there was nothing standard between them. What X.400 does is make it so that everything can be connected" (Banks, no date).

The other key feature of X.400 is an electronic analogue of the way the post office handles mail: that of an envelope and contents. A message is a technical term which refers to the unit of communication at the session layer. This should not be confused with the more primitive concept of electronic mail. A message can be of arbitrary length, and so a software file millions of bits in length is still considered a message. The *envelope/contents* concept essentially allows the user to put whatever contents he wishes in an envelope, regardless of whether it is simple text, computer graphics, digitized sound or video, or even computer software. This is nothing like as simple as it would seem at first sight, since special characters may be interpreted as operating system commands by different computers. As a result, a great deal of work has to be performed by the software to ensure that what a sender inserts into an *envelope* is *exactly* what the recipient(s) will receive.

This, of course, is closely tied to the concept of reliability. If a user is to send a file of several million bits of software electronically, say from Vancouver, B.C. to Oslo, Norway, it may well be next to useless if a handful of errors occur in the middle of the file. The situation is ever worse if the file gets lost as it is being transferred from one MTA to another. Again, a great deal of the complexity of X.400, which is not apparent to the casual user, is in ensuring the highest possible level of reliability and closely monitoring the progress of each and every message as it is sent from one computer to another.

X.400 is also inherently independent of the type of the physical media over which the messages are sent. X.400 systems can and do use X.25 switched packet networks, direct dial telephone networks, leased lines and high speed local area networks. X.400 will work equally well over satellites, CATV cable, fibre optics, etc. As a result the user is not concerned that, for example, cable inherently has far fewer data transmission errors than a telephone line. Similarly, in the vast majority of cases, the user is not concerned at the speed by which a message is transmitted from one MTA to another. On the other hand, the system is flexible enough to have alternative pathways which may be chosen if speed is critical, if economy is needed, or if one node of the network is temporarily unavailable. The simple elegance of the system means that *the user need only use the computer and operating system he habitually uses*. His user agent will use standard features of that operating system, such as the full-screen editor, with which he is both comfortable and familiar, and the interface between the user and the UA will use data transmission speeds which are normal for such activities, namely, 19,200 baud for ASCII terminals and much higher for bit-mapped workstations. All of the complexities of ensuring that his messages are reliably and speedily delivered to users around the world, and that incoming messages are placed in his own work area, are handled competently and automatically by the UAs and MTAs.

X.400, therefore, promises to be the first step in the creation of a virtual network. It is important, however, to remember that work on X.400 is just beginning. It is not likely to be available on major microcomputers such as the IBM PC™ until the latter part of 1987, and some of the user friendly features described in the previous section will not be available until X.400 is implemented on the Macintosh™, ICON™, Amiga™, etc. However, some

non-standard messaging systems, such as RBCS™, already make reasonable use of pull-down menus and a mouse or trackball, so it seems likely that these systems will eventually adopt X.400 or be replaced by systems that confirm to the international standard.

Systems for Conferring

It is clear that, at least in the area of electronic messaging, many of the technical and associated frustrations will be eliminated when X.400 becomes widely available. Many university researchers are already using such systems, and such users are immediately alerted to the fact that a message from halfway around the world has arrived *on the system they are currently using*, be it for word processing, AI research, simple calculations, or whatever. Because the users do not need to dial-up some remote computer to check their messages (all too frequently to find that the remote system is down for maintenance), even such things as speed and frequency of response are dramatically improved.

Messages, whether they are one-to-one, or one-to-many, lack many of the features which systems such as CoSy have shown to be so useful in group discussions. X.400, it will be recalled, specifies the protocols to be used between the MTAs and UAs. Current implementations make it a reasonably useful tool when two people wish to confer, but a great deal more work is still necessary to design a more general distributed conferring system.

In a very real sense, *Netnews* already is such a distributed system, but has bypassed the central problem by sending everything to everybody. As a result the communication costs for distributing *Netnews* in the U.S. alone are reported to be in excess of $1-million per month. In the school system, this would exacerbate a problem already observed with RAPPI: that children, even in high school are not familiar with techniques for reading selectively and skimming. Even though I would argue strongly that such techniques should be learned early in grade school, I still believe that technologies should be designed to improve human interaction and facilitate the acquisition of knowledge. For all its achievements, I regard *Netnews* as a step in the wrong direction.

Perhaps more hopeful is the EDAN project, which will be launched by TVOntario and the Ontario Ministry of Education early in 1987. This project will allow 75 schools from Ontario to use CoSy running under VMS™ on TVOntario's VAX™. Although it will replicate some of the work of RAPPI, it will allow much more attention to be paid to providing workshops and other means of assistance to the teachers. The project also has the advantage of having all of the participating schools use the same type of computer, the ICON™ and a common communications package, ICON Access™.

The same project will also use the RBCS™ software to allow distributed messaging directly between the schools. The fact that RBCS™ uses non-standard protocols will not present problems until the participants want to communicate outside the schools identified in the project. Hopefully they will ask, at an early stage, why they cannot send a message to TVOntario's VAX™ in the same way as they send one to another ICON™. Similarly, once they have begun to communicate, a) with each other directly using RBCS™, and b) with each other via the VAX™ using ICON Access™ and CoSy, they will also ask why they cannot have the best of both worlds, (i.e., the functionality of CoSy and the convenience of distributed messaging).

An even more ambitious initiative is being planned by the Knowledge Network in B.C. (Forsythe, Hart & Sinclair, 1986). Although the projects in this initiative will use many different media (satellite television, computer conferencing, audio conferencing, slow-scan,

compressed-video, VSATs, etc.), all of them have been carefully built up from the grass roots to meet real educational needs. An important part of this initiative is to establish collaborative efforts which transcend the usual provincial boundaries. If students in the public school system are able to use relatively primitive technologies to converse with and collaborate with their peers across Canada and around the world, then it is surely reasonable to expect educational administrators and researchers to do likewise. As a result, people doing world class work, which appears relevant to the initiative, have been approached informally to explore the possibilities of co-operation, regardless of where they are physically located. Assuming funding is approved, one of these projects will develop a prototype node which will serve a given *geographic* region. Such a node will offer state-of-the-art services to schools, including X.400 messaging, database access, computer conferencing, etc. and provide an infrastructure of organizational support to ensure that these are integrated across the curriculum. One of the goals of the exercise would be to encourage similar nodes to be established by ministries of education, school districts, and schools across Canada and internationally. Although these nodes would begin by using CoSy as a conferencing system, it is anticipated that research would be undertaken in tandem with this work to:

1. Specifically design a system which pays special attention to the needs of children; and
2. Begin to link these nodes into an integrated network, using the X.400 recommendations as the inter-node protocol.

Such an approach will allow the node(s) to use leading edge, but proven technology, which is currently deemed too expensive for *in school* use. For the past 30 years, the cost of computer hardware has consistently declined by 40% per annum and there is every reason to believe this trend will continue. The nodes, therefore, will be reasonably indicative of the technologies which will be available for classroom use by the end of the decade and represent the best possible prediction of third generation telematic technologies, which Cartier (1986) suggests will start to appear at that time.

By developing such a systems architecture, and working collaboratively with researchers at Guelph, OISE, and elsewhere, it seems likely that by the time the third generation telematic technologies are widely available, the problems of implementing distributed conferring systems will have been largely overcome. Every student will not only have the world *in the classroom*, but the present low-bandwidth communication channels will have been replaced with a virtual network which really does allow people to *confer* rather than to *conference*.

The Issue is Learning

No matter how attractive new or emerging technologies may seem, the educators must continue to remind themselves that the issue is learning, *not* technology. As I noted at the beginning of this paper, it is far too easy to forget that there is a wealth of experience which is generally applied automatically to the production of, say, printed course units, but frequently ignored when more hi-tech media are involved. It seems to me that good Open Learning starts with the needs of the learner and chooses whichever technologies are most appropriate. Naturally there are biases, so that a *redbrick* university is likely to continue to use *formal* lectures of one or two hours duration, despite the evidence that such methods are inefficient and ineffective. A *distance learning* institution with an expensive printing press

is likely to continue to churn out correspondence materials, even for courses which have low enrollments or which are poorly presented using the printed word. And similarly, knowing the energy and enthusiasm which some institutions have committed to the development of computer-based education, it should come as no surprise to see such institutions showing a marked preference for CBE, regardless of whether or not it is appropriate. The example of the part-time student who had to regularly drive 20 miles to a terminal in order to conference with his supervisor (McCreary & Van Duren, 1987) is indicative both of the power of the medium and the vagaries of inappropriate learning systems design.

In an effort to address this problem, David Godfrey and I (Godfrey, Hart & Woolard, 1986) have developed the concept of implementation engineering. This is a systematic approach to the design, production, and delivery of learning systems that goes well beyond the scope of course design. Certainly, even less is known about the implementation problems than, say, software production problems, but careful attention to details and patterns, and the search for rules that can be successfully applied in a variety of circumstances mark the beginning of implementation engineering as a recognizable and major category for telemathetics. For Canada, which already has an international leadership in communications and Open Learning, the implementation questions are in many ways the most challenging, which with future study and practice, will lead to equally spectacular results.

This concept has been used, with some success, in the introduction of CBE at North Island College (Cowper, Godfrey, Hart & Sterling, 1987) and East China Normal University (Godfrey, Gong, Hart & Smit, 1988). Furthermore, the experience of these projects confirm Dubrov's thesis that, for any significant technical advance to be applied successfully, the organizational arrangements must be developed to ensure that students and tutors alike are able to use the hardware and software effectively. Although the content of the knowledge may be contained in resources such as CBE, laserdisks, audio tapes, books, etc., knowledge itself is *as much the process or skill of acquiring it* as it is the content (Forsythe & Hart, 1980). As a result, any coherent, systemic approach which is applied to the use of new (or old) technologies in facilitating learning, inevitably includes a professional educator or *tutor* as a vital part of the delivery service. The role of the tutor is that of a guide, catalyst, learning helper, and motivator as well as an expert learner — in fact very much the role which Catherine Williams and other teachers around the country played wherever RAPPI was successfully integrated into the learning activities of an individual school.

REFERENCES

Banks, B. X.400 standard gaining momentum. *Computing Canada.*

Cartier, M. (1986). Un modèle d'accès à la connaissance. *Le laboratoire de télématique et de médiatique.* Montreal, PQ: Université de Québec à Montréal.

Cioni, M. & Associates (1986). *An evaluation report of the RAPPI project, September, 1985 - June, 1986: An international computer conferencing network* (Department of Communications). Ottawa, ON: Maria Cioni & Associates Inc.

Cowper, D., Godfrey, D., Hart, R., & Sterling, S. (1987). Teaching at a distance with CAL. *Open Learning, 2,*(1), pp. 25-30.

Forsythe, K., Hart, R., & Sinclair, G. (1986). Knowledge Network — Schools initiative. *Knowledge Network of the West Communications Authority.*

Godfrey, D., Gong S. K., Hart, R., & Smit, S. (in press). Project clear skies. *Computer Journal.*

Godfrey, D., Hart, R., & Woolard, R. (1986, May). *The GOLDCOIN consortium: From concept to transformation.* Paper presented at the Fifth Canadian Symposium on Instructional Technology (National Research Council), Ottawa, ON.

Hawkridge, D., & Lewis, B. N. (1979). *New methods of assessment and stronger methods of curriculum design* (Ford Foundation Project). Milton, Keynes: The Open University, Institute of Educational Technology.

Kaye, A. (1987). Introducting computer-mediated communication in a distance education system. *Canadian Journal of Educational Communication, 16*(2), 153-166.

McCreary, E. K., & Van Duren, J. (1987). Educational applications of computer conferencing. *Canadian Journal of Educational Communication, 16*(2), 107-115.

Pask, G. (1976). *Conversation theory.* Amsterdam: Elsevier.

Penny, D. (1986, May). *Reflections on reading the abstracts, or How do we get from where we are to where we want to go.* Paper presented at the Fifth Canadian Symposium on Instructional Technology (National Research Council), Ottawa, ON.

Tribus, M. (1979). *A new approach to teaching adults at a distance — problem-based learning* (CEAD Paper 35). Milton Keynes: The Open University.

Williams, C. (1986). *The RAPPI experience at Bishop Pinkham Junior High School* (Report to the Federal Minister of Communications). Calgary, AB: Department of Communications, Canada.

Next Steps

Introducing Computer-Mediated Communication into a Distance Education System

Tony Kaye

Abstract: Distance education institutions teaching at university level now exist in a wide range of countries, and many of these institutions cater successfully to very large numbers of students. However, opportunities for discussion and collaboration between dispersed and isolated students and tutors in such institutions are often severely limited. It is argued that computer-mediated communication methods could in principle have a powerful role to play in enhancing communication between and amongst students, tutors and course development staff in distance teaching universities

This article examines the potential of computer communications in a distance education context with specific reference to some early trials of electronic mail and computer conferencing at the British Open University. Three main challenges are identified in trying to introduce this new technology: scale, integration and optimisation. Barriers to acceptance of computer conferencing as an educational medium for distance learners and tutors are described and analyzed. Particular emphasis is placed on the importance of the role of tutors as potential moderators of conferences for distance education.

INTRODUCTION

Distance education methods for university level studies are now part of the normal educational scene in many countries. For example, in Britain, applications for undergraduate courses at the Open University (OU) in 1986 exceeded 56,000, even though only 20,000 new places were available. Altogether the OU has more than 120,000 students in its undergraduate and continuing education programmes, making it Britain's largest university and training agency. Other distance education universities deal with even larger numbers of students. For example, the Central Chinese Radio and Television University with over 800,000 enrolments, the Sukhothai Thammathirat Open University in Thailand, and Universitas Trebuka in Indonesia are likewise demonstrating that distance education at university level is being adopted successfully in a wide range of contexts (for recent discussions of distance education at university level, see Rumble and Harry, 1982; and Henri and Kaye, 1985).

Tony Kaye is Senior Lecturer, the Institute of Educational Technology at The Open University, Milton Keynes, MK7 6AA UK. His research interests include the development and analysis of communication methods for distance education. Reprints may be obtained from the author at the above address.

CJEC, VOL. 16, NO. 2, PAGES 153 - 166, ISSN 0710 - 4340

However, despite this degree of success, there is room for improvement in the methods adopted by institutions of mass higher education; in fact there are a number of problems associated with the teaching methods currently used by these large-scale distance teaching enterprises. Some of these problems are linked to the shift of the major cost elements in distance education, as opposed to face-to-face education, from student-related, recurrent, teaching costs to course-related materials development and infrastructure costs. They include:

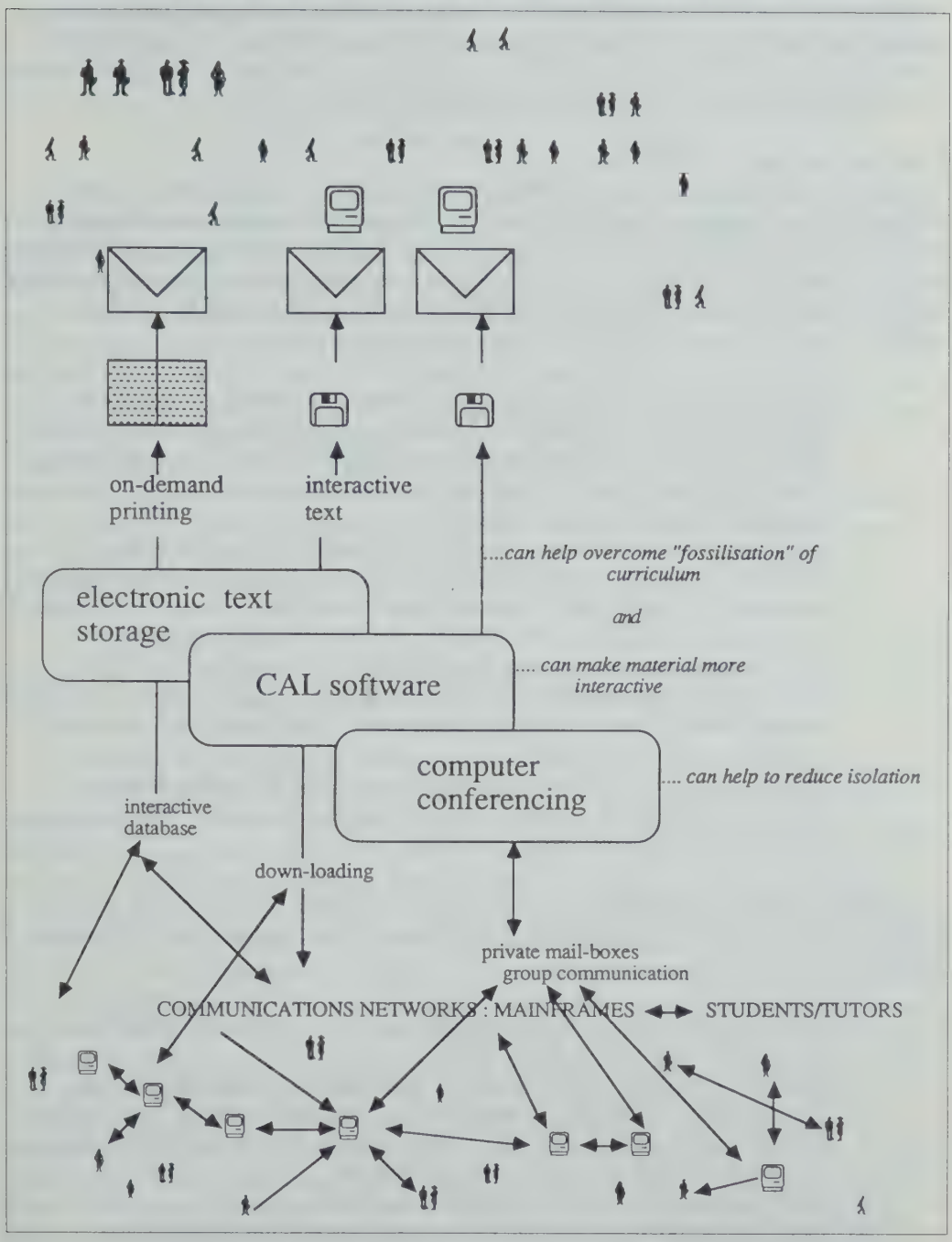
- the expense of up-dating and modifying mass-produced print and audio-visual materials (a course life of 5-8 years seems to be generally considered as necessary to amortise high materials development costs);
- the difficulty of introducing innovations in teaching or delivery methods into highly standardised and centralised production and distribution systems;
- the relative inflexibility of many distance education methods in responding to individual students' needs, interests, and experiences; and
- the limited opportunities for dialogue and group interaction amongst students, and between students and tutors, within what is predominantly a one-way communication system.

Some of these problems can become particularly acute when a system originally designed for handling very large population introductory courses is required to deliver, *nationally*, a wide range of higher level low population courses, in response both to the diversity of student interests and to academic expectations of what constitutes a comprehensive university curriculum. In 1985, for example, over a quarter of OU undergraduate courses had less than 200 enrolments. In addition, a number of low population post-graduate courses are being added to the academic programme.

In principle, there are a number of ways in which the new information technologies (see Figure 1, next page) could be applied in the OU system to help overcome some of these problems — when and if sufficient numbers of students and tutors have access to the necessary home-based computer equipment. Electronic storage of text materials could allow for on-demand printing (thus enabling material to be easily revised and up-dated, *and* avoiding warehousing costs), for establishment of course-related and administrative data-bases, and for mailing of interactive text to students on disk. CAL software, as now, could be made available for on-line access, or mailed to students on disk. And, central computer conferencing software could provide an opportunity for easy communication and interaction amongst our widely dispersed populations of students and tutors.

The University has in the past been a major innovator in the use of computers and information technology, in the running and administration of its system (i.e., student registration, fee payments, records, assessment, etc.), in communications between the thirteen Regional Offices and the Milton Keynes campus, and in its teaching (e.g., use of CAL materials in many science, mathematics, and technology courses). The University's Academic Computing Service (ACS) network provides computing facilities at terminals in around 300 local study centres, as well as to a small number of current and planned courses which require students and tutors to have home microcomputers and modems. Users can access this network from a number of dial-up nodes throughout the country, generally based in the University's regional offices — this provides around two-thirds of all current students with local or 'a band' call rate access. The justification for home computing facilities has generally been made in terms of students needing to spend significant amounts of time

FIGURE 1. *Using the New Information Technologies in Distance Education.*



to upload and download software from one of the mainframe computers, to carry out complex mathematical and statistical operations, to access CAL material, or to learn programming skills and languages.

However, little practical thought has been given so far to the potential of using home-based computer facilities to enable students, tutors, and central and regional faculty and administrative staff to *communicate* with each other through electronic mail and computer conferencing, nor to the ways in which on-line facilities could be used for relatively economical up-dating of courses (e.g., through the creation of course data-bases).

Computer-Mediated Communication

Electronic mail and computer conferencing are both examples of current computer-mediated communication technologies. These technologies allow individuals and groups of people to carry on discussions and conversations over a computer network regardless of time and place constraints, via messages keyed in to microcomputers connected by telephone to a central computer. Four features stand out as being practically tailor-made for use by students, tutors, and course developers in distance education systems:

- once the equipment (microcomputers, modems, mainframe) and necessary software and network facilities are in place, *communication costs are very low* (the great majority of OU tutors and students should be able to access our mainframe computers at local call rates of about 50p per hour [= about one Canadian $] on evenings and weekends);
- communications, whilst being virtually instantaneous to the mainframe computer, are *asynchronous*, unlike face-to-face meetings or telephone calls and conferences (messages can be entered and retrieved when convenient to users of the system, permitting time for reflection and for thoughtful composition);
- all communications are *stored* until deliberately deleted, and can be filed in such a way as to be immediately accessible when required — a feature not found with face-to-face and telephone communication unless burdensome recording procedures are employed; and
- the processing power of the mainframe computer and its communications software can be used to *organise* and *structure* inputs, outputs, and communication patterns in a variety of different ways.

This last point is of particular importance. Although current computer conferencing software packages vary in their degree of sophistication, several can support the following functions:

- electronic mail, both one to one and one to groups, usually with automatic signalling of mail that has been read;
- computer conferencing, with the ability to assign specialist roles to different participants (moderator, secretary, read-only membership, etc.), and with different categories of conference (open, closed, private) and in some systems, the possibility of creating branching conferences;
- private notepads for personal documents and notes;
- signalling of current on-line participants, with the possibility of synchronous communication;
- a directory of members with users' names, addresses, interests, etc.;
- on-line text editing;
- free text search and retrieval, enabling participants to access messages by

topic, date, name of sender, or by any given string of characters in either the text or header;
- voting or polling on forced-choice questions, with instantaneous display of results; and
- transfer of files, both to and from other systems (e.g., data-bases, electronic mail systems) and to and from the user's microcomputer.

A computer-mediated communication system is thus qualitatively different from other interpersonal and group communication media. In our context, it should be seen as a new medium which could permit us to do new things, and not simply as an electronic replacement for correspondence tuition, face-to-face tutorials, or telephone contact. In fact, there is some research evidence to demonstrate that introducing computer conferencing technology into organisations and communities (e.g., dispersed communities of scientists) may actually *increase* the frequency of other forms of communication, partly because it enables people who would never have met/communicated otherwise to make contact with each other very easily (see, for example, Kerr and Hiltz, 1982; Hiltz, 1984). Participating in an open computer conference, can be highly serendipitous. One can type in a suggestion, or a request for help or advise (rather like throwing a bottle with a message in it into the sea), and then discover upon logging in a few days later that several other, possibly unknown, participants have responded with suggestions and ideas. As a result, networks of relationships and contacts can develop in totally unanticipated patterns.

THE POTENTIAL OF COMPUTER-MEDIATED COMMUNICATION FOR DISTANCE EDUCATION

Assuming that the necessary pre-conditions can be met (Bacsisch, 1987), the challenge of introducing this technology into a complex distance education system like the Open University's will lie in developing new forms of course design which can not only accommodate this new medium, but also exploit it to its best advantage. This needs to be done without overloading the system, and thus leading to large increases in course presentation costs. Merely adding such a facility to our present course model may not only represent a significant additional cost, but also be pedagogically ineffective. There is little experience to go on, as yet, in the educational applications of computer conferencing within dedicated distance teaching systems like that of the Open University. Current educational applications are either as an alternative to correspondence tuition for external students (e.g., at New York Institute of Technology, see Haile and Richards, 1984), as a tool for in-service management training at the Western Behavioural Sciences Institute (Feenberg, 1986), as a supplement to conventional face-to-face teaching, as at Guelph University, or as the unique teaching medium on totally *electronic* Master's level courses, as in the Connected Education project at New School for Social Research in Manhattan, which uses the EIES computer at New Jersey Institute of Technology (reported in Kaye, 1985). Only a few reports of specific projects using computer conferencing in conjunction with other media, specifically for distance education, have been published to date (see Davie and Palmer; 1984; Harasim, 1986).

Study of projects such as these would lead us to believe that, as far as pedagogical issues are concerned, there will be three main challenges in trying to use computer-mediated

communication in the Open university situation:

- *scale:* most current applications of computer conferencing in the educational field have concerned small groups of students (i.e., in the tens), rather than the much larger student populations typical of many distance teaching projects;
- *integration:* this new technology must be integrated not only with existing print and audiovisual media, but also into complex course development and presentation systems, involving central teams preparing materials to be tutored by intermediaries (to make best use of these new technologies, it will undoubtedly be necessary to re-think many of the standard course development and presentation methods, and this will probably involve major enhancements of tutors' roles); and
- *optimisation:* it makes little sense to use these technologies merely to replace existing procedures (e.g., electronic mail as a substitute for postal correspondence or phone calls, computer conferencing as a substitute for face-to-face tutorials), since the unique characteristics of computer–mediated communication should be used where they can provide maximum benefit in terms of the quality of learning which they can promote.

The problem of scale can be tackled in several ways. Firstly, a clear distinction should be made between one-way and interactive use of computer-mediated communication. In the former case, one could envisage, for example, the use of a data-base under the control of a designated member of a course development team, to be used for stop-press and up-dating items (thus helping alleviate the problems of inflexibility and fossilisation of mass-produced course materials). Course developers and tutors might be invited to submit suggested items for inclusion to the data-base editor, and students would have read-only access. Such a facility would work equally well regardless of the total number of students on the course — in fact the cost advantage of computer-mediated communication over postal mailings increases with numbers in this case.

In the latter case, interactive use in the individual or group mode, the tutor group might be considered as the basic unit within which communication occurs. The Open University norm of 25 students to one part-time tutor fits well within what is probably an optimal group size for computer conferencing applications such as on-line seminars and tutorials. It is also a size which easily permits the establishment of self-help groups, especially as the students would have had the opportunity to meet face-to-face and thus get to know each other personally.

However, this does not imply that communication should occur *only* within individual tutor groups. One could envisage, in addition, the setting up of a conference which could permit all tutors and course developers to share information. Such a facility could be used for briefing, comparing marking and tuition practices, obtaining specialist help, evaluation, and feedback. Finally, on relatively low population courses, it would not be out of the question to have a general course conference to which all students and tutors could contribute.

Integration of computer-mediated communications into an existing distance teaching system is a more problematic issue than that of scale. It is probably only through experience of using the technology that the best ideas will appear for integrating the medium

with core course materials. In this context, it might be useful to explore the potential of computer communication for course development; experience of use of EIES by groups working on common projects demonstrates that computer conferencing can be a very effective medium for achieving consensus and for joint preparation of working group reports. Such a facility would certainly make it easier for dispersed members of course development teams to contribute to discussions on course content and objectives. And out of such an experience, ideas for using computer conferencing in teaching may well develop.

Optimisation of computer-mediated communication technologies for distance education will flow from two key features: 1) the potential for group communication, and 2) the fact that all information can be stored, organised, and retrieved at will. Straight away, this provides an opportunity for learners in the system to contribute and share their own knowledge and experience, changing a course from an inert set of pre-packaged materials into something much more dynamic and learner-centered. Research is needed to investigate how computer-mediated communication can best be used to facilitate cooperative learning, discovery learning and development of problem-solving and critical thinking skills. On the negative side, it will also be necessary to identify ways of helping users deal with the potential information overload which often occurs on systems using these technologies.

In general, computer-mediated communication has the *potential* for being more than just an electronic substitute for correspondence tuition and face-to-face meetings in the distance education context. This potential should be increasingly realised as the necessary equipment and software, coupled with access to low-cost communications networks, becomes more widely available. And as experience with using these technologies for educational purposes builds up, so new applications should develop — cooperative networking projects, skill exchanges, and peer teaching, are some of the more exciting examples which come to mind for the future. In the meantime, the immediate task is one of initial appropriation of what is, for us, a new medium of communication.

A STRATEGY FOR INNOVATION

Introducing a new technology into large-scale, well-established, systems is problematic. Excellent reasons can always be found for continuing to use well-tried methods rather than venturing down new and unexplored paths. The history of educational technology, as we all know, is littered with experiments and technologies that failed to realise their full potential. Hopefully, we have learned from these mistakes. Our strategy for introducing and developing the use of computer-mediated communication in the OU system is essentially gradualist, based on the notion of helping a network of potential users to develop as and when the value of this technology begins to be appreciated. The strategy is based on a number of elements.

1) Introduction of interested faculty and administrative staff to the use of, firstly, electronic mail, and secondly, conferencing, both from office terminals and from home-based equipment (micro-computers with modems and suitable communications software). Many faculty staff prefer to do their course development and writing work form home, and *a priori*, should be ready customers for text-based computer communication facilities for tasks such as commenting on draft materials, collaborative authoring, and preliminary

discussion of agenda items for meetings.

2) Investigation of existing conferencing software packages for installation on one of our mainframe machines, we have looked at a number of commercially available systems, including PARTICIPATE, PortaCOM, VAX Notes, and CoSy, and finally decided on CoSy.[1]
3) Initial trials of computer communications, as an add-on facility, with a small selection of OU courses which already required students and tutors to have micro-computers and modems at home for their course work (this year, these trials used MAIL MANAGER, a professional electronic mail package developed at Stanford University, and installed on our DEC-20 machines; next year, they will continue with the VMS version of CoSy, installed on a VAX mainframe).
4) Development of a strategy for using computer conferencing as an integral element of the design of a new Open University course — *An Introduction to Information Technology* — which is being planned for first presentation in 1988. This course will require all students (about 2,500) and tutors (about 100) to have, at home, an MS-DOS micro-computer with a modem and printer, to be used for the course practical work (e.g., word processing, spread-sheets, data-base construction, etc.) as well as for communications with other students, course developers, and various on-line data-bases.
5) Research and development work into the use of computer-mediated communication in distance education.[2]

The remainder of this paper refers to (3) above, and is a brief analysis of our impressions from the trials undertaken during 1986 of the use of the MAIL MANAGER electronic mail software on two courses.

---

[1]Some of the reasons for this decision are perhaps of interest: 1) CoSy was developed with a university environment (Guelph University, Ontario), for use by faculty staff, administrators, and students in their conferencing packages and is simple, easy to learn, and functional. CoSy's three principal modes are *personal mail*, *conversations* for informal group discussion, and *conferences* for more formal, organised, group interactio; 2) It has been adopted by *BYTE* magazine for their information exchange (BIX), which is now probably the busiest publicly available computer conferencing facilty in the world. This gives an additional guarantee of future support for the software; 3) We were able to obtain the source code, and are being encouraged to tailor CoSy for our own specific applications. No other commercially available package would allow us to do this.

[2] This work currently has two main strands: a) evaluation of user reactions to current computer conferencing facilities, and the identification of optimal ways of using them in an educational context. We are in touch, via conventional channels as well as through various computer conferencing systems, with other researchers in this field in several different countries [notably Canada, the USA, Denmark, Australia, and France]; b) development of new software for use on distance education work stations (the *Thought Box* project, see Alexander, 1986). This software is being designed specifically for a home-based learner to support both local functions such as word processing and remote functions such as communication with other learners, with tutors, and with on-line data-bases — the analysis of the problems experienced by naive users in learning to master existing conferencing software will be a valuable input to this project.

SOME PILOT EXPERIMENTS

Below is a description of the courses and user groups chosen for trials in 1986.

1) A new undergraduate *Cognitive Psychology* course in which each of the 24 tutors were provided with a Macintosh 512K micro-computer and a DACOM auto-dial modem. The Macintosh is used for a number of experiments in the course, as well as for some AI work (carried out with students at day schools and summer schools). The use of the modem and the electronic mail facility was an add-on element, which the course team thought would be valuable for stop-press notes from the course manager, for discussion of problems with the course experiments, and for providing a rapid feedback channel for problems encountered by students and tutors during the first year of presentation of the course. Students on the course did not use this electronic mail network, as they did not have the necessary equipment, but it was hoped that the tutors would be able to propose ways in which such a facility could, potentially, be used for tutorial purposes were students to have access.

2) A continuing education course, one of several involving the Science and Engineering Research Council (SERC) on the topic of *Software Engineering*. This course involves about 100 hours of study time, spread over up to two years. It contains a significant *hands on* component, making use of an OU-designed micro-computer, together with a modem, to access the university's mainframe machines for undertaking programming and software development exercises. Students can choose when to enrol, whether or not they undertake formal assessment, and the extent they wish to make use of a tutor. Unlike undergraduate courses, there are no group tutorials, but tutors give individual help by telephone or correspondence, and, for those involved in the trial, through electronic mail.

In each course, one group communication facility (a course bulletin board) was set up as users self-registered on each network, so their ID's and names, together with a few personal details, appeared in another bulletin board (*bboard members*), thus giving each user the opportunity to direct personal mail to any other user.

What Have We Learnt from These First Trials?

Firstly, the negative points. There is no doubt at all that, however great the educational potential of text-based computer-mediated communication might be, a certain number of basic technical conditions must be met before any but the most devoted hackers will actually use this technology. Three factors are of obvious importance in this context: 1) the equipment; 2) the communication link; and 3) the software. For the tutors using the Macintosh micro-computer, the equipment was less of a problem than for the students and tutors in other groups — after all, they *only* had to connect together their micro-computer, modem, and telephone, before calling the network (and they had auto-dial modems). But those in the *Software Engineering* course had, in addition, to power up and connect a TV receiver to provide the screen display; and, they did not have auto-dial modems. The communication link is the next problem. Parameters have to be set correctly, characters transmitted without corruption, and the connection made to the mail/conferencing software

on the host computer. Finally, the messaging/conferencing software has to be used correctly. For computer-naive users, this means that the commands must be intuitively evident, and the system easy to learn, transparent, and forgiving.

Our trials have clearly shown that all three of these technical aspects of the communication process are problematic. Some tutors had to wait several weeks before BT installed the new style telephone sockets needed for modem use, others had difficulties with connector cable fittings, and one had a modem that failed on its first use (despite the fact that they had all been tested beforehand). Of the 24 tutors in the first group, two failed even to register on the system either because it all seemed too complicated to set up, or because they failed miserably in their first attempts at access. A fairly regular (and perservering!) user reported 42 failed connections in a two-month period. Each of these calls actually got through to the University's computer network (thus clocking up at least one telephone charge unit) but in each case, for one reason or another, it was not possible to access the particular machine (a DEC-20) on which the mail system was installed. Finally, most users found the Mail Manager electronic mail software hard to learn and confusing to use. Many people failed to register correctly. The self-registration procedure was awkward, complex and unforgiving. Once registered, it proved impossible to modify one's personal details, or to correct keying errors. The log-in procedure was lengthy and error-prone, involving dialing a local phone number, to access the OU network, then choosing the right machine (the Milton Keynes DEC-20), then typing a special log in name (e.g., "d309.a-kaye" for myself on the Psychology course network), followed by a study centre number and a personal identifier. The actual mail system proved confusing to many users (e.g., the same commands can produce different results depending on which *level* of the system one is in). Many people experienced difficulty in using the bulletin board facility, hardly surprisingly, as it was called by different names depending on the commands given (to send a message to the *Cognitive Psychology* course board, for example, one addressed it to "d309" — the course code number — but to read the bulletin board, one entered "bboard" at the Mail Manager> prompt. To compound the confusion, when the bulletin board appeared, it was called by the machine "d309.mail.txt.1"!) Any user naive enough to address messages to "bboard" never saw them again. They ended up on the DEC-20 system programmers' bulletin board!

We are assuming that these technical and design problems can be overcome, to some extent, in our context for next year. We will be using proper conferencing software (CoSy) instead of a complex electronic mail system, and new mainframe machines are currently being installed which should help in reducing access problems. However, even if the equipment, log in procedures, and messaging system were made as easy to use as, say, any of the *messageries* on the French *Télétel* system, we would still have a second, and even more problematic, layer of factors to consider before knowing whether, in reality, this technology can be of use in our situation.

This second layer is concerned with user motivation, and with the factors which underlie personal preferences for particular modes of communication. We all know of people who love face-to-face meetings, others who are addicted telephone users, and even some who prefer writing and receiving letters and memos to talking on the phone or going to a meeting. And, there are people who feel a stronger need to communicate with their fellows and colleagues than others. Taking the *Cognitive Psychology* tutor group, it should be pointed out that tutors on the average OU course rarely communicate laterally (i.e., with each other) except on special occasions such as tutor briefing and de-briefing meetings at the beginning and end of a course, and, for those courses which include one, at residential

summer schools. Although potentially forming a good basis for subsequent contact on an electronic network (it is good to be able to put a face and a personality to the receiver of one's messages), such communication is not absolutely necessary for tutors to be able to perform their OU work. This perhaps explains why, amongst these tutors, there was a definite split into four more or less equally sized groups:

1) those who won't use the network, either because they are too busy, or just not interested;
2) those who use it very little, because they are slightly resentful of the time it takes, for which they are not being paid, and who, in any case, are "not interested in computers";
3) those who were interested in the idea, and tried, but then gave up, mainly because of access problems and other technical factors; and
4) those who take to the medium, and become regular users, mainly for personal messages.

If one takes the last two groups (those in principle favourably disposed to this medium) and assumes that there is a definite *need* for communication which cannot be, or is not, satisfied through other channels, there is still a further layer of factors to be considered. These are concerned with learning to use a new medium of communication, which, while sharing some of the properties of telephoning, of audio-conferencing, of letter-writing, and of face-to-face meetings, is yet unique. As a result, the protocols, standards, and behaviours associated with the more traditional forms are not appropriate. It is therefore hardly surprising if new users experience problems in appropriating this technology. For effective and stimulating communication to occur it would seem that two factors, other than those already mentioned, are critical:

1) users must develop a regular habit of logging on to the system to read and respond to new messages, and to initiate their own contributions (for example, one of the PMT600 tutors logs in four or five times a week to check mail from students and post contributions to the bulletin board); and
2) for formal conferences, there must be an effective conference *animateur* or moderator, who encourages new users to join in the discussion, who keeps the discussion focussed, and who provides periodic resumes and syntheses of the progress and main outcomes of the conference (Brochet, 1985; Feenberg, 1986).

During our trials with CoSy in 1987, we hope to concentrate our activities on this last point, as it is clear to us that our tutors will be key figures in the development of computer conferencing in our system, as they will not only have to deal with personal queries from individual students, but also assume the responsibilities of conference moderators. Dealing with individual queries via electronic mail should not present particular problems. The skills which tutors have already developed in writing comments on students' assignment scripts should be readily transferable. These skills are concerned with commenting positively on students' work, valuing their contributions, adopting a personal and friendly writing style, and so on. Electronic mail, with its much faster turn-around time than for written correspondence, will undoubtedly be seen as beneficial by students. It is, however, in the area of group communication within tutor-student conferences that we are most likely to run

into problems. Neither tutors nor students are familiar with computer conferencing, and in the large numbers of group conferences that we are likely to be establishing, it is evident that there will be a wide variety of conferencing styles, some of which will be more or less successful than others. The next major phase of our work will involve careful investigation of the most appropriate ways of stimulating effective communication through the interactions between students and tutors within electronic conferences.

In concluding this interim report on the early trials of computer-mediated communications at the Open University, it is important to stress that the successful use of this technology in our system will depend, above all, on the tutors. This is a technology which is liable to change their normal ways of working and interacting with our students, and, potentially, its use could consume enormous amounts of time. For example, the fast turn-around on electronic mail is likely to encourage students to indulge in much more frequent written dialogue with their tutors than is the case at present, and thus present serious overload problems for which we will have to provide training in coping skills (Hiltz & Turoff, 1985). On the other hand, the use of a group space for dealing with student problems could well protect tutors from having to answer the same or similar query several times over with each individual student, and thus save them time. The operation of conferences will require tutors to encourage newcomers to enter comments, to give careful attention to each student's contribution, to monitor conference activity, and to provide resumes, from time to time, of the discussions. Perhaps the key skill that tutors will need to develop will be that of encouraging students to help each other as much as possible within the conference workspaces. Then, if the right balance can be achieved, conferences could become self-regulating, only requiring occasional inputs from a tutor to maintain homeostasis.

LOOKING AHEAD

This paper has done little more than describe and analyse a particular stage in the early adoption of computer-mediated communications in an institution which in many ways is unique in its structure, scale of operation, and teaching methods. It is difficult to know how the early trials of the use of computer communications will develop at the Open Universtiy, but it is already clear to us that certain pre-conditions must be met if this technology is to be of more than marginal importance in our teaching.

1) The necessary equipment must be easily available in students' and tutors' homes, and simple, inexpensive and convenient to use. The current generation of equipment and software does not meet these requirements; however, as Roger Hart has pointed out in his paper in this issue of CJEC (Hart, 1987), work on 'third generation' systems is already advancing, so it is conceivable that in a few years time the goal of transparent, user-friendly systems may be achieved.
2) The educational assumptions underlying course design and student learning strategies must be consistent with an active, cooperative, and group involvement of learners, otherwise the technology will merely be used as a substitute for noticeboards, written mail or one-to-one telephone contact; but it is not evident that distance learners, used to studying alone, will want to adopt a conferencing medium which requires active group involvement. Following on from the analysis presented by Don Beckwith in his paper (Beckwith, 1987), it might be appropriate to consider

integrating group problemsolving exercises into distance course design, to 'coerce' students into using conferencing as a medium for group exchanges. And amongst the suggestions made elsewhere in this issue by McCreary and Van Duren (1987), the use of conferencing for public tutorials, structured seminars and peer counselling should be built into a course. All this, of course, has implications for overall course design and for integration with the other media being used.

3) In large measure, the success or failure of this technology in the distance learning context will depend on the motivation and skills of the tutors. Remember that in the Open University (as in many other open learning projects) the tutors who are in contact with students are *not* the people who developed the courses — they are acting as intermediaries and animateurs for courses produced by others. Tutors will need guidance in developing new ways of interacting with their groups of students, without creating intolerable overload for themselves. Tutors are only viable to accept and use this technology if they find that it helps them organise their time more efficiently, and/or if they find it more effective and stimulating than their traditional modes of interaction with students.

If these three sets of conditions can be met, and the use of microcomputers as home-based terminals becomes more widespread, then it is probable that computer conferencing will have a very important role to play in distance education. But these are three very big ifs!

REFERENCES

Alexander, G. (1986). *The thought box and the scholar's network: Computer-based tools for distributed learning*. Unpublished Manuscript, Open University, Faculty of Technology.

Beckwith, D. (1987). Group problem-solving via computer conferencing: The realizable potential. *Canadian Journal of Educational Communication, 16*(2), 89-106.

Bacsich, P. (1987). Computer conferencing in distance education: Will it work in the UK? In A. Jones, E. Scanlon, and T. O'Shea (Eds.), *The computer revolution in education: New technologies for distance learning*. Brighton, England: Harvester Press.

Brochet, M. (1985). *Effective moderation of computer conferences: Notes and suggestions*. Guelph, ON: University of Guelph, Computing Support Services.

Davie, L., & Palmer, P. (1984). Computer teleconferencing for advanced distance education. *Canadian Journal of University Continuing Education, 10*(2), 56-66.

Feenberg, A. (1986, March). Network design: An operating manual for computer conferencing. *IEEE Transactions on Professional Communications, Vol. PC 29*(1), 2-8.

Haile, P. and Richards, A. (1984). *Supporting the distance learner with computer teleconferencing*. Islip, NY: New York Institute of Technology.

Hart, R. (1987). Towards a third generation distributed conferring system. *Canadian Journal of Educational Communication, 16*(2), 137-152.

Henri, F., & Kaye, A. (Eds.). (1985). *Le savoir à domicile: Pédagogie et problématique de la formation à distance*. Québec, PQ: Presses de l'Université du Québec.

Hiltz, S. (1984). *On-line communities: A case-study of the office of the future*. Norwood, NJ: Ablex.

Hiltz, S. R., & Turoff, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM, Vol. 287*, 680-689.

Kaye, A. (1985). *Computer-mediated communication systems for distance education.* Unpublished manuscript, Open University, Institute of Educational Technology.

Kerr, E., & Hiltz, S. R. (1982). *Computer-mediated communication systems: Status and evaluation.* New York, NY: Academic Press.

McCreary, E. K., & Van Duren, J. (1987). Educational applications of computer conferencing. *Canadian Journal of Educational Communication, 16*(2), 107-115.

Rumble, G., & Harry, K. (Eds.). (1982). *The distance teaching universities.* London, England: Croom Helm.

A Theoretical Perspective

Emancipative Educational Technology

Gary M. Boyd

Abstract: In a democracy, public education should contribute to the development of responsible, autonomous people. The usual communication media of schools tend to favor conformity. However, the close match between Habermas' criteria for emancipative discourse and the main characteristics of computer-mediated conferencing favor this medium for education. The skeleton of a theoretical systems model for computer-mediated conferencing is presented here.

INTRODUCTION

Almost any technology can be liberative or dominative; indeed most technologies are both, but to/for different people. What I mean by liberation or emancipation is increasing a person's abilities and opportunities to make rational choices about matters important to that person. Both advertainment and peer or colleague pressure are terribly dominating influences, the former largely mediated by technology. The main form of educational communications technology is TV/Video in society at large, while in schools it is the paper copier. There is a vast difference between those two technologies; TV is mostly a few well endowed interest groups influencing vast numbers of people, whereas copiers usually involve many to many influence, or few to few many times repeated.

Emancipation or liberation is not simply freedom from involvement with other people concerning one's decisions but rather requires discussion with others where the outcome is determined by the best argument, not by promises or threats or captivating art or music. This notion of discursive emancipation is due to Jürgen Habermas (1981/1984). I find his perspectives very helpful in considering technological options, as opposed to the non-option of total rejection of technology. It seems to me that the ideal conditions for non-dominative, or liberative discourse which he puts forward can more easily be achieved through computer-telecommunications mediated communications than in any other manner. In this paper I am

Gary M. Boyd is Professor and Director (liason) of the Ph.D. Programme in Educational Technology and Assistant Director for Research and Development, Audio Visual Department, at Concordia University, 1455 de Maisonnueve Blvd. W. Montreal, PQ. H3G 1M8. His research and teaching interests include educational systems and cybernetics, computer-based educational technologies and social aspects of technology. Reprints may be obtained from the author at the above address.

CJEC, VOL. 16, NO. 2, PAGES 167 - 172, ISSN 0710 - 4340

concerned to demonstrate why I believe computer conferencing in particular is best suited to provide emancipative educational learning situations.

PROBLEM AREA

People in our society are constrained by a double yoke: mechanical bureaucratic administrations on the one hand; and time-consumptive 'advertainment' on the other. Both seriously constrict our opportunities to make autonomous and responsible choices about the propagation of culture and the conduct of education as cultural propagation. For example in Quebec, Law 101 and its language-police are an attempt to publicly control cultural propagation, but one which is not legitimate if all the people involved have not been able to participate in debates about the means and ends concerned. This is an unusual case, though, because there actually have been public debates about the issues. In other crucial areas such as class size, and timetable hours, decisions have been made by administrators on technical and financial grounds without any debate among those affected.

The other side of the yoke — the advertainment which gobbles up people's quality attention-time so that very little is left for debating educational questions — is all too easily exemplified by Coke™ commercials, and *Dallas*, etc. Concerned teachers, learners and citizens have no efficacious forum for debating key educational issues such as the relative place of fundamental intellectual skills versus peculiar vocational skills in curriculum and instruction. Even at the (micro-) instructional level there is very little opportunity for rational discourse to negotiate and validate instructional objectives, criterion measurement methods, or choice of media and materials. Some teachers do hold discussions on the responsibilities and rights of both learners and teachers, but it is an uphill struggle to do so. 'Historically legitimated' bureaucratic norms prevail over the classroom, while tired learners with poor attention skills have had their best time leeched-up by advertainment to which they are addicted. Actual formal education has to make do with what little functional time and discretion is left between the pressures of the administrative, and the advertainment pincers.

Jürgen Habermas (1973/1975) envisions a possible way beyond the double impasse of modern society (which incidentally he refers to as our legitimation crisis). This way lies through the widespread practice of life-world validating discourse. So called 'practical discourse' is discussion of a fully rational kind about the validity of norms and rights, and rules, and factual propositions, where the only determinants of the outcome of the discussion are the solidity of facts and the logicality and comprehensiveness of the arguments (Habermas, 1981/1984). This contrasts with ordinary debate where rhetorical tricks, and threats or promises often determine the outcome. For discourse to provide genuine legitimation for norms and procedures it must be undominated; that is to say, threats and promises must be censored out, and so must aesthetic enticements or repulsions (Boyd, 1984). Free speech should mean freedom to state arguments and ground them in facts, not license to seduce or frighten people. If there can be some way for us to conduct liberative discussions about curriculum goals, instructional system configurations and individualisation, expeditiously and freely, then we may be on our way to orienting activities toward our highest-level educational goals (such as promoting culturally rooted autonomy and potency) rather than making such a fetish out of tiny fact/skill low-level objectives.

Face-to-face discussion has two grave disadvantages when viewed in terms of Habermas' desiderata for life-world validating discourse: 1) it is difficult in ordinary meetings

to arrange for each person to have a full and equal chance to contribute, and to digest the contributions of others (especially if there are many vociferous people); and 2) unfair dominative speech acts cannot be ruled out of order until they have taken place if the actor insists on uttering them. By the time that the chair can rule a remark to be out of order it has already done its damage. "Ignore that!" is a weak command. For these reasons and some others, critics have considered Habermas' option of legitimative discourse to be merely an impractical ideal. However, it occurred to me when I came across Habermas, that perhaps computer-mediated teleconferencing is a medium through which his ideal discourse conditions can (very nearly) be met.

This is so because everyone can be given equal opportunity to enter arguments in the conference, and also because a moderator system can hide illegal entries from view. Threats and promises and rhetorical tricks can be archived, and dragged up after the main decisions have been taken if there is a challenge, but they can be kept out of immediate effect. It is crucial for liberative, life-world legitimating discourse that a centralized computer-mediating moderating conferencing system be used and not just exchanges of electronic mail. This is so, not only because illegal statements can be kept from influencing judgements, but in order that a permanent time-stamped archive of all transactions can exist and be publicly accessible. It may also be important to hold frequent anonymous discussions, with the moderator system archiving those who actually made which inputs, in case a serious *post hoc* challenge arises (or in cases like that reported by Karl Zinn (personal communication) where some participants masquerade as others, and try to play the pathological game "let's you and him fight!").

That computer-mediated conferencing can function to support and promote liberative discourse has been demonstrated by David Stodolsky's experiments at Irvine (1976) and in Sweden (1986). However, many questions remain open concerning appropriate system configurations and protocols for educational life-world building.

There are other technologies such as video-playback (Ryan, 1974), which can be liberative and should be combined with computer-mediated conferencing when possible (Boyd and Jaworski, 1985).

THEORY

The relevant theory for research on liberative educational computer-mediated conferencing has to be assembled from several sources. The whole system consists of participants (Paskian 'p' individuals), personal interfaces, the communications network, the mediating and archiving host computer system, software, and protocols. Another way of characterizing and modelling it is by using Helmar Frank's six dimensions of the pedagogic space (Frank, 1969). These are:

1) *goal* — the learning objectives and meta-objectives agreed upon;
2) *content* — facts, skills, and their organisation meshes;
3) *psychostructure* — the cognitive styles, schema and identity traits, entry level skills, etc. of participants;
4) *media* — the communications and control media and environment;
5) *sociostructure* — the grouping of "p" individuals into coalitions, or dialog partners, or their separation as teacher, moderator, etc.; and
6) *procedure* — the algorithms, or heuristics, and rules of order, etc.

These dimensions are, in order, answers to the questions: 1)To what end? 2) What? 3) Who? 4) Through what? 5) With whom? 6) How? Answers to these questions in the form of both structures and processes are required to model any learning system. Habermas' desiderata for legitimating discourse largely fall within the sixth dimension *procedure*, but they implicate aspects of all the others. Pask's conversation theory mainly relates to the first three dimensions and a little with the sixth (Pask, 1976). To tie all of the above together into a probabalistic causal model, or at least a good heuristic model which can successfully promote understanding, is a big job. All I can do here is sketch how I think it might be done.

There is one more essential piece, which falls into Frank's third dimension *psycho-structure*, and that is a model of the participant's higher level aspirations and fears insofar as they are relevant to participation in the system. In any real system it is necessary to live and work together with people in order to grasp aspirations and fears, before intervening — even then the intervention becomes a conjugation with the others also intervening in the teacher's own life world. If one cares for real education there must be *reciprocity* of communicative control.

The actual goals for any educational teleconference will depend on many situational factors and the goals of each participant. My conjectural model of the functioning of 'p' individuals is that at any given time a 'p' individual (participating entity — see Pask, 1982) can operate or interact at one or more of three levels:

1) *Receptive-Acquisitive level* of merely attending to and capturing pattern-forms and adding some of them to one's active schema;

2) *Transmissive level* functioning as a coduit by repeating received forms (e.g., memes) and outputting them or imposing them upon any thing, or anybody — any other 'p' individual who seems likely to pay attention; and

3) *Conjugative - Propagative level* where the 'p' individual connects part of its' own core identity form to some transmissible symbolic 'child' meme in such a way that some further 'p' individuals are likely to take up the form, and connect parts of their identities to it, and 'pass-it-on' indefinitely.

In short, each player at each 'play' can either: 1) accept or reject; 2) just pass-it-on; or 3) conjugate some 'self-pattern' with it and pass the changeling on.

This is a very rudimentary model, but I think it captures the most important communicative activities (actually there may be a sort of continuum between these possibilities). The above seems to belong more to Frank's *procedural* dimension than to the *goal* dimension; they are closely linked. As I see it, human beings have a wired-in 'ought-that-is' or highest-level imperative to propagate portions of their identity. One might call them 'identi-memes,' or even 'soul-memes'. This instinctual imperative is satisfied when I see some aspect of my own way of doing things being performed by others. That is the goal of the game. The highest payoff is to see such propagation when it has the appearance of being able to go on forever. The next best pay-off is to have someone copy something that you have taught them, even if it doesn't carry your own characteristic style.

Those are the desireable goals of the game in this model. They have their converse: at Level 1 a negative payoff occurs when one accepts and keeps 'garbage-forms' which are no

use for helping make new messages; at Level 2 of operation one may be infected by and propagate parasitic memes which one doesn't own at all, but which use up one's attention time and communicative opportunities; at Level 3 one may be infected by a virulent parasitic meme which does couple to one's identity so that one is now a gambler, or an alcoholic, or some other kind of self-destructive contagious addict (pay-off minus infinity) (see Hofstadter [1985] for examples).

At the procedure level and also at the goal level it seems to be necessary to have a mediating variable, which is used to help allocate resources. This is 'status' or reputation (or in life off-line it may be money). In particular I have argued (Boyd, 1977) that relevant-credibility status is the most important moderator variable in knowledge development games. Normally, status increases if high-status persons pay attention to your transmissions, and that in turn draws the attention of others. A deviation-amplifying feed-back loop exists so that those whose status starts to increase tend to get propelled to the top, while those who are initially ignored lose heart, do less, get fed less, get less support, and eventually drop out. Elaine McCreary's recent results (see this issue *CJEC*) tend to indicate a much more complicated role for status. There is also the difficulty that status in the computer-mediated conference may not correlate directly with status otherwise assigned.

This issue of status in the conference brings one back to Habermas (1984); for a message to be properly received and for the sender to be accorded full-participant status four essential conditions must be met: 1) truth of factual propositions; 2) rightness of collective norm assertion; 3) truthfulness of commitment; and 4) honesty of expressive parts of a communication. Failing on any of these weakens both the validity of the message, and the credibility status of the sender. These conditions seem to hold for any communicative act which is intended to promote *understanding* first and foremost. 'Understanding' is knowledge that has an open-ended on-going or heuristic property. This is defined in opposition to mere 'instrumental' knowledge that only allows one to extrapolate, or interpolate correctly, but has no leading-on quality (an operational test for understanding is whether the learner can *extend* the concept in an interesting and *valid* way).

The above is a gross over-simplification of the process of life-world building through message exchange, but I think it has the essential entities, goals and procedures. Therefore, it should be possible to use it to understand computer-mediated conferencing and to situate research work, most of which lies ahead of us, notwithstanding the nice work of others in this issue, and of still others like Hiltz, Johnson and Turoff (1986) and Stefik, Foster, Bobrow, Kahn, Lannry and Suchman (1987).

ENVOI

The foregoing may have given the impression that rational discourse for positing and criticizing validity claims lies at the heart of educational practise; it does, if the education has an emancipative meta-objective. But it is not all that lies at the heart of education. If we go back to Alfred North Whitehead's (1955) characterization of learning as a three phased cyclic process with an initial phase of *romance*, followed by a phase of *precision* and completed by the *generalisation* phase, then it would seem that text-based computer-mediated conferencing (notwithstanding Ferrarini,1984) is best suited as a vehicle for the latter two phases.

It is fairly easy to see how precision, the clear definition of one's thoughts and

procedures, can be facilitated by interaction via computer, and even clearer how multiple dialogs can aid with generalisation. Perhaps the *romance phase* needs solitude or museums, theatres and wilderness parks. It is more directly appropriate to employ aesthetic techniques (Boyd,1984) to support the *romance phase*, and possibly also ritual (See the chapter on Mary Douglas in Wuthnow, Bergesen, & Kurzweil, 1984). Habermas' ideal discourse desiderata are to life-world construction what Karl Popper's *Conjectures and Refutations* desiderata are to doing science; necessary but not sufficient. What is left out in both cases are both the creative imaginative synthesis which enlarges our cultural worlds, and also the ritual observances through which we re-enact our affiliation with these worlds, through which we re-create our collective identities.

REFERENCES

Boyd G. M. (1977). Towards a formalisation of educational cybernetics. In Rose, J. & Biliciu, C. (Eds.), *Modern trends in cybernetics and systems, Vol. III* (pp. 15-21). New York, NY: Springer.

Boyd, G. M. (1984). Cybernetic aesthetics. In Trappl R. (Ed.), *Cybernetics and Systems Research 2* (pp. 677-682). Amsterdam: North Holland.

Boyd, G. M., & Jaworski, W. M. (1985). PALS, PATHS, PLACES, and PRODUCERS: Four more appropriate forms of computer aided education. In *IEEE/ACM, Proceedings of COMPINT85,* (pp. 614-616). Washington, DC: IEEE.

Dawkins, R. (1982). *The extended phenotype.* Oxford: Oxford University Press.

Ferrarini, E. M. (1984). *Confessions of an Infomaniac.* Berkeley: Sybex Computer Books.

Frank, H. (1969). *Kybernetische grundlagen der padagogik.* Baden Baden: Agis Verlag.

Habermas, J. (1975). *Legitimation crisis* (T. McCarthy, Trans.). Boston, MA: Beacon Press. (Original work published 1973).

Habermas, J. (1984). *The theory of communicative action* (T. McCarthy, Trans.). Boston, MA: Beacon Press. (Original work published 1981).

Hiltz, R. S., Johnson, K., & Turoff M. (1986). Experiments in group decision making. *Human Communication Research. 13*(2), 225-25.

Hofstadtdter, D. R. (1985). *Metamagical themas.* New York, NY: Basic Books.

McCreary, E. K., & Van Duren, J. Educational applications of Computer conferencing. *Canadian Journal of Educastional Communication, 16*(2), 107-115.

Pask, G. (1976). *Conversation theory.* Amsterdam: Elsevier.

Pask, G. (1984). The architecture of knowledge and the knowledge of architecture. In Trappl, R. (Ed.), *Cybernetics and Systems Research 2* (pp. 641-645). Amsterdam: Elsevier.

Ryan, P. (1974). *Cybernetics of the sacred.* New York, NY: Doubleday.

Stefik, M., Foster, G., Bobrow, D. G, Kahn, K., Lannry, S., & Suchman, L. (1987). Beyond the chalkboard: Computer support for collaboration and problem-solving in meetings. *Communications of the ACM, 30*(1), 32-47

Stodolsky, D. (1976). *Machine Mediated Group Problem Solving.* Unpublished doctoral dissertation, University of California, Irvine, CA.

Stodolsky, D. (1987, May). *Computer-based support of rational debates.* Paper presented at the meeting of the IFIP 8.2 Conference on Information Systems, Atlanta, GA.

Whitehead, A. N. (1955). *The aims of education.* London: William and Norgate.

Wuthrow R., Bergesen, J. D., & Kurzweil, E. (1984). *Cultural analysis.* London: Routledge.

An Edited Transcript of CoSy 'bcjec'

Edited by Robert M. Bernard,
Jacques LeCavalier, and
Don Beckwith

INTRODUCTION

The idea for organizing a CoSy conference on computer-mediated communication came about as a result of the realization that something new — a synthesis of ideas springing from but not duplicating the papers themselves — could only be achieved by engaging the authors in a discussion on the topic of computer-mediated communication. There seemed to be no way of facilitating this objective, given the great distances that separated the authors until it occurred to us that the CoSy Conferencing System was designed for precisely this purpose. Gary Boyd took the initiative and set up a conference entitled 'bcjec'. There were topics for each individual paper, and a general discussion topic (topics are work spaces within a conference within which discussion can occur). Most of the edited transcript that appears in Sections I and II was taken from the DISCUSS topic. Several of the papers were actually input on-line into individual author topics, but most were distributed to participants through the mail. At one time or another during the conferencing period (February 1 to March 20), each of the discussants was out of town and unable to participate. The transcript demonstrates clearly the advantage of asynchronous communication in this regard.

The edited version of 'bcjec' is divided into three sections:

> Section I is a lightly edited version of the first half of the conference. We have included both substantive and peripheral discussion in an attempt to demonstrate the nature of comments that occur in a real conferencing environment (it is unlikely that 'bcjec' is representative of conferences involving novice conferees since most participants were acquainted with CoSy in particular and all were acquainted with conferencing in general). Stars between sections indicate the beginning and end of sequential message blocks. Actual line endings have been left intact.
>
> Section II consists of two threads of substantive discussion, which did not necessarily appear as contiguous messages in the conference. The first thread addresses questions related to using computers as communicating writing instruments. The second is a discussion of the means and ends underlying the evolution of computer conferencing systems.

CJEC, VOL. 16, NO. 2, PAGES 173 - 191, ISSN 0710 - 4340

Section III is an attempt to simulate a desirable feature of conferencing systems of the future. Here, meaningful quotations from all authors and all parts of the conference have been edited together into a synthetic whole which explores the educational potential of computer-mediated communication. In a sense this section represents the 'collective intelligence' of the authors; to preserve the flow of the text, individual citations have not been included. It is interesting to note that the 'editing' took the form of simply providing transitional phrases for these direct quotations from the discussion (i.e., 85% of the section is comprised of a reordering of the participants' actual comments). This section edited by anon.

Section I - Contiguous Segments

(The conference began with a lighthearted exchange involving the mysterious 'Misc. Discussio'. The beginning of this transcript follows from a previous set of comments concerning a misspelled topic name (Misc. Discussion) and demonstrates how the system software sometimes reacts in a way that is unpredictable and confusing to the participants. Eds.)

==========
bcjec/discuss #1, from jlecaval, 294 chars, Sat Feb 7 19:42:51 1987
There is/are comment(s) on this message.

TITLE: Surrender to the Evil Miss Discussio
The original "misc.discussio" topic was causing a few of
us some unwelcome mental stress, so it has been removed —
we only hope it doesn't find us again. . .
Please use this topic from now on for all discussion related to the papers.
==========
bcjec/discuss #2, from rhart, 210 chars, Mon Feb 9 12:30:35 1987
This is a comment to message 1.
There is/are comment(s) on this message.

The 'EVIL' still seems to be with us in B.C. (blooming
daffodils notwithstanding). CoSy is telling me I have
TWO topics called misc.discussio, each with 6 new messages
in them. <grin>
==========
bcjec/discuss #3, from bmcqueen, 91 chars, Mon Feb 9 16:40:34 1987
This is a comment to message 2.
There is/are comment(s) on this message.

Roger, you have somehow been enrolled twice. Is that a conf, or a topic within a conf?
==========
bcjec/discuss #4, from rhart, 73 chars, Mon Feb 9 18:00:49 1987
This is a comment to message 3.
There is/are comment(s) on this message.

It was a topic within bcjec. However, someone somewhere
has fixed it.

==========
bcjec/discuss #5, from jlecaval, 182 chars, Tue Feb 10 09:45:03 1987
This is a comment to message 4.
There is/are comment(s) on this message.

I think the person who finally slew Miss Discussio is Tom Smith
at Guelph. I had asked Ken McKay for help with this, and he
passed on the question to Tom. May she rest in peace.
==========
bcjec/discuss #6, from rhart, 160 chars, Tue Feb 10 13:19:50 1987
This is a comment to message 5.

Alas, I think she has risen again. To quote my sign-on today:
>Conf/Topic New Messages
>misc.discussio 8

What is it they used to do with vampires?

****

==========
bcjec/discuss #9, from lharasim, 1458 chars, Thu Feb 12 14:26:20 1987
There is/are comment(s) on this message.

Robert:
. . .could you provide some orientation on how you see these
discussions taking place. What form of response do we make to
the papers? Specific questions/critiques/additions? Or to
pursue some of the lines being developed in the paper and hence
enter a more general discussion? It would be very helpful (to me)
to have some orientation on the focus of our discussions.
. . .It seems to me that there are two different types of discussions:
one is a collegial reflection/exchange over the topics, while the
other is a peer review. Thanks for any clarification on the above questions.
==========
bcjec/discuss #10, from tkaye, 949 chars, Thu Feb 12 14:31:47 1987
There is/are comment(s) this message.

. . .probably, we are not sure of the etiquette/rules of the game for commenting publicly on
colleagues' work. The papers by myself and Elaine have been in bcjec now for over a week,
yet neither of us have had any feedback (unless Elaine has been getting comments
privately in her mailbox: I have not). And the only comments I have sent in, briefly, to Roger,
were for information on the RAPPI project, because
I want to include a mention of it in some course material I am currently
preparing for the OU.
==========
bcjec/discuss #11, from jlecaval, 520 chars, Fri Feb 13 00:22:57 1987
This is a comment to message 10.
There is/are comment(s) on this message.

. . .The lack of discussion to date, in spite of two papers being in already, seems in my
opinion to follow the pattern of courteous dinner guests

waiting for all to be seated before digging into the feast! (Ç'a l'air delicieux!)

==========

bcjec/discuss #12, from rbernard, 3229 chars, Mon Feb 16 15:53:12 1987
This is a comment to message 9.
There is/are comment(s) on this message.

The object of this discussion, it seems to me, is not the usual review of separate articles, but discussion of the set of ideas presented by the collective authors. The intention here is to generate a consensual focus on what computer conferencing could and should become, and what might be the best means of getting there (i.e., to build something new rather than tear down and rebuild separate articles). With this in mind, please consider the following "guidelines" in commenting on the various papers:

1. In making comments try to bring together two or more ideas across articles (i.e., ideas that support or contradict each other).
2. Attempt to build on earlier comments of participants, rather than developing another topic, at least until the discussion on a topic has been exhausted.
3. Allow the content of the articles to stimulate new ideas in your own messages rather than repeating ideas from your own paper.
4. Issues in particular papers in need of clarification may serve as a springboard for discussion. . .

****

==========

bcjec/discuss #14, from lharasim, 667 chars, Tue Feb 17 00:20:42 1987
This is a comment to message #12.

Bob: Thanks for the orientation. I have not yet received my copies of the papers, but I expect to soon and will follow through as per your suggestions. Re: the discussions: while you speak of
the collective wisdom, I feel like much of my own work is groping to make some sense of a very new and exciting — but as yet relatively unmapped terrain.

==========

bcjec/discuss #15, from tkaye, 886 chars, Tue Feb 17 10:07:41 1987
This is a comment to message 12.
There is/are comment(s) on this message.
There are additional comments to message 12.

Your guidelines for the commenting procedure are very helpful, and I must say that it was a real pleasure to receive the papers — all 3 look very interesting and I think that this issue of CJEC will become a very important document in this newly emerging field.

I hope to get some comments in before I depart to Ghana on Thursday night — in any case, I shall take the papers with me to read, as I have
2 weekends in Accra, and it's nice to have things to read as a pretext for lying on the beach day-dreaming! Just think how I will be suffering, in temperatures of 30-35 ^{o}C, whilst you have a nice refreshing, brisk - 19^{o}C!!!

==========
bcjec/discuss #16, from dbeck, 3021 chars, Wed Feb 18 15:38:55 1987
This is a comment to message 15.
There is/are comment(s) on this message.

This is a comment to messages 10, 12, 15

I've only read three papers so far — Elaine and Judith's, Linda's and Tony's. I find them to be stimulating, posing more questions than answers — which, I think, is the way it should be at this stage of cc development. A common thread, of interest to me, in all three papers, is the question of moderator/ teacher skills that may be used to effect desired conferencing outcomes.

An attempt to bring some of the ideas together in order to focus discussion: Successful moderating skills necessary for the various types of conferencing activities will emerge (Elaine and Judith). Some of these skills are already known, e.g., positive feedback and encouragement skills, and are currently used (in other media) by successful distance education tutors (Tony). Other desired skills, e.g., the ability to facilitate participants' self-regulation (Tony) so that teachers eventually assume the role of guide rather than central participant (Linda), are, perhaps, less known.

I'm wondering if we might try to draw upon our collective experience with this new medium in order to discover (nail down in Jello/jelly?) some of the essential and viable elements necessary to the moderating technology(ies). For example, there appears to be some evidence to suggest that the presence or contribution by an expert may have some effect on conferencing proceedings (Elaine and Judith). Could the awareness of such lead us to key elements of the moderating role (whether assumed by a leader or the participants as a group)? Another example: There may be clues that emerge from experiences such as an instructor and co-instructor switching roles (Linda) (or two moderators, using different styles, in similar conferencing applications) that may guide us to the development of potentially facilitative procedures. Might there be observable differences in user participation (amount, type, quality, etc.) that may, at least in part, be attributable to particular styles of moderation? Can we collectively analyze(se) such moderation styles to determine possible causal elements? I think it's worth a try.

. . . Why don't we, however, focus
on the more difficult cc possibilities.
Those that go beyond the horseless
carriage applications of the medium
(as suggested by Tony, Linda, Elaine and Judith)?
By jumping into the deep end of the pool (keeping
each other afloat, of course) we may
discover that we may indeed, collectively,
know much more than has yet been verbalized
about this issue!

P.S. This could be a lot of fun.

==========

bcjec/discuss #17, from lharasim, 3353 chars, Fri Feb 20 22:17:35 1987
This is a comment to message 16.
There is/are comment(s) on this message.

Hi: First of all, I received the 3 papers earlier this week and
they all looked very interesting. I have not had a chance to read them
all in-depth, but from the first readings, I found it very exciting to have
this collection of ideas and analyses of cc — and I look forward to the on-line discussions to
follow-up some of the themes which emerge from
the papers. . .One of the things that I was somewhat surprised to
discover as I was putting my data together for the paper, was the students' perception of
how effective this medium is for learning. My own position had been that it was a medium that
offered new options for learning: and that for some applications, particularly distance
education, cc seemed to have some real advantages. I had not anticipated that
students would rate cc-mediated learning so favorably over classroom
learning. This prompts an interest to conduct more research into student perceptions of the
phenomenon of on-line learning: to try to identify
and rate the perceived benefits and problems associated with learning
(and teaching) on-line. It would be important to involve a wider sample of students and
research for a longer period of time to try to move beyond any novelty effects. . .and also to
see how more extensive experience in
learning on-line might affect initial our early perceptions.

Don: I was very pleased to see that your paper took a crack at developing a model to
analyze group problem-solving in the cc medium. . .I have been very interested in
researching computer-mediated collaboration in education, but find that the models or
theories available are mostly from social psychology and do not help us understand
what is happening in an educational, as opposed to an organizational context. I look forward
to reading your article more thoroughly. Have you any thoughts about how your model might
apply to a group learning situation?

In response to Don's suggestion that we focus on moderation, I agree
with the general need to identify one or several themes for discussion. I have no
problem in addressing some of the issues
raised in the previous point, but I would also like us to consider
some of the innovative potential which this new medium offers to us
as educators. In some ways, this new 'electronic space' offers us the

potential and the challenge to sculpture out new learning environments: ways of learning that have hitherto not been possible. I start to see images of global learning networks. It is a challenge to rethink our notions and practices of education.

Apologies for the overlong message. . .also for the typos*(The typos referred to have been edited out. Eds.)*. For me conferencing is more an act of speaking rather than 'publishing' so I tend to make typos as my fingers struggle to keep up with my thoughts! I am also still getting used to CoSy again, and the editing facilities are a bit clumsy.

==========

bcjec/discuss #18, from dbeck, 1742 chars, Mon Feb 23 19:15:42 1987
This is a comment to message 17.
There is/are comment(s) on this message.

Hi, It looks like we're off to a start. Linda, as you may have guessed, I see problem-solving (whether individual or group) as a learning phenomenon, since the problem-solver must learn to create viable procedures/processes in order to create a product (i.e., a workable solution to the problem at hand). To answer your more specific question, the image of a classroom learning environment (whether centralized or distributed) was never out of my mind while developing the problem-solving model. Problem-solving, as I see it, unfortunately, is a skill that only a very few learners possess and fewer educational environments address. I think, therefore that the process of group problem-solving may be used to help individuals master the skills of problem-solving at the same time that the group is mastering group problem-solving skills; the process may be less threatening to the individual, and, at the same time, there will always be problems that will not be soluble by individuals alone.

I like your idea of sculpturing out new learning environments, and have no problem with our tackling some other aspect(s) of cc besides moderating. I chose it only because I thought it might be a starting point.

I hope the others join into this discussion; there's much to sculpt. I will not be able to continue my end of the discussion until next Monday, since I'm off to sunny Atlanta for a conference. (Well, if Tony can rub it in, why can't I?) Please don't solve all the problems while I'm away.

P.S. You're being overly kind calling the editing "facilities" a bit clumsy.

****

==========
bcjec/discuss #21, from lharasim, 2452 chars, Tue Feb 24 20:52:03 1987

TITLE: a few last comments
Don: well, as it seems that so many of this group are off to sunnier climes, I might as well throw in my hat: I am off to enjoy Carnival in Brazil for the next 2+ weeks. In a way I am sorry that this discussion didn't really get off the ground before I left, (but then I also have been feeling overburdened with all the other things on my desk and in-boxes).

However, I do wish to pursue a bit your comments on the relation between group decision-making and group learning. In fact, much of the literature on group learning takes a somewhat similar position to yours: examining how individuals learn to work in groups and learn to make decisions in groups. But is there not another aspect — or even several other facets? For example, in my (and the other) on-line grad courses, the students are learning how to go about making joint decisions, but they are also doing other things that are learning activities, i.e., the exchange of ideas and information; the process of selecting certain ones and building upon these; the collaboration and the arguments seem to have some distinctive properties in this mode. We find that students can argue, challenge one another, develop a line of reasoning on-line, perhaps differently from what happens in the classroom situation. I don't mean to go too far out on a limb, but dialogue (or info-sharing) is an educational process and perhaps a key one to learning. I wonder if some of those facets could be incorporated into your model? How groups work to learn?

Last point: about key issues in cc and education. Perhaps we might all brainstorm what we see as the critical issues in this new mode. Don mentioned the issue of moderation, and I strongly agree. I believe, however, that the design of the activity is even more basic: planning and designing I find to be the most time-consuming part of the process. Even though the first few weeks of helping students get on-board, learn the technical skills and feel comfortable communicating on-line is also very time-consuming, the design issue I think will make or break an activity. In addition to design of the activity (taking into consideration the technical features of one's cc system and also one's learning goals and context) and then moderating the activity, are issues such as learning styles, information overload (both for the instructor and the learner), threading discussions, etc.

==========
bcjec/discuss #22, from lharasim, 757 chars, Tue Feb 24 20:57:22 1987

TITLE: theory
One last comment: one of the things that might also be addressed is the need for some theoretical development of this new phenomenon in education. Much or most of the literature is quite practical and empirical: in a way that is reasonable, as we are all exploring the beast. However, there is a need for theory-building in this area. A recent CJEC article

pointed out the lack of theory in relation to education and technology
in general (Torkelson, 1987). CC in education is a clear case in point.
The bulk of research and theory-building in relation to computer-mediated communication is either in management science
(OD) or social psychology. Neither is adequate or appropriate for
education. Where to go from here?

****

==========
bcjec/discuss #24, from garyboyd, 455 chars, Wed Feb 25 15:06:37 1987
This is a comment to message 18.

With regard to this new environment
it seems to me it is the beginning of our single
planetary mind for Gaiea, or at the very least
a new vast frontier territory to be settled and
civilized. More than civilized, really democratized
in the Athenian or Jeffersonian senses of direct
democracy. These however require a lot of maturity
and intelligent discourse skills.
I think people are capable of rising to the challenges
of this new MIND-SPACE FRONTIER.

****

==========
bcjec/discuss #31, from elainemc, 232 chars, Tue Mar 10 15:24:19 1987
This is a comment to message 11.

I like this line of Jacques' about "courteous dinner guests waiting
for all to be seated. . ." . . .while there is such a thing as the intentional late entry — mine is more a Bette Midler getting here when I can manage it,
honey!
==========
bcjec/discuss #32, from elainemc, 614 chars, Tue Mar 10 15:29:51 1987
This is a comment to message 12.
There are additional comments to message 12.

This is really a high quality piece of guidance here from Bob about
how to use the discussion to draw out a "set of ideas", a consensual focus on what computer conferencing could and should become. . .
to build something new. . .rather than to critique papers individually.
==========
bcjec/discuss #34, from jlecaval, 479 chars, Tue Mar 10 23:41:55 1987
This is a comment to message 33.

Welcome back, Elaine! Just in time for dessert and a few Spanish
coffees to wash it down.

****

==========
bcjec/discuss #38, from dbeck, 934 chars, Fri Mar 13 12:15:50 1987
There is/are comment(s) on this message.

Hi. Glad to be back; it was cold and rainy in Atlanta. Hope I'm in time for the brandy and cigars. According to the orientation
suggestions we could focus on creating something new, going beyond our papers, but I think our collective papers have indeed already created something new — and exciting. Long live dreamware!

Section II - Two Conference Threads

==========
bcjec/discuss #53, from rhart, 1677 chars, Mon Mar 16 14:40:24 1987
There is/are comment(s) on this message.

One of the things which the OU pioneered (I think) was the provision of superb tutoring services for its students. The feedback which was given to the student in the early days (I assume still is) was far beyond any 'correspondence course', and more professional than many campus based courses (the early experiments at using OU courses at Essex are well worth re-reading).

If we start from the assumption that the goal of the exercise is people LEARNING, the good and professional feedback is essential. The question then becomes: 'How can computer-mediated instruction help in this?'

It seems to me that the trend is inexorably towards people using computers as a writing instrument. In B.C. 13% of the OLI students already have a computer at home. Many more have access to one at work, and with the dramatic fall in hardware costs, purchasing a computer — at least in western Canada is about the same as buying a washing machine, dishwasher, or VCR. It also seems to me that if students have access to these tools, they produce better essays, reports, etc. The logical conclusion for me would be to set up the infrastructure ('orgware') so that students with computers can submit their assignments electronically to their tutors (rather than having them printed out and mailed).

What are the advantages of this? Well — I would like to hear other people's views — but I will suggest two for a start:
(a) Far better turnaround.
(b) Encouraging the student to submit preliminary drafts. In the REAL world (even at graduate school) we don't expect to produce something that's perfect without several iterations. Why should we expect undergraduates to do it?

==========
bcjec/discuss #54, from tkaye, 768 chars, Tue Mar 17 13:46:14 1987
This is a comment to message 53.
There is/are comment(s) on this message..

. . .right on: as far as I am concerned, the REALLY interesting use of micro-computers is as

COMMUNICATING WRITING INSTRUMENTS. It's so good to hear someone else say this. Many of our "professional" computer people here see
this as being a non-serious use of computers — this goes very much for our mainframe people, and even for many of our Maths and Technology faculty members. What is happening now, of course, is that "non-professionals" (i.e., people like me) who have a basically Luddite stance towards new technologies, can see
how computers-as-communicating-writing-machines can be used to do really new and different things — especially in the (distance) education context. . .

==========

bcjec/discuss #55, from rhart, 1519 chars, Tue Mar 17 16:10:24 1987
This is a comment to message 54.
There is/are comment(s) on this message.
There are additional comments to message 54.

I don't think ANYONE should be expected to use a line editor in 1987
<'nuff said>!

I wholly agree with you, Tony, when you talk about the use of computers as COMMUNICATING WRITING INSTRUMENTS, but it isn't just "professionals" who have a problem with this. I'm presently engaged in a discussion with a number of teachers (all of whom are computer fluent), and I have suggested that they ought to be thinking of teaching children to touch-type at a very early age — especially since we now have the technology to do this fairly efficiently and painlessly. You should see the red-herrings that get thrown up! "Their hands aren't big enough'! (I had to point out that that doesn't seem to be a problem with playing the piano), "The curriculum is already far too full (in elementary school)'!, or 'Young children don't have anything to write about' (and that from teachers no less!).

But my heavens, in the U.S. you can purchase a bit-mapped computer based on a 68000 chip for less than $500. There's a lot of truth in the old adage that a picture is worth a thousand words, and yet, other than the very specialized interest groups such as SIGGRAPH, and some outstanding work in Scandinavia, I don't know of anyone who is looking at protocols which would allow us to include graphics in a conference as readily as we can with ASCII text. On the contrary, as far as graphics are concerned, the Macs, the Ataris, the Amigas and the SUNs seem to be intent on creating a latter day, visual tower of Babel.

==========

bcjec/discuss #57, from dbeck, 378 chars, Tue Mar 17 22:47:58 1987
This is a comment to message 53.

Yes, I like the idea of preliminary drafts, which is something I encourage (and even at the next-to-last stage of project development, insist on) in my courses. How nice it would be to do this electronically. Then all students could give feedback to each other as well as receiving feedback from the instructor — a collective intelligence behind all student creativity. Great!

==========
bcjec/discuss #58, from dbeck, 56 chars, Tue Mar 17 22:49:37 1987
This is a comment to message 54.
There is/are comment(s) on this message.

And it would be such a simple application to implement.
==========
bcjec/discuss #62, from elainemc, 521 chars, Wed Mar 18 12:23:06 1987
This is a comment to message 58.
There is/are comment(s) on this message.

We use electronic cutting and pasting through multiple iterations here as the norm for graduate student papers and preparation of research proposals. As an academic advisor, I have no qualms at all about requiring grads to improve their ratiocinations when I know that it will be easy enough for them to reprint the good bits into another draft.

But I really wonder what we are asking of the undergraduate teacher/tutor/advisor if we start expecting multiple drafts of every student paper in classes of 60 to 300.
==========
bcjec/discuss #63, from rhart, 63 chars, Wed Mar 18 15:37:41 1987
This is a comment to message 62.
There is/are comment(s) on this message.
There are additional comments to message 62.

Can we really expect learning to take place in classes of 300?
==========
bcjec/discuss #65, from tkaye, 898 chars, Wed Mar 18 16:36:43 1987
This is a comment to message 55.
There is/are comment(s) on this message.

. . .one of the most common reactions I get from many Faculty members — especially amongst scientists — when I suggest they explore the idea of using cc to make our system more humanistic, to allow students and tutors to communicate more freely, is that I cannot expect people to. . ."learn to type". As we all know, using a keyboard is a low-level skill only expected to be performed by young females who left school at 16 because they wanted to become secretaries and find a husband! Yes, I am afraid to say that in our classist and sexist society, there is an element of truth in what I have just said. Just as amazing is that, when there are MACs, PCs, and Amstrads crawling out of the woodwork (or brickwork in our case) of practically every office on the campus, there are still academics in our institution who don't realise that typing and word-processing are different skills. C'est bien triste.
==========
bcjec/discuss #68, from dbeck, 107 chars, Fri Mar 20 10:54:37 1987
This is a comment to message 62.

Perhaps the 60 to 300 students could assume some of the feedbacker role. Collective emerging intelligence?

==========
bcjec/discuss #72, from lharasim, 220 chars, Fri Mar 20 18:36:53 1987
This is a comment to message 65.

Tony: Did you notice that when it was predominately a female activity, it was called 'typing'. Now, perhaps to make it sound more sophisticated, we use the term 'keyboarding'. . . . . now that men are doing it as well.

****

(Below, 'bmcqueen' is Bob McQueen, responsible for the marketing of CoSy services. Eds.)
==========
bcjec/harasim #5, from lharasim, 2033 chars, Fri Mar 20 18:30:15 1987

Hi! Am (reluctantly) back from Brazil. I have downloaded the contents of this conference and topics in order to get back into the rhythm of the discussions. (As an aside, I often feel quite frustrated with CoSy — it seems to be quite a barren and inflexible communication environment. As I was downloading, for example, while I was told the sequence # of each comment, there was no indication of the total # of comments in a conference or topic — i.e., comment #10 of 18. Similarly, it is tedious and almost impossible to change topics midstream). Anyway, I mention this as I think that it significantly impacts upon future applications and acceptance of this medium. If we are really discussing the emergence of a new 'environment' for learning and education, then that goal and vision should be integral to the nature of the software. I have this feeling that if and while CoSy may be acceptable for what Roger Hart terms 'conferring', it still falls far short of providing a malleable environment that can be shaped to different communication activities, including a spectrum of educational environments. I would like to see more information available to users that would make their on-line interactions more effective (as well as less frustrating). More flexibility in being able to shape and create environments is also essential — we need to be able to do and try new things that have hitherto not been possible or perhaps even dreamed out. (Anyway, apologies for my complaints;. . .

==========
bcjec/harasim #8, from bmcqueen, 2657 chars, Sun Mar 22 12:54:20 1987

. . .I'd like to respond to the criticisms you made above about CoSy . . .you'd like to see an "18 of 22" message identifier in the header and an easier way of transferring between topics.

Both of them would be relatively easy to do. If so, why haven't we done it already, you ask? The answer is in two parts. The first has to do with what we call "creeping featurism", or the adding of neat features to make the life of a heavy user a bit simpler. COM is rich in these kinds of features, but the price paid is a more confusing interface for the neophyte user. CoSy is targeted at the neophyte user; the default command select on <cr> is intended to avoid decisions, and superfluous information, so the non-computer-literate user feels comfortable in the first session.

We intend to continue to improve CoSy, but new features and functions are exhaustively discussed to see what impact they will have on new users, besides adding a whizbang piece of new information for experts. Our current priorities are development of an enhanced mail presentation, some behind the scenes system manager functions, and of most interest, a distributed function that will allow conferences running on separate machines, regardless of operating system or manufacturer, to exchange messages using existing mail networks, with conferences being updated without local user intervention or request.

The second part as to why we haven't done it already lies in funding. CoSy development at Guelph is funded by license sales and service bureau revenue. We're doing quite well with license sales, with about 20 sites now running or installing CoSy. ALL of them looked at the alternatives, including Parti, and chose us. If OISE, as a Canadian institution, really wants to move the art and science of computer conferencing forward, why not join us? The fees are low, we supply source (code), and we want to work with you. Your suggestions as to improvements perhaps could follow the path of the Univ of Arizona, who chose CoSy, then funded an additional $12,000 of additions that they are donating free to the next release of the VMS version.

In other words, those who are willing to pay the freight obviously get listened to very clearly, and we hope that relationships with all of our sites will result in new and interesting advancements in the use of computer conferencing, especially at educational institutions, over the next few years.

==========

bcjec/harasim #10, from bmcqueen, 1101 chars, Mon Mar 23 10:30:59 1987

I hope I didn't give the impression we've abandoned the heavy/sophisticated user. What we feel is important is getting the "critical mass" of users in a group regularly using conferencing as a way to reach their colleagues. If 40% to 50% of the people you want to reach are on, it will become a habit. I feel that the majority of that critical mass are neophyte users (at least for the first few times), and if you don't get them hooked in the first session, they won't come back the second time; and if most of the first time users don't come back, you lose the critical mass.

The CoSy architecture has two layers: the default <cr> to select the next most logical command, and a command string parser to allow strings of a few letters (non-ambiguous) per command to be joined together, e.g. "j bcjec har sea string", which joins bcjec, topic harasim, and searches for the messages with string 'string' occurring.

Getting the proper balance of fancy/powerful features and intuitive default commands is the trick. (We are not) there yet, but are aware of the tradeoff.

==========

bcjec/harasim #11, from rhart, 1289 chars, Mon Mar 23 12:14:12 1987

. . .I agree with what you are saying in your second paragraph, and I think CoSy goes a long way — better than any other system I know — to meet those goals. There are some weaknesses in its user interface, particularly in mail and conversations, but I know from your previous comments that you're aware of these, and are planning modifications.

I wonder, however, if we could come up with a new catch phrase, rather than 'critical mass', since it seems to me that many people interpret that as meaning a large number of users, out of which a small percentage will bubble up to the surface as 'real' users. As you say yourself, Bob, that isn't the problem. I as a user need to know that the people with whom I want to communicate (or at least a significant proportion of them) are going to *read* and *respond* to my comments fairly quickly. When this doesn't happen, as with the OLI CNCP system I mentioned earlier, one simply stops using the system because it has no functional value. Putting on another 100 users, who also have no rationale for using the system, isn't going to help matters one iota.

==========
bcjec/harasim #12, from lharasim, 1368 chars, Mon Mar 23 14:59:39 1987

In response to the preceding discussion about computer communications, I don't want to (and certainly did not mean to initiate) a debate about bells and whistles of various brands of conferencing systems. But there is an important point to be made, I believe, about the evolving nature of computer communications. . .My point is that computer communications has been evolving from the very simple and crude 'chat' systems up to computer conferencing and BEYOND. Stevens (1986, "Electronic Organization and Expert Networks: Beyond Electronic Mail and Computer Conferencing") sets out what he sees as 8 levels of computer-aided communication. In his schema, computer conferencing is at the 4th level and is already outdated by level 5, many-to-many communication (characterized by topic branching to form groups and sub-groups) and we are currently at or near level 6, electronic organization and moving into level 7, expert networks.

In order to begin to develop and 'sculpture' electronic educational environments, we (as educators) require such facilities as topic branching, access controls, knowledge base editing, and even decision-tools, in the software.

==========
bcjec/harasim #14, from lharasim, 1110 chars, Mon Mar 23 15:31:57 1987

Bob: I don't have the text of your message before me, but I would like to respond to one or two things that you raised. First of all, I still think that system developers (like researchers and practitioners) need a sense of VISION! By that I mean that users will increasingly expect and demand the facilities for creating an electronic environment. It's true that CoSy is selling for a very low price, but you seem to be suggesting that your buyers (i.e., potentially OISE) then reprogram and rewrite the system to be more usable for educational applications. Some of your buyers CAN and even WISH to do this. Others, such as OISE, are not in the position of having the resources (programmers) to work on the system to make it usable. . .

==========
bcjec/harasim #15, from bmcqueen, 1942 chars, Tue Mar 24 08:57:01 1987

Linda, perhaps the issue here is the economics of product development rather than the functionality of conferencing systems. Funding for the technical resources to evolve and improve a product doesn't appear out of thin air (except in the case of gov't funding), but rather comes from marketplace acceptance of the first version of that product. The revenue, and suggestions of those first users, are plowed back into evolution and development of the next version, and the process repeats so long as the product continues to meet the market needs. . .

I don't think your comment about having to put programmers to work to make CoSy "usable" would be shared by our installed sites; what we do, however, is provide source code so tailoring at a local level can take place, and hopefully incorporate the best of those improvements in future releases. One person's "feature", such as the topic spawning/branching you suggest, may be another person's anathema. Structure versus flexibility is not a simple issue which can be easily dismissed, or characterized as "good" across a broad diversity of user backgrounds and experience.

Anyhow, this discussion is hopefully providing some insight into the criteria that are driving our development efforts. We welcome all potential partners in this very interesting area to share their ideas with us.

==========

bcjec/harasim #16-17, from rhart, ### chars, Tue Mar 24 12:07:57 1987

I must read the (Stevens) article — but the schema you describe sounds very superficial. I agree we have to think BEYOND the limitations of present day systems, but we have to start from reality, not some idealized schema. . .

I think the discussion which has been going on between you, Linda, and you, Bob, is illustrative in itself of the problems we face in moving towards a real conferring system. If the three of us were sitting around a table, with a seminar leader who was both knowledgeable about the content, and skilled in interpersonal relationships (the renaissance university professor, as opposed to his assembly-line, modern-day counterpart), I think what we should rapidly find is that we would get a synergy from our three distinct, and different viewpoints.

Now I know that this does happen frequently with present day conferencing systems, but in my experience there has to be a high degree of coherence between the participants for this to occur. It rarely happens, in my experience, when we get the degree of distinction which is being shown in the present discussion.

I would suggest that there are two reasons for this. The first is that this medium necessarily attenuates the discussion. Even with handwriting. . .you can express anger, frustration, pleasure, etc. not only by the words, but by the shape of the letters, the colour of the ink, the size of the characters, etc. When we moved to the ball pen from the fountain pen we lost a good deal of that expressiveness. This medium is so constraining that we have to try to simulate the same thing artificially, like this <grin>. The second problem is that human conversation (using the word in its technical sense) is highly non-linear. The ASCII terminal — especially at 1200 baud — is a very linear device.

. . .If we look at hardware and communication trends over the past 25 years, we can predict, with a high degree of accuracy, when (the desired) high-bandwidth, high-resolution, multi-tasking systems are going to be widely available. Cartier's estimate *(Reference to this work may be found in Hart's paper. Eds.)* is 1988 - 1993. With deliveries of the Mac II UNIX machine due to start in December 1987, I'd say that Cartier's estimate is likely to be close. Developing the software and orgware to use these new systems is a whole new ball game. However, with players like Guelph, and some other equally fine teams around the country, I would say (yet again) that Canada is in a VERY strong position. I have no worries that we will lose our leadership. Rather, I think we will consolidate it, PROVIDED we can use our differences creatively to develop something that is greater than the sum of the parts.

==========

bcjec/harasim #18, from lharasim, 1003 chars, Wed Mar 25 11:00:45 1987

I agree with Roger that this is an example where the limitations of conferencing appear to be at play. . .I find that this text-based discussion makes some tentative thought or comment suddenly 'cut in stone'. In the case of the discussion between Bob, Roger and I, the potential synergy. . .is reduced. Again I wonder if the reason is not linked to the fact that the 'creative' process involved in such synergy — where people toss out ideas, thoughts, half-baked notions — is negatively affected by the fact that 'typography' seems to harden the thought. . .

==========
bcjec/harasim #20, from lharasim, 1896 chars, Wed Mar 25 11:41:16 1987

Roger: I'd like to share your optimism re: Canada's preeminence in computer communications, but I have some reservations; of course, most important are the economic issues raised by Bob to fuel research and development, something which Canada is not doing and which is resulting in a dangerous backsliding. But also missing here is the context for debating, discussing, sharing, speculating about this new medium: cc as a software to facilitate new environments and also cc as a whole new social (and political and economic) environment. Just this morning I was reading a fiery debate (on-line, in a US network) about initiatives for global meta-networks and issues, plans, activities that are being promoted and on their way to drawing boards, boardrooms, etc. . . . At another level, the earlier references which I made to historical categorizations of CAC, most categorizations are limited but do have the advantage of providing some overview and hopefully, perspective about lines of development, evolution, and maybe future directions. . .
==========
bcjec/harasim, from bmcqueen, 752 chars, Thu Mar 26 09:29:24 1987

Linda, I'd like to comment on your thought that Canadian funding agencies should be "doing more". In my previous life in the real world as owner of a hi-tech small business I believed that the market, not government bureaucrats, should be the driving force behind product development. The attractiveness of the free grants may well be tarnished by the requirement to aim the development this way or that way, or make some changes to accommodate some govt need, while the silent market really wants something entirely different. I feel much more comfortable in responding to buyer requirements, and listening to the want lists of existing customers. Maybe the theory isn't quite so pure, but the results will be far more practical in the long run.

Section III - Collective Intelligence

The intent of this discussion is to use the set of ideas presented in our six articles as a springboard to generating a consensual focus of what computer-mediated communication (CMC) could and should become, and of the best means for getting there. Using our collective intelligence, we can build something new and comprehensive, rather than tearing down and rebuilding separate ideas.

Part of the trouble with any new and exciting medium like this is that its promoters tend to gloss over the inadequacies. While some of the inadequacies are certainly hardware-related, many more can be traced directly to our lack of communicating the full conceptualized ideal technology to function within this medium. We tend to forget that appropriate technology is in the mind of the user, not the supplier. While we wish for distributed systems and preach systemic cybernetic implementation, what we allow ourselves to practice (due to insufficient communication of appropriate technology) has often been much more limited.

Can we afford to take comfort in the fact that this dilemma is nothing new to the field of education? It is true that sometimes we who are involved in innovative educational projects tend to be a little defensive and ignore the conventional efforts which take place in the majority of our "educational" institutions under the guise of learning; it is only when

we begin to examine some of the (meta) goals that we can appreciate how totally inappropriate some of these so-called "traditional" methods really are. For example, while we may decide ourselves to facilitate the learning of problem-solving skills, we might remind ourselves that problem-solving is a capability that only a very few learners possess and even fewer traditional educational environments address. This is of little comfort, however, when our collective vision of what could be is so clear and so desirable.

What we have achieved through so many CMC networks and forums across the country, continent and ocean is a social hyperspace. . .and we might as well enter it humbly because it is a burgeoning wonderland of goodheart and bad baggage. . .the goodheart being our collective enthusiasm and individual idealizations of how it might be some day; the bad baggage being the inhumanly expansive job description (which all self-managing individuals seem to work under) made just that much worse by expanding CMC collegial contact. While CMC is a medium through which Habermas' ideal discourse conditions can (very nearly) be met *in principle*. . .when we get a technology which is a little less flaky and far less obtrusive. . .CMC still falls far short of providing a malleable environment that can be shaped to serve different communication activities, including a spectrum of educational environments.

As we observe the emerging "artifacts" of on-line group dynamics, we dream of yet-to-be realized "artifacts". We watch users (ourselves included) learning how to go about making joint decisions, exchanging ideas and information, and selecting certain ideas/information to collaboratively build upon. At the same time, we dream of a technology that makes more information available to users, making their on-line interactions more effective (as well as less frustrating); a technology that allows more flexibility in being able to shape and create environments; a technology that can facilitate the doing and trying of new things that have hitherto not been possible. . .or perhaps even dreamed out.

Therefore, as educators we have a dual function. One is to *use* the medium's technology to demonstrate what is possible. The other is to learn from this use, and insist that the technology is further refined so that it can be used regularly for educational purposes *without* the frustrations. Integral to this refining process is dreamware. How can we put dreamware back into education? (Dreamware from educators in tune with reality does not need to be threatening nor unimplementable.) Imagine how much more motivational drive users would have if the medium were geared up to facilitate learning in fun, easy and satisfying ways.

If we are really discussing the emergence of a new *environment* for learning and education, then that goal and vision should be incorporated into the software design, and we need to rethink what makes for quality learning (which may mean eradicating a lot of preconceived notions of tutors, students, "material" to be learned and the process of learning). Given this, we could easily restructure CMC into a learning-conducive and facilitative medium

With regard to this new environment, it seems it is the beginning of our single planetary mind for Gaiea, or at the very least a new vast frontier territory to be settled and civilized. More than civilized — really democratized in the Athenian or Jeffersonian senses of direct democracy. While this requires a lot of maturity and intelligent discourse skills, people are capable of rising to the challenges of this new *mind-space frontier*.

To be sure, there are really exciting opportunities here for collective cultivation of precision and even more exciting opportunities for valid generalization construction. We need to have more than just message organization, but also ways to create and explore new learning interactions and environments. When we can mindmerge without any mediating

technology (i.e., when the technology is transparent), it will be a true "conspiracy" (breathing together).

This new *electronic space* offers us the potential and the challenge to sculpture out new learning environments. With images of global learning networks before us, the challenge is to rethink a) our notions and practices of education, and b) CMC possibilities that go beyond horseless carriage applications.

Computer-mediated communication offers the potential for improving both the processes and the products of learning. In other words, through this medium it is possible not only to facilitate learning of knowledge, skills and values, but also to facilitate learning how to learn. How might this be effected?

Of primary importance is our insistence on loosening up the storage and handling functions of the software. This capacity to move items around, edit, regroup, thread, represent and revise what has been thought and said is what will transform CMC into a collective art form.

With the technology so changed to reflect the single and collective minds of the users (learners) rather than the minds of the suppliers, we may direct our attention to sculpting new learning environments. For example, we may teach learners (through the modelling of idea and information manipulation) how, when, why, etc. to interact in the receptive-acquisitive, transmissive, and conjugative-propagative modes; how to perform the conditions of a) truth of factual propositions, b) rightness of collective norm assertion, c) truthfulness of commitment, and d) honesty of expressive parts of a communication; and how to control interactive environments in order to effect purposeful and desirable group problem-solving. The pieces are all there to structure the medium so that learning outcomes are closer to a sure thing than to chance; so that learners can effect self-facilitation of their own learning processes. We just need to put them together to create the architecture required to improve learning.

The plea for *educational optimisation* of CMC's unique character is the themesong of this whole issue. We have demonstrated a unity of purpose in our sense that something never before attained is going to be possible for us through this medium. It's better than the early days of flight. And it's better than the early days of radio. And we've all got the time and intent to tinker with the darn thing until it does something spectacular.

'night all . . . . . .

it was a great party!