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COMPUTER-MEDIATED COMMUNICATION

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15.1 INTRODUCTION AND OVERVIEW

15.1.1 Scope of the Chapter

15.1.1.1 Principal Focus. This chapter will focus essentially on asynchronous text-based computer-mediated communication (CMC). By this, we mean email, whether one-to-one or one-to-many, e-mail-based discussion lists, bulletin boards, computer conferencing environments, and the growing number of Web-mediated manifestations of these types of communication.

As technologies change, the forms of CMC evolve. Sometimes there is divergence, for example, the newer audiovisual possibilities to contrast with the purely text-based, while in other aspects there is convergence, as in the amalgamation of many forms within a single Web-browser environment. Some forms of CMC are purely synchronous, some purely asynchronous, while others (e.g., NetMeeting™, ICQ™) are now allowing the two to occur in the same environment.

Technological issues, such as system and interface design, and speed of message transmission, have been known for many years to influence CMC use (Collins & Bostock, 1993; Perrolle, 1991; Porter, 1993). With this in mind, the technology should "be transparent, so that the learner is most conscious of the content of the communication, not the equipment" (Mason, 1994).

15.1.1.2 Partly in Scope. Many other forms of CMC exist, and especially many more synchronous (real-time) forms. All of these have been proposed and tested for educational purposes, in the same way that synchronous one-to-one telephone conversations have been used to provide learner support and telephone conference calls have been used for discussions among groups of students and their teachers.

However, as the advantages of distance and online education, and the various models of e-learning, are posited around the idea of overcoming the need for students to meet together in real time, the use of real-time interactions of this type are open to question. Chat forums, mediated through IRC chat and other software, such as the many proprietary forms of instant messaging now available, have been used for educational purposes, but usually as an adjunct to other modes of delivery. Thus, for example, they might be used to provide an additional communication channel to accompany a web broadcast of a lecture, and to provide the facility for students to pose questions to the lecturer and to other students. One of the major advantages of such synchronous CMC is to bring together geographically dispersed students, and in doing so, add immediacy and increase motivation, although it also reduces flexibility. This whole area merits further study, as we may be on the verge of seeing some really significant changes with real time electronic communications in developing social presence and hence community.

Some have advocated the use of MOOs (multiuser object-oriented environments) for learning, especially because they see the real-time role-playing aspects fitting with aspects of professional continuing education, or less formal forms of education (Collis, 1996; Horton, 2000). Fanderclai (1995), Looi (2002) suggests that MOOs and MUDs (Multiuser Dungeon, Dimension, or Domain) can provide learning environments that support constructivist approaches to learning, due in large part to the students controlling the timing of learning, and through the construction of knowledge within the online environments. Collis (2002) views them as still peripheral forms of online education, due to the technical support that is often needed, and the

difficulties of scheduling the synchronous interactions needed for them to function effectively.

15.1.1.3 Out of Scope.
Many other forms of computer, Internet and web-based technologies exist and can be used for educational purposes. One can stretch definitions of communication to possibly include them. However, we will exclude from our definitions and discussions the use of computer networks for accessing remote databases, or library systems, or for the transmission of large amounts of text. Online journals are another area that we will exclude, although evolving models of journals, which encourage interaction of readers with the authors through feedback, are starting to blur the distinctions (Murray & Anthony, 1999). One example of this latter area is the *Journal of Interactive Media in Education* (JIME – http://www-jime.open.ac.uk), which promotes an interactive online review process, while many health journals, for example, the *British Medical Journal,* regularly publish responses to the articles, appended to the articles themselves.

15.1.2   Basic Concepts

15.1.2.1 What is CMC?
A working definition of CMC that, pragmatically and in light of the rapidly changing nature of communication technologies, does not specify forms, describes it as "the process by which people create, exchange, and perceive information using networked telecommunications systems that facilitate encoding, transmitting, and decoding messages" (December, 1996). This seems to encompass both the delivery mechanisms, derived from communication theory, and the importance of the interaction of people that the technologies and processes mediate (Naughton, 2000). It also provides for great flexibility in approaches to researching CMC, as "studies of cmc can view this process from a variety of interdisciplinary theoretical perspectives by focusing on some combination of people, technology, processes, or effects" (December, 1996).

The social aspects of the communication, rather than the hardware or software, form the basis of the more recent definitions. Jonassen et al. (1995) focus on the facilitation of sophisticated interactions, both synchronous and asynchronous, by computer networks in their definition of CMC. One of the most overt examples of the move away from a technological focus in definitions describes it thus: "CMC, of course, is not just a tool; it is at once technology, medium, and engine of social relations. It not only structures social relations, it is the space within which the relations occur and the tool that individuals use to enter that space" (Jones, 1995). In our selection of research studies for the present review, we have been guided more by the social and organizational aspects of specific projects than by their use of specific varieties of CMC and the associated technologies.

15.1.2.2 Synchronous and Asynchronous Communication.
One of the main distinctions that has been made in CMC has been between synchronous (real-time) and asynchronous (delayed time) communications. Synchronous, real-time communications, as between two people in a face-to-face discussion, or talking on the telephone, or as in a one-to-many form, such as a lecture, has its equivalent within CMC in chat rooms and similar environments. Much software exists to mediate this form of communication (e.g., IRC and various forms of instant messaging). These forms have had some use within educational contexts, but, in general, asynchronous forms seem to predominate, wherein there is a, potentially significant, time delay between sending a message and it being read. In offline communication, this latter form is similar to letter writing, or sending faxes, and online has its usual manifestations in email, discussion lists, and most forms of bulletin board and computer conference. For reasons that will become obvious as the reader proceeds, we do not plan to review synchronous and asynchronous applications of CMC in separate sections. Instead, we will refer to both of these categories as relevant in any or all of the sections of our review.

15.1.2.3 Highly Interactive Communication.
CMC provides for complex processes of interaction between participants. It combines the permanent nature of written communication (which in itself has implications for research processes) with the speed, and often the dynamism of spoken communications, for example via telephone. The possibilities for interaction and feedback are almost limitless, and are not constrained as they are in some of the "electronic page turning" forms of computer-aided instruction, wherein the interaction is limited to a selection among a small number of choices. It is only the creativity, imagination, and personal involvement of participants, that constrains the potential of online discussions. The potential for interaction in a CMC environment is both more flexible and potentially richer than in other forms of computer-based education. The textual aspects of CMC, and in particular of asynchronous CMC, support the possibility of greater reflection in the composition of CMC than is seen in many forms of oral discourse, with implications for levels of learning. We reflect these aspects of CMC in specific sections dealing with the dynamics of CMC processes in educational contexts.

15.1.2.4 Oral or Textual.
There is a substantial body of work within the discussion of CMC practice and research on the nature of CMC, in particular whether it is akin to oral discourse or to written texts, or whether it is a different form (Kaye, 1991; Yates, 1994). CMC has been likened to speech, and to writing, and considered to be both and neither simultaneously. Some have criticized this oral/literate dichotomy, believing that it "obscures the uniqueness of electronic language by subsuming it under the category of writing." (Poster, 1990).

Discussion list archives, and the saving of interesting messages by individuals, which they may then reuse within later discussions, provide for new forms of group interaction, and suggest features unlike those seen in communities based on face-to-face interaction and the spoken word. Such a group can exist and "through an exchange of written texts has the peculiar ability to recall and inspect its entire past." (Feenberg, 1989).

This ability to recall and examine the exact form of a communication has profound significance for research conducted on or using CMC (McConnell, 1988). From a poststructuralist theoretical perspective, "the computer promises to redefine the

relationship between author, reader and writing space." Bolter (1989).

For the reasons implied by the above, our review will place special emphasis on discourse analysis studies. Many of these have been performed by researchers especially interested in questions of language acquisition and use and are reported in journals and websites that are not part of the "mainstream" literature of educational technology.

15.1.2.5 Active or Passive Participation (Lurking). In most discussion forums, a majority of subscribers do not contribute to the discussion list in any given time period. Of those who do contribute, most tend to make only a small number of contributions, while a small number of active subscribers provide a larger proportion of message contributions.

One of the criticisms of many forms of CMC discussion is this tendency for a few members to dominate the discussions, or for the majority to lurk and not actively participate or contribute messages to the discussion forum. However, face-to-face discussions in educational contexts are often designed to be, or can become, monologues, with "silence filled by the teacher, or an exchange of unjustified opinions" (Newman et al., 1996). The fact that it is technologically possible for everyone to speak leads initially to the assumption that it is a good thing if they do, and to the measurement of a successful conference being related to the number of students who input messages.

Most members of discussion forums are, most of the time, passive recipients of the messages, rather than active contributors to discussions; they are, de facto, lurkers. Lurking, that is, passive consumption of such electronic discussions, has been the subject of much discussion in CMC research. However, despite all that has been written, it remains under-theorized and under-researched. In most face-to-face group discussion environments, most participants lurk most of the time, and make occasional contributions. Indeed, most discussion forums, whether online or offline, would be impossible if all participants tried to actively contribute more frequently than they do. In addition, there is an assumption, one that has been insufficiently challenged in the research, of lurkers as passive recipients, rather than actively engaged in reading. Reading cannot be assumed to be passive. Much reading, whether online or offline, can encompass active engagement, thought, even reflection on what has been read. The fact that it does not elicit an overt contribution to the discussion forum should not, as has generally been the case in CMC research, be taken to assume lack of such engagement, or of learning.

15.2 RESEARCH ON CMC SYSTEMS IN GENERAL

The above mentioned comments on active/passive participation and the comparison drawn between how this issue is interpreted and handled in CMC and face-to-face (F2F) contexts, is one major justification for inclusion of just a few studies that compare learning in these two contexts. However, the majority of comparative research studies have been omitted for reasons now well understood and accepted in the general educational

technology community. This point will be addressed from a research methodology perspective later in out review in the section on research methodologies. The present "general research studies" section is subdivided into studies that focus pedagogical and instructional design issues and those that raise general issues regarding the technologies employed.

15.2.1 Pedagogical/Instructional Aspects

Do online learning environments (Web courses) work? Do people learn in these environments? The literature on the topic is large and growing, but most of it is anecdotal rather than empirical. The many outstanding research questions will not be resolved quickly, since many variables need to be accounted for and control groups established for comparisons, which is a difficult task in real-life "intact" educational environments (Mayadas, F., 1997).

Early studies of online education focused on the viability of online instruction when compared to the traditional classroom. Recently, researchers have begun to examine instructional variables in courses taught online. Berge (1997) conducted a study of 42 postsecondary online instructors to discover strategies that educators might use to improve their online teaching. The instructors indicated that they believed learner-centered strategies to be more effective than instructor-centered strategies. They also indicated that they preferred the following methods: discussion, collaborative learning activities, and authentic learning activities. However, what was not discussed in the study was the effect the strategies had on the students.

Carswell et al. (2000) go a bit further than most previous studies when they describe the use of the Internet on a distance-taught undergraduate computer science course. This paper examines students' experience of a large-scale trial in which students were taught using electronic communication exclusively. The paper compares the experiences of a group of Internet students to those of conventional distance learning students on the same course. Learning styles, background questionnaires, and learning outcomes were used in the comparison of the two groups. The study reveals comparable learning outcomes with no difference in grade as the result of using different communication media. The student experience is reported, highlighting the main gains and issues of using the Internet as a communication medium in distance education. This paper also shows that using the Internet in this context can provide students with a worthwhile experience.

The students elected to enroll for either the conventional course or the Internet version. In a typical year, the conventional course attracts about 3500 students; of this, about 300 students elected to study the Internet version. The target groups were as follows:

- Internet: all students who enrolled on the Internet presentation (300);
- Conventional: students enrolled on the conventional course, including students whose tutors also had Internet students (150) and students of selected tutors with only conventional students.

The composition of the conventional target group allowed the researchers to consider tutor differences as well as to make conventional-Internet comparisons for given tutors.

The data sources for this analysis included:

- *Background questionnaires:* used to establish students' previous computing experience and prior knowledge, helping to assess group constitution;
- *Learning style questionnaires:* used to assess whether any student who displayed a preferred learning style fared better in one medium or the other, and to compare the learning style profiles of the groups overall;
- *Final grades* including both continuous assessment and final examination; used to compare the two groups' learning outcomes.

The student's final grade was used as an indicator of learning outcomes; the final grade is the average of the overall continuous assessment score and the final exam grade. Eight continuous assessment assignments were spread over the course. Each assignment typically had four parts which related to the previous units of study. The background questionnaire and the learning style questionnaire were sent to students in the target populations at the beginning of the course. Conventional students received these materials by post and Internet students received them by electronic mail.

The research results suggest that the Internet offers students a rapid and convenient communication medium that can enable increased interaction with fellow students (both within and beyond their tutor groups) and tutors. Possibly the biggest gain for Internet students was the improved turnaround time of assignments, so that students received timely feedback. A summary of gains includes:

- Faster assignment return; more immediate feedback;
- Robust model for queries, with greater perceived reliability;
- Increased interaction with tutor and other students;
- Extending learning experiences beyond the tutorial;
- Internet experience.

Learning outcomes (as indicated by continuous assessment and final examination) were comparable, and the Internet students' experience was favorable and was one they would wish to repeat—a major factor in maintaining the enthusiasm and motivation of distance education students throughout a complete degree program.

The biggest obstacle to Internet presentation was inexperience—and cultural inexperience presented tougher obstacles than technical inexperience:

Internet presentation requires a culture shift by students and tutors. Both must learn how to cultivate communication in a largely asynchronous environment, and both must develop a sensitivity to the emerging etiquette and conventions of Internet culture. Using the Internet does imply higher expectations: students (both Internet and conventional) expect electronic communication to be faster. One of the keys to successful Internet presentation is to instill appropriate expectations among all participants (Carswell et al., 2000)

A comparison, by Collins (2000), of correspondence and Web versions of the same course indicated that, although the students were very satisfied with the Web version, the correspondence section achieved the higher mean final scores in three of the four semesters while the Web course achieved the higher mean final scores in only one semester. Each module ends with a multiple-choice quiz (with text and diagrams) which students can complete and submit for immediate online scoring and feedback. The feedback informs the student as to whether each response was correct or incorrect, and in the case of the latter gives the correct response as well as a hot-link to the subunit containing the information related to that particular question. The Web version of the course is, therefore, much more interactive than the correspondence version in which students receive, by mail, a course manual, containing the text and diagrams, in addition to the course objectives and glossary of terms, and multiple-choice quizzes with the answers provided. Students taking the correspondence version of the course do not have access to the class Web forum, and their only access to the instructor is by the phone during weekly office hours, or by email.

While most other studies, with the notable exception of Zhang (1998), have reported that there was seemingly no significant difference between the performances of students in the Web and traditional versions of courses, Collins found that the students in the Web course achieved lower mean final marks than those in the correspondence and lecture sections, although the differences were not statistically significant. As with other studies the students were very satisfied with the Web course, and gave a number of reasons they liked this approach, including the ability to study at one's own convenience, being able to communicate easily with both the instructor and classmates, and the opportunity of gaining experience with email and the Internet. But, the learning effects, as measured through the instruments used, was inferior for the Web-based students. This important aspect will be addressed further—and in depth—in the remainder of this section of our review.

In recent years, partially as a result of the so-called "technology revolution" and partially due to paradigmatic shifts in educational philosophy, both the theories and the practice of instruction have undergone significant change. In the area of learning theories, there has been a shift from a behaviorist to a constructivist view of learning as a process involving the construction of knowledge. This, in turn, has led to an increasing emphasis on collaborative learning strategies, in which people work together in small groups. The physical environment of learning is also shifting ever more from face-to-face classroom instruction, to distance-learning on the Internet.

Constructivist theory states that students should be encouraged to construct their own knowledge. Computer-mediated communication, it is argued, effectively supports constructivism because of the emphasis on access to resources and the extent of collaboration between students promoted through the use of discussion boards. Therefore, many constructivists argue, students in an online environment can construct

their knowledge through active learning and collaboration and, therefore, would presumably learn more effectively. Another theoretical perspective—engagement theory—suggests that learners must be actively engaged in meaningful tasks for effective learning to take place (Kearsley & Schneiderman, 1998) and one means of providing such meaningful tasks is to engage the students in discussions. Researchers also argue that collaborative learning and social interaction play a major role in cognitive development. Collaborative learning is the "acquisition of knowledge, skills or attitudes that take place as a result of people working together to create meaning, explore a topic or improve skills" (Graham & Scarborough, 1999). Hiltz (1997) states that collaborative learning is crucial to the effectiveness of online learning environments.

Both engagement theory and collaborative learning theory would suggest that the use of discussion forums brings the students directly into contact with the content material of the course instead of leaving them on the outside as passive learners. Through this interaction, it is postulated, students are building their knowledge instead of relying on simple memorization skills. If these theoretical positions are valid, one could expect the use of discussion forums to be more effective than, for example, quizzes or objective testing as a means of promoting learning. However, both these theoretical positions seem to espouse online learning mainly because it offers tools for collaboration and so is in tune with the latest philosophical views on education in general and the learning process in particular. We see a certain circularity in the arguments presented in the literature This lack of clarity in the arguments makes it particularly important to investigate the relative effectiveness of the two levels of interaction represented by the two most-used forms of online learning exercises: individual quizzes and group discussion forums.

The substitution of interactive "CAI" tutorial sequences, or individually completed quizzes, by online group discussions is observed to be an increasingly common practice among teachers who modify previously existing courses for online delivery. This trend is often justified from the standpoint of Collaborative Group Learning principles drawn from theories of Active Learning based on modern educational philosophies such as Constructivism. However, the available research data that would confirm these claims is scarce and inconclusive. Furthermore, given that the popularity of this trend seems to have grown with the increasing availability of efficient technology for the organization and management of threaded discussions, one may question whether theoretical principles or technological fashion are the real driving forces. It also seems that some of the specific new strategies that are being implemented in the name of new theoretical positions do not always exhibit the characteristics that these strategies should (theoretically speaking) embody. In some cases it seems that the changes are driven more by the appearance and availability of the new technologies than by any coherent set of theoretical principles.

Lewis (2002) addressed exactly these concerns when she investigated the learning effectiveness in online course contexts of two alternative forms of practice activities: asynchronous online discussion forums and individually completed quizzes. The study was conducted in existing regular courses, where learning effectiveness is formally assessed by means of objective tests derived from the subject matter content of the course. The goal of this study was to investigate the extent to which one specific change in methods and media, namely the use of asynchronous discussion environments as a component of online courses can be seen to be theory driven or technology driven. Another motivation for the study arose from the desire to understand the effectiveness of such discussion forums on students' achievement scores. Among the many as yet unanswered questions regarding Web-based courses is whether the use of asynchronous online discussion activities, as a means for providing opportunities for practice and learning, is necessarily an improvement over previously used strategies, such as quizzes.

The theory and practice of the discipline of instructional design suggests that in order to implement a new instructional approach, based on a different theory of learning, it is usually necessary to modify not one, but maybe all or most of the components of a lesson (Dills & Romiszowski, 1997; Romiszowski & Chang, 2001). However, it is currently quite common to utilize the newly available online discussion environments as the practice component of lessons that are otherwise unaltered in their basic instructional design. Existing content-presentation materials, previously used in conventional courses, are posted to the Web without any modification. The same final evaluation tests and procedures are employed, regardless of the implied modifications to the underlying course philosophy and shift in key objectives from the content to the process of learning.

The Lewis (2002) study intentionally selected just such a context for its investigation. An existing course that has for some time been offered as a conventional face-to-face course is now also being offered as an online course. This course is based on a well-established basic textbook that not only is a major source for the course content, but also includes a large questions bank from which instructors may create a variety of learning assessment instruments and practice quizzes. In the process of transforming the conventional course to an online version, little instructional design change was introduced as regards the presentation phase, in that the same textbook was made available online and similar instructor advice and support was offered. Also, little change occurred with respect to the final test or assessment phase, in that the same questions bank was used to generate final examinations. However, some of the instructors involved chose to modify the practice phase by introducing online discussion activities in place of the previously used quizzes.

This particular course that Lewis analyzed is a 15 week online course in a major university setting. The course and the instructional materials it uses (i.e., the content of 12 chapters of the set book, the test bank and any tests and unit quizzes derived from the bank) is a standard online course that is offered by three different instructors each semester at the university. The enrollment is 50 students per course. Therefore, on an average, 150 students per semester take the online version of the course, using the same course materials. The entire course syllabus, quizzes, and discussion activities are available online in a WebCT course shell.

An intact cohort of 50 students, registered to take the above-mentioned course was randomly subdivided into two

experimental groups who were subjected to different treatments as regards the practice phases of the online lessons that compose the course. All students participated in quizzes for some of the lessons and in online discussions for other lessons, according to the experimental design explained below. This procedure allowed the investigator to compare the learning effectiveness of the two alternative practice procedures and also to investigate some other secondary questions. The following procedures were applied to the assignment of the participants to the treatment sequences and measurement of the results. Each participant:

- Completed an online pretest which was based upon the information contained in 12 chapters of the required textbook;
- Read the book and the lecture notes, one chapter per course unit;
- Completed six online quizzes for six of the course units (based on randomized assignment to one of two groups: Group 1 in odd and Group 2 in even units);
- Completed six threaded discussion forums for the other six course units, which were based on questions posted by the instructor on issues in the unit.
- Completed an online posttest based upon information in the textbook (exactly the same assessment procedure that has been used for years for grading both on-line and face-to-face versions of the course);
- Completed an end of course evaluation questionnaire.

The tests were taken from the test bank prepared by the publisher of the book used in the course. This book and test bank have been used for the past 3 years at the university. As stated above, the course is offered three times a semester as an online course for a total of nine times a year. Besides the online version of the course, this course is also offered three times a semester as a traditional course using the same test bank. Therefore, even though there is no available statistical analysis of the reliability of the test items, it could be inferred that the test questions do have general acceptance by expert teachers of the subject as a valid instrument by which to measure learning of the course material. Different versions of the assessment instrument (i.e., test) have been used at least six times a semester (including traditional and online courses), three times a year, over a period of 3 years, for a total of 54 times.

Fifty students began the class; however, only 37 students finished the course. Thirteen students either dropped out of the course or took an incomplete grade. The concluding 37 students remained in the same random groups and subgroups as assigned in the beginning of the course. The first step of the experiment involved the administering of a pretest. The main reason for administering a pretest was to verify that the randomly selected groups were indeed equivalent as regards entry level. Once this was established, all comparisons between the groups were made on the basis of posttest scores. Each posttest score was divided into the 12 chapter units scores. The investigator found some interesting differences among the subunit scores.

Several one-way ANOVAs were performed to test the null hypothesis: "there is no difference in the learning outcome for those who engage in discussion activities versus those who complete the quizzes." This analysis revealed that the null hypothesis is accepted for subunits 1, 3, 5, 6, 7, and 9. However, the null hypothesis was rejected for subunits 2, 4, 6, 8, 10, 11, and 12. This finding is interesting in that the Chapters 2, 4, 8, 10, and 12 are the chapters for which Group 2 did the discussion forums and Group 1 did the quizzes. These results, taken on their own, seem to suggest quite strongly that the quiz-taking activity generally leads to superior posttest performance than the discussion activity.

However, the other half of the results did not tally with this finding. The only time when there was significance when Group 2 did the quizzes and Group 1 did the discussion forums was in subunit 11. In all the other 5 such cases, the differences were not significant. The question that arises out of the data, therefore, is why is there generally no significance when Group 2 takes the quizzes and Group 1 engages in online discussion.

Let us examine these findings from yet another theoretical position—the objectivist theory of instructional design. This position has a long history of practical use and acceptance. It is arguably rather incorrect and unfair to label the position as behaviorist, because it really represents the established practice of the teaching profession from times way before the development of behaviorism. However, this position did tend to get formalized as a result of the growing popularity of the use of behavioral objectives as a basis for the design of learning activities. The practical influence of programmed instruction models reinforced the widespread acceptance, almost as an axiom, of the principle of designing the learning activities as a mirror image of the final evaluation activities. In the case of this particular study, the objectivist position would argue that we should expect the quizzes to be more effective learning activities than the discussions, because they better reflect the final test conditions used to evaluate the learning. Once more, however, one must observe that, in the present study, one part of the results supports this position, but the other part does not.

Further light is, however, shed on the results of this study if one examines the objectivist position a bit more critically. The partial result that students who participated in the discussion activities scored just as well as those who took the quizzes is in line with Mouton's (1988) findings that success on lower level testing can be achieved by the review of "higher-order learning" problem-solving questions during the practice assignments. In his study, Mouton looked at what types or combination of types of practice activities should be provided to students, studying through mediated self-instruction. The finding of the study showed that a "more stable and durable memory trace results if deeper cognitive processing occurs during encoding" (p. 97) and "students when engaged in higher level thinking questions will do as well on lower level thinking test items as students just doing lower level thinking questions."

Also predating the constructivist movements of today, Bloom (1981) suggested that, in order to be independent and active learners, the learners should engage in so-called "higher-level thinking." They should also " possess the ability to learn and solve problems, be intrinsically motivated, and possess a

degree of social responsibility to interact with others in the acquisition of learning." Using the logic of Mouton and Bloom, the use of online discussion forums can be postulated to serve as an avenue for learners to obtain higher levels of achievement, even on lower-level rote-memory test instruments, than by means of participation in lower-level forms of learning activities, such as quizzes. From this theoretical position, the use of higher level thinking questions and discussions does not hinder but enhances a student's learning, even if tested by lower level thinking tests. This theoretical analysis helps to explain the partial finding in the present study that Group 1 students studying in the higher-order-thinking mode of the discussion forum did just as well as Group 2 students who studied these same subunits in the lower-order-thinking mode that was a mirror image of the final test conditions.

However, we still have the other partial result that seems to support the conventional objectivist position of designing the learning activities as a mirror-image of the testing procedures. It is difficult to escape the conclusion that, despite the apparent equivalence of the two groups, as demonstrated by means of analysis of overall pretest scores, something differentiated them during the course of the study. One factor that may have played a part is the intensity and frequency of participation in the group discussions.

To explore this question, Lewis looked at the content of the online discussions. She reviewed the number of messages read and number of messages posted to see if any differences may have had an effect on the posttest scores. A one-way ANOVA was conducted on both the messages read and messages posted by the students. There was a significant difference on messages read by students between groups. However, there was no significant difference on messages posted within the groups.

Palloff and Pratt (1999) claimed that interaction and collaboration become critical in Web-based training. They also suggested that the successful online learner is a "noisy learner" who is active and creative in the instructional environment. Students in Group 1 were more active than students in Group 2. This is apparent from the number of messages read by the students. Students who participated frequently and intensively in the online discussions could be expected to have benefited from the higher level thinking activity more than those students who engaged less thoroughly and less frequently in the discussions. Thus, a possible, though by no means proven, interpretation of the results of this study is that the difference between Group 1 and Group 2 scores is due to the varying amount of effort and frequency of participation in group discussion activities. The higher level of engagement of Group 1, as compared to Group 2, led that group to get more value out of the discussion activities and thus compensate for the "handicap" imposed by the lack of a practice exercise that directly mirrored the final evaluation.

Further research would be required in order to establish whether this hypothesis is consistently supported in practice. If it proves to be supported, one may gain some important insights into the factors that must be designed into online learning activities in order to ensure that they are effective learning experiences as measured and evaluated by the conventional, content-based, criteria that are commonly utilized by most educational systems. Finally, we may add that the study

here analyzed illustrates the importance of adopting a theory and research-based instructional design approach to Web-based education and training. One outcome of such a design approach would be to reexamine right from the start whether the maintenance of the same conventional testing procedures for the online course was theoretically justified, or was just the result of overlooking an opportunity for the improvement of that aspect of the course as well.

15.2.2 Technological Aspects

In this section, we shall address just a few of the technology-related design and use aspects of modern Web-based CMC systems. Space precludes the analysis of all the many technological solutions that have been launched on the CMC market in recent years. The approach of this section is to critique some general aspects of the current trends, rather than to focus on specific technologies and products.

The variety of Internet-based synchronous and asynchronous communication systems keeps growing. In addition to the already well-known forms of asynchronous computer-mediated communication systems, such as email, listserv and threaded discussion lists, we now use a variety of new synchronous communication alternatives, such as electronic whiteboards, Internet relay chat, Web-based audio and video conferencing, and a growing variety of "groupware" packages. As the power of the Internet grows, so does the complexity of the material posted. Ever more ambitious examples of interactive multimedia are launched on the Web every day.

A number of novel research questions and issues arise in relation to the design and use of these new systems. Much existing research is related to earlier forms of text-based CBT. Some of these results may be equally valid within the context of multimedia distance education/training systems. However, we may expect many new issues and questions to emerge as these broad band multimedia, multimodal communication systems link both people and remote databases into one seamless information and communication environment. One recurrent problem is that we tend to hop from one recently emerged technology to another currently emerging technology that promises some new potential, without ever learning to fully exploit the potential of the old. It is a sobering thought that in all the centuries since the Gutenberg print technology facilitated the mass dissemination of text, we are still struggling with the issues of mediocre textbooks, instructional manuals that fail to instruct, and communications (including online texts and hypertexts) that just do not communicate (Romiszowski & Villalba, 2000).

In addition to the communication technology and instructional design variables, another aspect to consider for improvement of existing online learning environments is the promotion of effective conversational interaction between groups of students (and instructors) engaged on a joint project. There is a growing need for the implementation of learning exercises that prepare students for the new profession of "knowledge work." These exercises should allow students to work creatively, collaboratively and at a distance on complex, leading-edge problems that impact their life and work. Teaching methods such

as seminars or case studies are traditionally employed for developing creative thinking skills through collaborative effort. They are typically implemented in small or medium sized groups, led by skilled and experienced facilitators. The success of these methods depends much on the facilitators and the skill with which they perform their roles: focus the discussion; guide the approaches adopted by the participants; use the natural group dynamics to stimulate interest; promote and support participation and deep involvement by all; and pull together what has been learned in the final debriefing discussion. Can such participatory discussion methods be effectively orchestrated at a distance? How might this be done? And, most importantly, how might we do it so as to create practical and sustainable WBT systems that will survive the test of time as the initial enthusiastic "early adopters" move on to other projects and their place is taken by the rank and file of the teaching/training profession?

In a recent study, Villalba and Romiszowski (1999) performed a comparative analysis of typical online learning environments currently used in higher education and the typical ways in which these environments are used to implement collaborative group learning activities. The findings indicated that few currently implemented online courses actually include a strong emphasis on collaborative small-group learning and, when such activities are implemented, this is generally as a relatively unstructured online group discussion, using either synchronous chat sessions or, more frequently, asynchronous email driven discussion lists. There is little if any research, however, indicating that such environments are conducive to in-depth reflective discussions of the type required to develop critical and creative thinking skills. And there are some studies (e.g., Romiszowski & DeHaas, 1989; Romiszowski & Chang, 1992) that suggest they are singularly ineffective in this respect. As a means of verifying these suggestions, the authors selected one of the previously evaluated online learning environments, Aulanet, for further in-depth study.

Aulanet is a Web-based instruction environment, developed in Brazil (Lucena et al., 1998), which is also available in an English language version. It was selected as it offered a wider variety of online discussion environments than most other currently available systems. In addition to the regular e-mail, both threaded and unthreaded asynchronous discussion environments and text-based synchronous chat rooms, options are available for audio audiographic and full video-conference sessions in small or large groups. In addition, the creators of Aulanet claim the system is based on or influenced by contemporary theories of cognition and constructivism. Villalba and Romiszowski (1999) analyzed the use of Aulanet as a delivery system for four courses running through several semesters. The study involved both the observation of student use of different collaborative learning environments provided within Aulanet and the analysis of student questionnaire responses and user-evaluations administered during the course of the academic year.

In that study the students made some quite significant suggestions for enhancement of the learning environment. A major observation is concerned with the structure of facilities for constructive educational "conversations." The many and various components of Aulanet that permit both synchronous and asynchronous student/teacher and student/student interaction

are seen to be no different from the facilities that exist in many other online learning packages currently on the market. Both faculty and students have come across limitations in the available group communication facilities that limit what they can implement in the way of "creative group work at a distance."

In a similar vein, Chen and Hung (2002) highlight a technology-related concern with using online discussion for learning. They argue that there is a lack of technological support for the development of personalized knowledge representation in most online discussion forums. Analyses of existing discussion forums suggest that there is a range of collective knowledge representation mechanisms which support a group or a community of learners. However, such mechanisms "may not necessarily lead to learners' internalization of collective knowledge into personalized knowledge." They discuss how internalization can be facilitated through the notion of "knowledge objects," while externalization can be mediated by "idea artefacts." These notions are translated into technological supports and suggestions of how online discussions can be designed differently from the common threaded discussion.

The recent proliferation of student online discussions calls for a reexamination of the meaning of knowledge. Though not explicitly or intentionally so designed, most discussion forums seem to focus more on supporting the construction of collective knowledge rather than on the construction of personalized understanding. There seems to be an assumption that during the processes of social dialogue, students' personal understanding is automatically guaranteed. The situation could well be that individual students have developed personalized understanding differently and perhaps with misconceptions. In essence, how can we better facilitate the process of constructing personalized understanding in relation to collective understanding? (Chen & Hung, 2002)

The distinction between personalized and collective knowledge representations questions the assumption that participants in the social dialogue will automatically acquire "the inter-subjectivity reached within a particular community of learners." By *only* supporting the construction of the collective knowledge representation the authors argue that:

. . . we may unknowingly discourage or even impede students' personal understanding because (a) such support does not foster/facilitate personalized understanding; (b) it provides limited opportunity for multiple foci in discussion and thus does not cater for the varying needs of individuals; and (c) the mass of contributions remains overwhelming. We argue for the necessity of technological supports for this transformation. In addition, we also challenge the adequacy of the traditional threaded discussion representations, which, we believe, are problematic in at least four areas: (a) difficulty in summarizing the current state of the discussion, (b) difficulty in referring (or linking) to a message posted earlier (thus, the need for an easy way to index and refer to messages), (c) difficulty in determining which thread to go to because a message could be related to more than one message, and (d) difficulty in tracking all messages and filtering only the relevant ones. (Chen & Hung, 2002)

Chen and Hung (2002) propose that knowledge representations, though not the knowledge itself, can be transitional aids and supports to the dialectic internalization and externalization processes. For example, the threads of a discussion are

visual representations that bring together all externalizations from participants. In other words, these visualizations facilitate and coordinate the organization of the collective knowledge representation. In a similar manner, the personalized knowledge representation would assist individuals to internalize the current state of the discussion, translate it into personalized knowledge objects, and later integrate it into their own existing schema. It is then logical to think of two types of technological support, one for collective knowledge representation (for externalization and negotiation) and the other for personalized representation (for internalization).

In an ideal online discussion environment, students would have access to both collective and personalized representations. They could even superimpose the two to perform further compare and contrast. It is also possible to design the system in such a way that if a learner wishes, he/she could publish annotated remarks on why certain messages are included or excluded and why certain links are made the way they are. Most current online discussion systems only support collective knowledge representation, which primarily facilitates the externalization and negotiation of intuitive inspirations or ideas. Chen and Hung (2002) argue for the need to support personalized knowledge representations in order to cater for individual differences:

Personalized knowledge representations are the transitional states of knowledge and understanding in the process of internalization from objective knowledge to subjective knowledge. When translated to technological supports, the objective knowledge could be represented by the collective knowledge representation of an online discussion forum; the knowledge objects could be illustrated by personalized knowledge representations; and idea artifacts could be messages, which every individual learner contributes. Without these supporting mechanisms, students may soon be overwhelmed by the massive number of messages or de-motivated to participate due to inflexibility in choosing the more relevant topics to pursue. (Chen & Hung, 2002)

It is clear that more research studies are needed to test the arguments and approaches proposed in this paper, in particular of the internalization process. But, we believe that the authors have suggested an attractive alternative to current states of online discussions. As CMC systems are used ever more frequently in contexts of continuing adult education in the workplace, the issues related to knowledge capture, knowledge management and its storage in forms that serve the purposes of other users of the newly created knowledge base will take on ever greater importance. So will the development of online tools that may help the users of this knowledge to use it productively in the process of knowledge work. An underlying process of importance in this context is productive learning which, according to Collis and Winnips (2002), is defined as:

. . . learning that can be reused, in application to new problem situations in an organization or for assimilation and reflection in structured learning situations such as courses. An important but under-exploited form of productive learning relates to the capture and reuse of the tacit knowledge of members of an organization. (Collis & Winnips, 2002)

Collis and Winnips describe two approaches for this reuse of tacit knowledge, along with instructional strategies and technologies to support the knowledge capture and reuse process

within each of the approaches. In one of the approaches the emphasis is on how those in mentor or supervisor positions can more systematically support the diffusion of their own tacit knowledge to those of their mentees and in the process create new knowledge for reuse in other situations. In the second illustration, a change in orientation from knowledge transfer to knowledge creation and sharing in the formal training programs of the organization is the focus. An underlying database as well as easy-to-use tools for resource entry and indexing are key elements in facilitating the reuse of experience-based resources within and across both informal and formal learning.

15.3 THE CMC PROCESS

15.3.1 Student Participation

15.3.1.1 Dynamics of the CMC Process. In one of several early studies, Warschauer (1996, 1997) examined the nature of computer-mediated communication (CMC) and its potential in promoting collaborative language learning. He examined various features of CMC in terms of their relationship to theories of collaboration and interaction in education and in language teaching. The most significant of these theories in this study is the "*text-mediational*" interpretation of Vygotsky. Warschauer (1997) states that by bringing together the concepts of expression, interaction, reflection, problem solving, critical thinking, and literacy, and seeing how these concepts are tied together through various uses of talk, text, inquiry, and collaboration in the classroom, the text-mediational view of Vygotsky provides an extremely useful framework for understanding collaborative learning in the language classroom and for evaluating the potential of online education to assist that process. The author then explores several aspects of text-based and computer-mediated interaction and how these aspects relate to the text-mediational interpretation of Vygotsky. Among the apects of CMC examined by Warschauer (1987) are "many-to-many communication," "synchronous discussion in the composition classroom," "synchronous discussion in the foreign language classroom," "time- and place-independent communication," "long-distance exchanges" (both one-to-one and many-to many), and "hypermedia information and student publishing." Warschauer (1997) that all of the long-distance activities described above have several important elements in common. First, the activities are experiential and goal-oriented, with collaborative projects carried out and shared with classmates and foreign partners via the Internet and other means. Second, issues of linguistic form are not dropped out but rather are subsumed within a meaningful context. Finally, international collaboration is combined with in-class collaboration; students work in groups to decide their research questions, evaluate responses from afar, and report and discuss their findings.

These words would seem to summarize many of the dynamic process factors of CMC that are of relevance to much more than the context of language learning. However, much of the early in-depth research into the dynamics of the online learning process seems to have been performed in this context. For example,

Leppänen and Kalaja (1995) discuss an "experiment where computer conferencing (CC) was used in English for Academic Purposes (EAP) in the context of a content-area course." They tested the possibilities offered by CC in the Department with a group of first-year students taking a two-term course in British and American Institutions consisting of a series of lectures, discussions in small groups and reading and writing assignments on relevant topics. Of interest are the class discussions in which the students participated electronically. In these discussions, the

> ... tutor's role turned out to be a fairly passive one. In CC it was the students, and not the teacher, who dominated. In the ESL classroom, in contrast, the teacher normally dominates and does most of the talking. The students, in turn, when they talk, tend to respond only to the teachers question. In the experiment, the students also started off by responding to the tutor's questions, but soon they did other things as well—asked questions, argued, initiated new topic, expressed opinions, commented on each other's messages, etc. (Leppänen & Kalaja, 1995)

Toyoda and Harrison (2002) examined the negotiation of meaning that took place between students and native speakers of Japanese over a series of chat conversations and attempted to categorize the difficulties encountered. The data showed that the difficulties in understanding each other did indeed trigger negotiation of meaning between students even when no specific communication tasks were given. Using discourse analysis methods, the negotiations were sorted into nine categories according to the causes of the difficulties: recognition of new word, misuse of word, pronunciation error, grammatical error, inappropriate segmentation, abbreviated sentence, sudden topic change, slow response, and intercultural communication gap. Through the examination of these categories of negotiation, it was found that there were some language aspects that are crucial for communication but that had been neglected in teaching, and that students would not have noticed if they had not had the opportunity to chat with native speakers. In light of these findings, the authors make pedagogical recommendations for improving chat conversations.

In another language-learning-related study, Sotillo (2000) investigated discourse functions and syntactic complexity in English-as-a-second-language (ESL) learner output obtained via two different modes of computer-mediated communication (CMC): asynchronous and synchronous discussions. Two instructors and 25 students from two advanced ESL writing classes participated in this study. Answers were sought to the following questions:

(a) Are the discourse functions present in ESL learners' synchronous discussions of reading assignments quantitatively and qualitatively different from those found in asynchronous discussions?
(b) Which mode of CMC shows more syntactically complex learner output?

The results showed that the quantity and types of discourse functions present in synchronous discussions were similar to the types of interactional modifications found in face-to-face conversations that are deemed necessary for second language acquisition. Discourse functions in asynchronous discussions were more constrained than those found in synchronous discussions and similar to the question–response–evaluation sequence of the traditional language classroom. Concerning syntactic complexity, the delayed nature of asynchronous discussions gives learners more opportunities to produce syntactically complex language. Sotillo concludes that "asynchronous and synchronous CMC have different discourse features which may be exploited for different pedagogical purposes."

We now proceed from the language-learning context to consider some general aspects of thinking and learning. Writers such as Schon (1983) have alerted the educational community to the importance on reflection-in-action as a learning strategy. Salmon (2000) suggests that, through the provision of opportunities for reflection-in-action at critical learning stages and with the support of a trained e-moderator, the participants in computer mediated conferencing (CMC) can be encouraged to engage in reflecting about their online experiences. Such reflection aids the building of a productive online community of practice. In addition, by encouraging participants to reflect on later stages of their online training experiences, a reflection-on-action record can be built up. Participants' reflective processes can be captured through analysis of their onscreen text messages and so be available for research purposes. Examples of conference text message reflections are given throughout the paper, drawn from the onscreen reflections of Open University Business School (OUBS) associate lecturers who were working online through the medium of computer mediated conferencing for the first time. The conclusion is that reflection-on-practice in the online environment is beneficial for helping the participants to learn from online conferencing and can provide an excellent tool for qualitative research. Opportunities for reflection, says Salmon, need to be built into the design of online conferences and facilitated by a trained e-moderator.

Curtis and Lawson (2001) investigated the extent to which evidence of collaborative learning could be identified in students' textual interactions in an online learning environment. The literature on collaborative learning has identified a range of behaviors that characterize successful collaborative learning in face-to-face situations. Evidence of these behaviors was sought in the messages that were posted by students as they interacted in online work groups.

Analysis of students' contributions revealed that there is substantial evidence of collaboration, but that there are differences between conventional face-to-face instances of collaborative learning and what occurs in an asynchronous, networked environment. There is some commonality between the collaborative behaviors in face-to-face situations and those observed in this study, although there are some important differences. Those differences include the lack of 'challenge and explain' cycles of interaction that are thought to characterize good interchanges in face-to-face tutorials. The significant presence of planning activities within groups interactions, the extent of which seems to be related to communication limitations imposed by the lack of good real-time interaction support tools, was another notable difference between face-to-face and asynchronous online interactions.

In a similar vein of inquiry, Jonassen and Kwon (2001) compared the perceptions of participants, the nature of the

comments made, and the patterns of communication in face-to-face and computer-mediated groups in terms of problem-solving activities while solving well-structured and ill-structured problems. Findings indicated that students in the computer-conferencing groups perceived that communicating asynchronously through the conference was a higher quality and more satisfying experience than did F2F students; that students in the computer-conferencing environment used more task-directed and focused communications while solving both well-structured and ill-structured problems; and that students' patterns of communications in the computer-conferencing groups better reflected the problem-solving nature of the task when compared with the F2F environment. Although most participants indicated in their comments that the major advantage of computer conferencing was its flexibility and convenience, the more important implication is that participants perceived the flexibility to be conducive to deep and reflective thinking, as indicated in participants' comments.

Participants believed that even though they had to make a greater effort to communicate with other group members in the computer conferencing environment, they were satisfied with the group process because the greater levels of personal reflection and critical thinking facilitated better decisions.

That computer conferencing groups required four to six days to complete a group assignment, while most face-to-face groups finished their group assignments within one hour, confirms the greater opportunity for reflection and supports the beliefs of Kaye, Mason, and Harasim (1991) that the computer conferencing environment leads to more reflection and debate. (Jonassen and Kwon, 2001, p. 46)

The authors comment that these results are not consistent with the findings of Olaniran et al. (1996) who found that F2F groups were perceived as more effective, easier, and more satisfying than CMC groups. However, this study confirmed other research that found that group interactions in computer conferences are more task-oriented compared to face-to-face discussions (Olaniran, Friedrich, & VanGrundy, 1992). Both the total number of messages and the number of nontask messages in computer conferencing were smaller than those in face-to-face group negotiations. The study also supports previous research which showed that virtual groups tend to be more task oriented and exchange less social-emotional information (Chidambaram, 1996).

In addition to differences in participants' perceptions and the content of their messages, the patterns of reasoning, as reflected in their communications, also differed. The group interaction patterns in the computer conference were more complex and more similar to problem-solving processes than those in the F2F meetings.

Results of the cluster analysis indicated that the group interaction patterns were influenced by communication mode and to a lesser degree influenced by task variables. Activities were grouped into four different clusters that generally reflected the communication mode as well as the nature of the task (well-structured vs. ill-structured problem solving). Therefore, interaction between communication mode and task variable was a primary predictor of group activities into four patterns. (Jonassen and Kwon, 2001, p. 48)

15.3.1.2 Online Community Development.
As Internet-based education applications began to proliferate, educators and researchers turned their attention to issues related to building community among the online learners (Bruffee, 1993; Dede, 1990, 1996; Harasim, Hiltz, Teles & Turoff, 1995; Kaye, 1995). As online programs replace the on-campus experience, there is increasing interest in understanding how interactions among learners are being addressed in the online world. There is, among other issues, a need to understand what community means in these environments. The emphasis on creating community is fueled by research that reveals a number of positive outcomes for individuals and the learning communities to which they belong. The strong interpersonal ties shared by community members increase the flow of information among all members, the availability of support, commitment to group goals, cooperation among members, and satisfaction with group efforts (Argyle, 1991; Bruffee, 1993; Dede, 1996; Harasim et al., 1995; Wellman, 1999). Individuals tend to benefit from community membership by experiencing a greater sense of well being and happiness, and having a larger set of colleagues to call on for support in times of need (Haines & Hurlbert, 1992; Haines, Hurlbert & Beggs, 1996; Walker, Wasserman, & Wellman, 1994; Wellman & Gulia, 1999b).

However, the situation in many learning communities is different from what many of these authors describe. First, the classic community model is bound to the notion of people living close to each other, interacting face-to-face to share companionship and support of all kinds (Wellman, 1999). So, too, our concept of learning communities is typically bound up with the notions of university campuses and physical colleges. How can we build community without a physical place, and through computer media that are unable to transmit the full range of verbal and nonverbal cues necessary to support strong interpersonal ties?

Second, there are different classes of communities described in the literature. Some authors focus on learning communities, as a general category (Baker & Moss, 1996; Bauman, 1997; Cross, 1998; Haythornthwaite, 1998; Hill & Raven, 2000; Kowch & Schwier, 1997; Palloff & Pratt, 1999; Rasmussen & Skinner, 1997; Raymond, 1999; Riel, 1998; Schwier, 1999; Wilson & Ryder, 1996). Others distinguish between learning communities and communities of practice (Lave, 1993; Lave & Wenger, 1991; Wenger, 1998). Yet others single out the special characteristics of virtual or online communities (Kim, 2000; Preece, 2000; Wellman, 1999; Wellman, Carrington, & Hall, 1988; Wellman & Guila, 1999a, 1999b).

Some studies of online environments have found that one can indeed create community and sustain strong ties through electronic media (e.g., Baym 1995, 1997; McLaughlin, Osborne, & Smith, 1995; Reid, 1995; Rheingold, 1993; Smith, McLaughlin, & Osborne, 1996). These studies show that when we view community as what people do together, rather than where or through what means they do them, we can see that community can exist separate from physical boundaries such as campuses (Wellman, 1999). Yet other studies suggest that online participants in email networks, newsgroups, chat rooms and MUD environments support common goals and a strong commitment to the purpose and tone of their community (Baym,

1995; Curtis, 1997; Donath 1999; King, Grinter, & Pickering, 1997; Reid, 1995; Rheingold, 1993). They recognize boundaries that define who belongs and who does not, establishing their own hierarchies of expertise, their own vocabularies and modes of discourse (Marvin, 1995; Sproull & Kiesler, 1991). They may develop special rules and behaviors, even community rituals (Bruckman, 1997; Fernback, 1999; Jones, 1995, 1998; Kollock & Smith, 1999; McLaughlin, Osborne, & Smith, 1996).

In one study, singled out from this plethora for its unusual and unique contribution to the literature, Bruckman (1997) asserts that too much attention is paid to the Internet's ability to provide access to information and not enough to its use as a "context for learning through community-supported collaborative construction."

A constructionist approach to use of the Internet makes particularly good use of its educational potential. The Internet provides opportunities to move beyond the creation of constructionist tools and activities to the creation of constructionist cultures.

These issues are explored through a specific example: MOOSE Crossing, a text-based virtual world (or MUD) designed to be a constructionist learning environment for children ages 8 to 13. On MOOSE Crossing, children construct a virtual world together, making new places, objects, and creatures. Bruckman's thesis discusses the design principles underlying a new programming language (MOOSE) and client interface (MacMOOSE) designed to make it easier for children to learn to program. It presents a detailed analysis, using an ethnographic methodology, of children's activities and learning experiences on MOOSE Crossing, with special focus on seven children who participated in a weekly after-school program. In its analysis of children's activities, this thesis explores the relationship between construction and community. It describes how the MOOSE Crossing children motivated and supported one another's learning experiences: community provided support for learning through design and construction. Conversely, construction activities helped to create a particularly special, intellectually engaging sort of community. Finally, it argues that the design of all virtual communities, not just those with an explicitly educational focus, can be enhanced by a constructionist approach.

However, the special characteristics of groups (cohorts) in formal educational contexts are rather specific and in many ways different from the types of communities described in much of the literature quoted above (including Bruckman's thesis). For example, the virtual community literature puts much emphasis on attracting members and defining the community based on common interests. But in many educational contexts the students are "forced" to form a community by the structure of the course they are taking. Outsiders, who are not registered on the given course, are not allowed to participate. And the course participants are not a special-interest group of people who share common goals and can share relevant experience and knowledge. Unlike an informal learning community, which is based on a self-selected group of people coming together for informal learning purposes, the formal learning community is largely defined and structured by others than the actual community

members. Obviously, students may be encouraged to bring their experience and knowledge to bear on their coursework, but nevertheless, the learning in question will be much more restricted and externally defined than an informal learning community.

Misanchuk and Anderson (2002) discuss the above mentioned argument in a paper that proposes specific strategies for moving an online class "from cohort to community." The authors give suggestions for instructional and noninstructional strategies that have students interacting at the levels of communication, cooperation and collaboration. Strategies that fall into the instructional category include: ways of presenting material; assignment design; team management; content covered; strategies for discussing material. Noninstructional strategies include: creating a computer support system so that students look beyond the technology; making reserve readings and other library resources readily available to distance students; designing an on-site orientation that encourages students to quickly bond with each other at the beginning of the program; creating an online café for off-topic discussions; dealing with team/class disputes. The authors also identify a range of questions requiring further research. These include:

- What are valid measures of community development?
- How can learners be motivated to take part in community activities?
- What are the special features of the "forced community"?
- What is the expected/observed life cycle of the typical learning community?
- How does this community develop and maintain its history?
- Should the distance community be integrated with the residential graduate community? If so, how can this be accomplished?
- How can the community best be mentored?
- What are the different roles for instructors, graduate assistants, volunteers, etc?
- What communication/collaboration tools foster the development of a learning community?
- What are the best practices for using existing communication tools in distance education?
- What tool features lend themselves to different aspects of collaboration and community building?

Some recent research studies have addressed at least a few of this list of questions. Rovai (2002a, 2002b) investigated how the sense of community differs between students enrolled in traditional face-to-face and those enrolled in asynchronous learning network (ALN) courses. Subjects consist of 326 adult learners who were enrolled in a mix of 14 undergraduate and graduate courses at two urban universities. As operationalized by the Sense of Classroom Community Index (SCCI), there appears no significant difference in classroom community between the two groups of subjects. However, a discriminant analysis shows a significant overall difference in community structure between the two groups. Variations between groups on feelings of similarity of needs, recognition, importance of learning, connectedness,

friendship, thinking critically, safety, acceptance, group identity, and absence of confusion are the characteristics contributing mostly to this difference in learning effectiveness.

Brown (2001) discusses the process of community building in CMC, very much from the perspective of the students participating in the learning community. Based on interviews with 21 adult learners participating in online courses, she outlines a three-stage process of community development. The first stage was making friends online with whom students felt comfortable communicating. The second stage was community conferment (acceptance) which occurred when students were part of a long, thoughtful, threaded discussion on a subject of importance after which participants felt both personal satisfaction and kinship. The third stage was camaraderie which was achieved after long-term or intense association with others involving personal communication. Each of these stages involved a greater degree of engagement in both the class and the dialogue. She lists several helpful strategies to get the students to participate more fully in the social aspects of the forming community:

- Early discussion of community and its potential benefits may create a perceived need that students will then want to fill. Certainly the discussion will convey that community is a course expectation so students will work to meet it.
- Building opportunities for the students to learn more about each other to facilitate early discovery of commonalities. Asking the students to provide e-mail addresses, phone numbers (suggested but not required) and FAX numbers to encourage communication beyond the required responses.
- Asking them to note in the cafeteria when they are planning to go to what conferences or to be on-site because others from class may be there, and they could meet face-to-face.
- Using a "community reflection piece," perhaps three times a semester, in which students note what they have done to contribute to community, what others have done to help them feel more a part of a community, what this has accomplished, and what still needs to be attained.

Another perspective on community building is offered by Oren, Mioduser, and Nachmias (2002), reporting on five studies at Tel Aviv University, that explored social climate issues in both synchronous and asynchronous online activities in academic courses. These studies focused on the following questions: Does a social atmosphere develop in online learning discussion groups? What are the different modes of social interaction are manifest in online learning discussion groups? What is the role of the virtual teacher with regard to the social climate in online learning discussion groups?

Their research shows that teachers find it difficult to change their dominant role to that of moderators and facilitators of learning. As a result, students neither have enough opportunities to interact with each other, nor are they directed to develop self-initiative and make active contributions to the collaborative learning process. Social behavior is a natural human need and is acknowledged as an important factor in the development of learning processes. In their tutoring and moderating of virtual learning groups, teachers should explicitly support creation of a social climate with learning groups. With respect to the teachers' role in promoting community, the authors suggest that online teachers should:

- Moderate the group's work in a way that enables students to interact;
- Encourage participants to create a relaxed and calm atmosphere;
- Be attentive to participants' social needs;
- Offer a legitimate platform for messages that have social significance;
- Enhance the social atmosphere by using supportive feedback, discussing with the group ways to facilitate the creation of social interactions, emphasizing the importance of peer feedback, and by encouraging students to relate to each other during the learning activities and beyond.

Further observations at the level of the *pedagogical rationale* of online courses are related to aspects such as the character of the assignments included in the course, the focus of the discussion forums, or the identities assumed by the students. Examples of these are:

- Group work should be encouraged and course developers should aim to define learning assignments that demand varied forms of interaction and collaboration.
- Teachers should implement learning strategies that support communication such as appointing students to moderate discussion groups or encouraging students to help each other and to refer to each other.
- Course developers should create a varied range of virtual spaces in order to respond to different social needs evolving during the group's work.
- A distance learning course should include a social forum as a place for social integration of the learning group.
- It should also include a forum in which students can find contextual (e.g., technical, content-related) help.
- In order to achieve the degree of intimacy required for significant exchanges within online interactions, the number of participants be limited to 20.

This list of suggestions quite clearly places to responsibility for the building of a social climate and community on the course developers and teaching staff involved. It is not surprising, therefore, that in the remainder of their paper, the authors stress appropriate teacher training as a key factor in the "design of successful models of socially sound technology based learning."

15.3.2   Teacher Participation

15.3.2.1   Teaching Strategies in CMC. Online teachers have at their disposal a variety of novel strategies that they may incorporate in their lesson plans. Some of these, such as online threaded discussion lists, have already been discussed earlier. Others will be mentioned in this section. They also face some

novel problems, for example the relatively greater difficulty of keeping a virtual group working in an asynchronous mode "on task" or "on topic" (Romiszowski & DeHaas, 1989). Recent studies have begun to offer solutions to some of these problems.

Beaudin (1999) identifies various techniques recommended and used by online instructors for keeping online learners on topic during asynchronous discussion and researches what factors affected their selection. A 37-item online questionnaire was developed and completed by 135 online instructors. Thirteen techniques for keeping online asynchronous learners on topic were rated using a six-point Likert scale. The online instructors rated the following as the top four techniques for keeping asynchronous online discussion on topic:

1. Carefully design questions that specifically elicit on-topic discussion.
2. Provide guidelines to help online learners prepare on-topic responses.
3. Reword the original question when responses are going in the wrong direction.
4. Provide discussion summary on a regular basis.

A common element for learning in a typical classroom environment is the social and communicative interactions between student and teacher, and student and student. In examinations of interaction, the concept of presence or a sense of being in a place and belonging to a group also has received attention. However, as this concept is studied, the definition is expanding and being refined to include telepresence, cognitive presence, social presence, teaching presence, and other forms of presence. The term community is related to presence and refers to a group of individuals who belong to a social unit such as students in a class. In an online course, terms such as communities of inquiry, communities of learners, and knowledge-building communities have evolved. As the definition of presence has expanded and evolved, a distinction is being made between interaction and presence, emphasizing that they are not the same. Interaction may indicate presence but it is also possible for a student to interact by posting a message on an electronic bulletin board while not necessarily feeling that she or he is a part of a group or a class. If they are different, then it is also possible that interaction and presence can affect student performance independently.

Anderson et al. (2001) developed a tool for the purpose of assessing *teaching presence* in online courses that make use of computer conferencing. The concept of *teaching presence* is defined as having three categories—design and organization, facilitating discourse, and direct instruction. Indicators that we search for in the computer conference transcripts identify each category. Pilot testing of the instrument reveals differences in the extent and type of teaching presence found in different graduate level online courses. Results show the pattern of teaching presence varying considerably between two courses (in education and health) facilitated by two experienced online teachers.

Liu and Ginther (2002) review the knowledge base for verbal and nonverbal factors affecting impression formation in both FtF and CMC environments. Based on this review, instructional strategies for achieving effective communication and a positive impression in CMC distance education courses are proposed.

These recommendations cover both verbal and nonverbal strategies. The verbal strategies discussed include:following language norms for greetings, information sequencing, reciprocity, and appropriate compliment giving; using standard discourse schemas—interpersonal, rhetorical, and narrative—selectively, in accordance with the nature of the topic being communicated; using pragmatic and syntactic codes selectively; using intense language, such as strongly worded messages, to express their attitudes toward the topic being communicated; using immediate language; using a wide range of vocabulary; using powerful language style; selecting appropriate verbal influence strategies when being involved in disagreements and/or persuasive learning tasks; using appropriate ironic remarks.

The nonverbal strategies discussed include: using paralinguistic cues such as emoticons appropriately; taking into account chronemics; maintaining a high frequency of messaging; maintaining longer duration messages; maintaining a fast reply of messaging; manipulating primacy effect; manipulating recency effect; ensuring no typing errors. Rossman (1999) performed a document analysis of more than 3000 course evaluations from 154 courses conducted during 11 consecutive quarters. The narrative responses were grouped into the following categories: faculty feedback, learner discussions, and course requirements. General observations related to these categories are presented followed by several tips for successful teaching in an online environment using an asynchronous learner discussion forum. The tips were initially generated by the document analysis. Additional tips were then added and the list was revised each quarter following the end-of-quarter teleconference with the instructors. The tips discussed include the following.

A. Faculty Feedback: Weekly notes on class business; encourage learners to send private e-mail messages or to phone the instructor as appropriate; send personal notes throughout the online course to simulate the informal chat that often occurs at the beginning of a traditional class; keep track of those who respond and those who do not; encourage learners to complete course evaluations; encourage learners to engage each other in debate; post relevant citations or URLs; encourage learners to be on the lookout for URLs that interface with the course content units and to post them to the discussion forum for all to see; keep track of these to enhance the next offering of the course.

B. Facilitating Discussion: Present a personal introduction the first week. Send a picture of yourself to all learners at all sites. Encourage learners to pass on to one another any helpful hints they may have or hear about regarding success at the home institution. Let learners know if you are comfortable with a first name basis for those who wish to address you by your first name. Use synchronous postings to the discussion forum and allow learners to post at their convenience. Post a weekly summary of the class discussion for the prior week. Make every effort to keep learners up to speed with the discussion's progress. Monitor the quality and regularity of learner postings. Keep all comments positive in the forum—discuss negative feedback privately. Learners frequently have expertise related to the subject matter of the course and should be encouraged to share their knowledge with their

classmates. Keep notes about each learner so that you are reminded about learner interests and experience.

C. Course Requirements Be sure to let the class know what your expectations are for the course. Be sure to negotiate the final project requirements, if required, with the learner well in advance of the time it is due. Be sure to find the time at the end to go through all the final papers or projects.

Campos, Laferrière, and Harasim (2001) analyse the teaching practices of postsecondary educators who integrated asynchronous electronic conferencing in over 100 mixed-mode courses at eight North American institutions between 1996 and 1999. Quantitative and qualitative research methods were applied to assess their practices and to further understand the correlation between the use of electronic conferencing and the degree of collaboration achieved. Based on the findings, pedagogical approaches for the use of electronic conferencing are provided, and are grouped according to the level of collaboration. As a result of this study, the authors present a suggested model for the networked classroom to foster and guide the transformation of pedagogical practice.

The study suggests that educators are integrating conferencing technology into their teaching in creative and dynamic ways. Results point to a re-discovery of the art of teaching with the support of new technologies. The authors suggest that even the most individualized activity presents a minimal level of collaboration. The findings highlight the pedagogical opportunities that technology offers to education and the profound changes that networked classrooms may bring to the very nature of the teaching and learning experience. This study also demonstrates the more online experience educators possess, the less they focus on individual processes and the more they benefit from the advantages and collaborative possibilities that new learning technologies bring. Finally, the authors claim that educators are learning how to integrate networked activities through applying and transferring their face-to-face expertise into the online environment. The findings and model identified present a first step for considering the dynamics of online course design.

15.3.2.2 Teacher Training and Development. One question raised by the previous paragraphs might be: So where do the online teachers gain their initial experience and expertise in online teaching? The answer most commonly offered is "On the Internet." This response may imply "learning by doing," but it also implies "learning from others, through knowledge-sharing in virtual communities of like-minded teachers." The literature on the use of such communities of practice is, as we have seen, quite extensive. However, in the case of the use of such communities for in service teacher development (whether for online or conventional teaching duties), the literature is not very conclusive.

Zhao and Rop (2000) present a critical review of the literature on networks as reflective discourse communities for teachers, that merits more detailed analysis. The study was guided by five questions.

First, why were electronic networks developed for teacher professional development? Second, what beliefs about the benefits of electronic teacher networks for professional development are evidenced by the goals of the networks? Third, to what extent were these claims evaluated in the literature? Fourth, to what extent were the claimed benefits realized? And last, what factors (e.g., technological and social arrangements, and participants' cognitive and affective characteristics) seem to be related to the degree of success or failure?

Twenty-eight papers, describing 14 networks that "ranged from small local efforts to huge national projects, and from early, pioneering ventures to very recent and current undertakings," were analyzed according to criteria established for the five research questions. It may be interesting to summarize the findings related to each of these questions, as they shed much light on the current state of the research on many topics associated with CMC.

Why Electronic Teacher Networks? The characteristics of CMC technologies that have been most frequently promoted in the literature as having the potential to counter the difficulties in teacher professional development are their power to transcend time and space. Furthermore, CMC technologies are believed to have the potential to individualize professional development. In addition, telecommunications technology may encourage the reflection needed for long-term teacher growth in several ways. Written interaction allows time to carefully shape discourse. This may encourage reflection and enable participation for some teachers. Network interactions also offer various degrees of anonymity. For some individuals this may encourage a freedom of expression and comfort level that allows them to address issues that they may not feel free to share with school colleagues (Hawkes, 1997; Zhao, 1998).

What Claims Were Made for the Effects of the Network? It is often claimed that networks had a number of positive effects on their participants: they supposedly reduced teacher isolation, enabled cooperative curriculum development, facilitated the dissemination of information, and provided easy access to curricular materials. The network also connected teachers to "local, national, and global communities of peers and experts," providing links to subject matter Internet resources, providing support for teachers and students in using community-based projects for math and science learning, and providing collaborative research opportunities. The network also supported conversations and "philosophical" discussions in addition to information and practical suggestions, and increased teachers' understanding of the national standards. Finally, it was claimed that networks provided emotional support for their participants and encouraged the feeling of belonging to a group. The general tendency is to assume that a group of people connected and periodically interacting via some kind of CMC technology constitutes an online community. Both in the larger body of literature that we initially explored and in the set of papers on the 14 networks examined, community is a term that generally is used as casually as it is pervasively. Although these networks were identified as communities, they were not necessarily identified as reflective discourse communities. The number of networks identified as "reflective discourse communities" is much smaller (about 34%). The concept of reflection and discourse as terms for substantive, thoughtful conversations, although not as commonly occurring as ideas of community, do appear repeatedly in the literature.

To What Extent Were the Claims Evaluated? It is evident that beliefs about benefits shaped the network goals, but it is not common that the subsequent claims were carefully examined in the literature. Very few of these networks were subjected to a research process to determine if community did indeed exist; further, there were very limited indications of what community might be, and no concerted effort to define the concept. In most cases the only evidence that could be garnered for the existence of a community was that a number of people were communicating with each other.

Were the Claimed Benefits Realized? Most of the literature does not provide enough evidence to answer this question in any scientific fashion. In some cases authors made effective cases for specific claims. The more limited and specific the claims, the more likely that they were supported. However, in many cases, broad claims were made without supporting evidence. It is also safe to suggest that not many reflective discourse communities, in the true sense of the words reflective, discourse, and community, were realized in these efforts.

What Factors Are Related to the Success of Networks? Although a lot of time, money, energy, and commitment are being spent in trying to use telecommunications to link teachers, it seems apparent that the majority of these efforts are only mildly successful, even on their own terms. Some common factors surface which are necessary but not sufficient conditions for simply getting teachers talking to each other. We highlight some of these in the following paragraphs.

Technology. Teachers' technological proficiency, access to equipment, and the stability of the technology have been reported to influence the success of networks. Several of the networks in this study found that their greater goals were limited or prevented by the teachers' technical difficulties.

Motivation. Teachers must have some reason to talk to each other in the first place. We found that most of the networks were developed by university researchers with support from government agencies or private foundations. Very often the reasons for using the networks were determined by these researchers or project leaders, and not by teachers.

Project Time Frames. Most of the networks had a relatively short life span. Consequently, few networks reached a point where a clear assessment of the project was viable. Many reports focused on suggestions for the future, rather than evidence of success.

Time to Participate. Teachers cite a lack of available time as a primary reason for foregoing online communication. This problem must be addressed before it is reasonable to expect that reflective discourse communities can be effectively supported.

Project Goals. The development of teacher reflective discourse communities in electronic contexts demands significant amounts of funding, with little to show for it in traditional terms. It also requires the development of a research base that supports the effects of this type of teacher development.

To summarize, it seems that the interest in development of computer networks for teachers results from two considerations: (1) CMC technologies can transcend time and space to bring together teachers who may not be able to communicate with each other in face-to-face situations, and (2) the nature of CMC technologies may enhance reflections and community-building among teachers. Many networks have pursued the goal of building learning and reflective communities of teachers. However, the authors found a general lack of rigorous research on these networks. Little is known about their effectiveness for teacher learning. Few researchers seriously examined the degree to which the networks indeed were communities that promoted reflective discourse.

We now turn to some important issues highlighted by the study findings. First, although it seems that claims about the power of CMC technology to create reflective communities for teachers have not been well supported by systematic empirical evidence, on a theoretical level these claims seem logical and reasonable. Secondly, the study shows that although much has been written about the teacher networks, most of the studies have been descriptions of the design and implementation of networks, or a priori arguments for CMC's potential benefits for teacher professional development. Furthermore, the evaluative studies relied mostly on surface features, such as number of participants, number of messages/turns, or simple topic/thread counts, and anecdotal evidence, such as selected comments by participants.

Collaboration is generally described as a process of willing cooperation with peers and colleagues to reach educational objectives. In schools, however, teachers often work more in isolation from—than in collaboration with—each other. In a study of teachers' collegial relations, Rosenholtz (1988), using case study methods and repeated measures, arrived at some conclusions about the effects on teachers working in isolation. In interviews with 55 teachers from schools classified as having isolating characteristics, Rosenholtz found that collaboration included little if any sharing of existing materials and ideas; that planning and problem solving with colleagues rarely happened at all; and that teachers preferred to keep discipline problems to themselves.

Newer visions of professional development emphasize critical reflection on teaching practice through collaboration and collegial dialogue. Research on approaches bearing these qualities indicate that by using them, teachers are better able to make and sustain unproved instructional practices with greater consistency than when attempting to make these improvements alone or when supported by traditional professional development approaches (Corcoran, 1995; Darling-Hammond, 1996; Lichtenstein, McLaughlin, & Knudsen, 1992; Lieberman & McLaughlin, 1993). Unfortunately, the research also indicates that due to time, cost, and lack of will and vision, opportunities to engage in professional development experiences that are collaborative, collegial, and reflective are limited (Lichtenstein, McLaughlin, & Knudsen, 1992; Little, 1993, Lieberman, 1995).

In its role of bringing together diverse voices, CMC is thought to be especially suited to the task of linking teachers together in experiences that may be both professionally and personally rewarding (Honey, 1995; Kimball, 1995; Ringstaff, Sandholtz, & Dwyer, 1994).

Despite CMC's ability to connect teachers, little is known about the technology's ability to facilitate teacher collaborative reflective processes. Studies that do address reflection are usually done in the highly controlled context of pre-service teachers development (Colton & Sparks-Langer, 1993; Kenny, Andrews, Vignola, Schilz, & Covert, 1999; Mickelson & Paulin, 1997; Ropp, 1998). Only a few studies address the reflective quality of computer-mediated discourse for practicing teachers. Of those studies, little description of the reflective processes or outcomes of collaborative teacher discourse is offered.

One of the earliest efforts offering an insight into the application of network-based communications is the LabNet project. In 1989 the Technical Education Research Center (TERC) launched the LabNet project as a technology-supported teacher-enhancement program aimed at high school physics teachers. LabNet organized 99 physical science teachers from across the county into clusters of 6 to 10 teachers in a summer workshop experience. Teachers used the asynchronous network to communicate with peers both in and out of their clusters. An analysis of the conversation of these teachers showed discourse outcomes of growing teacher confidence for teaching physics, increased enthusiasm for teaching, and a sense of belonging to the physics teaching community (Spitzer, Wedding, & DiMauro, 1995). These outcomes are attributed in part to the reflective nature of the teacher discourse. Unfortunately, the study does not treat reflection as a systematic variable, and no discussion on the nature of the reflection or the process used to examine the reflective content is made.

Another informative study of reflective outcomes of CMC is McMahon's (1996) research on the PBS Mathline project. This project brought together middle school teachers using a wide range of technologies—video, computers, satellite, and closed circuit broadcast television—to deliver and discuss material aligned with National Council of Teachers of Mathematics (NCTM) standards in curriculum, teaching, and assessment. The online electronic support system linked 25 to 30 teachers at a time. McMahon studied the flow, frequency, and volume of the 393 messages posted to the listserv over the 8 weeks of the course. Using a four-point reflection rubric to determine the reflective nature of electronic messages in the listserv, McMahon discovered that 29 percent of the participants posted at least one critically reflective message. A message was critically reflective when it "raised issues exploring underlying beliefs, motivations, and implications related to teaching and learning" (p. 91).

In a similar vein, Hawkes & Romiszowski (2001) describe a study that explored the professional development experiences of 28 practicing teachers in 10 Chicago suburban schools involved in a 2-year technology supported problem-based learning (PBL) curriculum development effort. Asynchronous computer-mediated communications were used as the communication tools of the project. The computer-mediated discourse produced by the teachers was compared with the discourse produced by teachers in face-to-face meetings. Research methods including discourse analysis and archival data analysis were applied to determine the nature of the teacher discourse and its reflective content.

The primary goal at the outset of the program involved building teacher capacity for developing PBL curricula. Teacher teams completed and delivered their first PBL unit in the spring of the first project year. Teachers provided written critiques on their units shortly after, and planned for refinements to the first PBL units and the development of a second unit through the summer. The focus of the second year of the initiative was to use new technology tools to expand teacher instructional practices and skills in PBL curricular development.

To determine what levels of collaborative reflection are present when teachers interact under normal circumstances, researchers recorded face-to-face work meetings of school teams consisting of two to five teachers. The collection of computer-mediated communication commenced through the same four month period that face-to-face data were gathered. Collection and storage of CMC discourse between members of the group was ongoing. Researchers categorized messages posted to the common project forums as they were produced. Reading the posts as they appeared provided an indication of the pace of online activity and the topics that were addressed.

All computer-mediated and face-to-face communications between project participants were scored on a seven-point reflection rubric. The rubric is based on Simmons, Sparks, Starko, Pasc, Colton, & Grinberg's (1989) taxonomy for assessing reflective thinking. This framework for analyzing the reflective discourse embraces a model of teacher development in which teachers acquire new information that helps them reach "new and creative solutions" to decision making through collaborative dialogue-leading to reflection (Colton & Sparks-Langer, 1993; p. 49). Independent rater assessments show that computer-mediated discourse achieves a higher overall reflective level than reflections generated by teachers in face-to-face discourse. Although more reflective, CMC proved not to be as interactive as face-to-face discourse.

Teachers found that the convenience, quality, breadth, and volume of peer-provided information facilitated by network technology improved their knowledge of educational theory, policy, and the educational community. Still some teachers in this study remained hesitant about the use of technology for an intimate level of discussion. Follow-up interviews revealed that nearly half the teachers participating in this study firmly believe that CMC cannot a replace face-to-face conversation; that the disjointed presentation of information on the medium is difficult to understand; and that disclosure on a public forum brings professional risks. These and other reservations remind us that network technology is not an answer to every teacher's professional development needs.

15.4 THE INDIVIDUALS INVOLVED IN THE PROCESS

15.4.1 Student-Related Questions

15.4.1.1 Gender Issues. Issues of gender have been studied ever since the first computer networks and email systems were invented. Recently, the intensity of this particular strand of research seems to have become less popular. It is not clear

whether this is due to the "answers being known" or to other reasons. The few selected research studies on gender influences in the context of educational CMC, reported below, would seem to indicate that there is still much to learn regarding this question.

Tella's (1992) study focused on "students' attitudes and preferences to teaching practices and teaching tools." The study examined the "gender sensitivity" of e-mail and "the question of equality" in education. Tella addressed the following issues: "computer equity/inequity," "equality education," "opinions and preferences between boys and girls concerning the use of communications NetWorks and e-mail," "achievability of aims and goals," "student-generated disturbances," and "students' initiative."

In the course of the study, Tella found that girls' comments were "more analytical" than those of boys. "When expressing a critical opinion, many girls motivated their views while the boys often contented themselves with blunt statements. More girls than boys appeared to be ready to commit themselves to a new kind of learning environment." Tella concludes that computer-mediated instruction should take into account the differences which tend to surface regarding boys' and girls' preferences and aptitudes in computing. Boys tend to have an interest in the hardware and technology used in itself, while girls tend to focus on "manipulat[ing] the word-processors" and "exchang[ing] ideas in writing." In the end,

both boys and girls could enjoy working in a learning environment focused on computer-mediated communication", becoming "deeply committed to working in an e-mail-equipped co-operative environment". In such an environment they would "learn not only from each other but also learn from and interact productively with the computer.

Hardy et al. (1994) open their article with a review of important studies dealing with "Gender and CMC," "Gender and education," and "Gender and language." The article principally deals with three small-scale studies which Hardy and her colleagues performed on three computer-mediated graduate courses in management learning. The first study looks at the number and length of turns taken by men and women in online conferences. The results of this study showed that women take more turns, but that the length of turns is approximately the same for men and women. Many previous studies had claimed that men generally took more turns.

The second study treats "the nature of men's talk and of women's talk and their impact as experienced by women." This study's results showed that women spent more time "being themselves or using their own language" and finding "the ease of feeling connected to and responding to other women." On the other hand, women commented on the men's contributions, referring to the length, "the language used and something about the style, 'heavy and cerebral' and their [own] reactions such as to be 'intimidated', or to 'shy away'."

The third study deals with comments on how "some people behaved online and how easy or not it was to read and respond to their inputs." Women tended to engage in "rapport" talk, while men engaged in "report" talk. While women would speak of feelings or relationships between participants, men

tended to distance themselves emotionally and intellectualize all responses. Sometimes, when "feelings" were at issue male participants would address other males about something a female had written, rather than respond to the female directly.

The authors conclude that while CMC does have certain egalitarian potential (in the realm of turn taking) there is still a "subtle potential for gender imbalance in online conversations."

In contrast, Ory, Bullock, and Burnaska (1997) present the results of an investigation of male and female student use of and attitudes about CMC after 1 year of implementation in a university setting. Results of this study revealed no significant gender differences.

Blum's (1999) research project was an interpretative qualitative case study of higher education students learning through asynchronous, CMC-based distance education. Subjects consisted of adult professionals studying for bachelor and master's degrees. Male and female preferred learning styles, communication patterns, and participation barriers were compared for differences in gender. Differences were then contrasted with traditional gender differences in face-to-face (FTF) higher education learning environments. Results of content analysis from one month of online student messages suggests there are gender differences between male and female distance education students which contribute toward inequitable gender differences which are both similar and different from the traditional learning environment. There are higher dispositional, situational, and institutional barriers for female distance education students. This helps to create an inequitable learning environment for distance education students because the nature of the medium requires at least some technical skills and a degree of confidence about distance education. Furthermore, the CMC-based environment supported a tolerance of male domination in online communication patterns, which effectively silenced female students. Implications for practice are discussed.

15.4.1.2 Discourse Analysis. Kilian (1994) treats what he refers to as the "passive–aggressive paradox" in online discussions as it applies to the classroom. While many claim that electronic media help to eliminate the domination of discussion by a small minority, this may not in fact be the case. Kilian holds that in electronic bulletin board systems, for example, a few contributors dominate while everyone else "lurks." This is what he calls the passive–aggressive syndrome. The same phenomenon, he contends, occurs in the classroom: "Most teachers and students who go on line are passive readers of other people's postings; they rarely, if ever, respond to what they read. That leaves the aggressives in charge—teachers and students who post often and, of course, have only one another to respond to." This is due to the fact that people who are not computer specialists do not know the "rituals" of cyberspace—which is to say that there is no easily identifiable linguistic register on line. As a short-term solution, Kilian (1994) suggests that: "Cyberspace democracy, like the classroom itself, will need to rely for a time on teacher domination of the medium to ensure that a disinterested moderator is there to look after the interests of the less aggressive." For the long term, he writes that "we need to get beyond mere netiquette to find the real registers of on-line communication."

Uhlíøová (1994) examined the "textual properties of a corpus of computer-mediated messages" to "show the effects of the computer as a new technological medium upon the message." The corpus of messages studied was composed of over 100 messages written by two correspondents in Prague to various recipients, and approximately 50 messages which these same two correspondents received. Uhlíøová outlines the "*contexts of situations*" in which e-mail is used. These include the following: common *subject matters;* more or less private issues; secondary messages (e.g., a proposal for an official wording of an agreement or of a project, a curriculum vitae, a list of e-mail names); and messages about the technology of e-mailing. Also included in the article are descriptions of the mix of spoken and written language features in e-mail. Uhlíøová concludes that e-mail "...contributes significantly to the development of language use offering new writing strategies in the frame of new constraints and requirements of the medium." This is because "although *written* in its substance, e-mail messages are in some respects no less interactive than speech," and this "blurs" the categories of writing and speaking. Not only does the "capability of e-mail to widen the possibilities of language use" affect the content of messages sent, but may eventually lead to the creation of new registers."

Warschauer, Turbee, and Roberts (1996) analyze the potential of computer learning networks to empower second language learners in three ways: (1) by enhancing student's opportunities for autonomous control and initiative in language learning, (2) by providing opportunities for more equal participation by those students who may be otherwise excluded or discriminated against, and (3) by developing students' independent and critical learning skills. The article reviews the literature as it relates to these three points and also includes a discussion of potential problems. The final section, "Suggestions for the Practitioner," discusses some general principles for effective use of computer learning networks.

In a related paper, Warschauer (1996a) compared ESL students' discourse and participation in two modes: (1) face-to face discussion and (2) electronic discussion. A repeated measures, counterbalanced experiment was set up to compare student participation and language complexity in four-person groups in the two modes. Using a formula which measured relative balance based on words per student, the study found that the electronic discussion featured participation which was twice as balanced (i.e., more equal among participants) than the face-to-face discussion. This was due in part to the fact that the Japanese students in this multiethnic class were largely silent in the face-to-face discussion, but participated much more regularly in the electronic discussion. The study found that students' increased participation in the electronic mode correlated highly with their relative feelings of discomfort in face-to-face discussion.

Finally, the study looked at the lexical complexity of the discourse in the two modes as well as the comparative syntactic complexity. The electronic discussion was found to be significantly more complex both lexically and syntactically. This finding was highlighted by the use of examples which illustrated some of the lexical and syntactic differences between the discourse of the two environments.

15.4.1.3 Individual Student Styles, Perceptions, and Attitudes. The research literature regarding the importance of interaction in education especially in Web-based distance learning is extensive. Both students and faculty typically report increased satisfaction in online courses depending on the quality and quantity of interactions. For example, Shea, Fredericksen, Pickett, Pelz, and Swan (2001) in a survey of 3,800 students enrolled in 264 courses through the SUNY Learning Network (SLN), conclude that the "greater the percentage of the course grade that was based on discussion, the more satisfied the students were, the more they thought they learned from the course, and the more interaction they thought they had with the instructor and with their peers." Dziuban and Moskal (2001), likewise report very high correlations and relationships between interaction in online courses and student satisfaction.

Related to the research on interaction is the concept of presence. Students who feel that they are part of a group or present in a community will, it is argued, wish to participate actively in group and community activities. Lombard and Ditton (1997) define presence as the perceptual "illusion of nonmediation." An illusion of nonmediation occurs when a person fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there. Furthermore, because it is a perception, presence can and does vary from individual to individual. It can also be situational and vary across time for the same individual, making it a complex subject for research. Researchers studying applications related to virtual reality software, CMC and online learning increasingly are redefining our understanding of presence in light of the ability of individuals to communicate extensively in a group via digital communications networks. The term "telepresence" has evolved and has become popular as an area of study.

Biocca (1995) classifies presence into three types: spatial presence, self-reflective presence and social presence. Rourke, Anderson, Garrison, and Archer (2001a; 2001b) have proposed a community of inquiry model with three presence components: cognitive, social, and teaching. Their model supports the design of online courses as active learning environments or communities dependent on instructors and students sharing ideas, information, and opinions. What is critical here is that presence in an online course is fundamentally a social phenomenon and manifests itself through interactions among students and instructors.

Interaction and presence in a an online course can be studied for many reasons. Ultimately, however, student performance outcomes need to be evaluated to determine the overall success of a course. An extensive amount of literature exists on performance outcomes as related to distance learning. Course completion and attrition rates are considered to be important student performance measures especially as related to adult and distance learning. The literature on quality issues in distance learning suggests that multiple measures related to individual academic program and course objectives should be used in studying student performance (Dziuban & Moskal, 2001; Shea et al., 2001). Performance data can be in the form of tests, written assignments, projects, and satisfaction surveys. The above discussion sets the scene for an extensive study (Picciano, 2002)

that utilizes this multiple measure approach. The major research questions that guided this study are as follows:

1. What is the relationship between actual student interaction/participation and performance?
2. What is the relationship between student perception of social presence and performance?
3. What is the relationship between student perceptions of social presence and actual participation?
4. Are there differences in student perceptions of their learning experiences and actual performance?
5. Are there differences in student perceptions of their interaction and actual participation?

Data on student participation in online discussions were collected throughout the semester. Students also completed a satisfaction survey at the end of the course, which asked a series of questions addressing their overall experiences, especially as related to their learning and interaction with others and the technology used. A series of questions that relate to social presence was included as part of this survey.

In addition to student perceptions of their learning as collected on the student satisfaction survey, two further student performance measures were collected: scores on an examination and scores on a written assignment. The latter measures relate to the course's two main objectives: to develop and add to the student's knowledge base regarding contemporary issues in education, as well as to provide future administrators with an appreciation of differences in points of view and an ability to approach issues that can be divisive in a school or community. The results are summarized below.

Student Perceptions of Interaction and Learning. These results indicated that there is a strong, positive relationship between student perceptions of their interaction in the course and their perceptions of the quality and quantity of their learning.

Actual Student Interaction and Performance. The overall conclusion was that actual student interaction as measured by the number of postings on the discussion board had no relationship to performance on the examination. Actual student interaction as measured by the number of postings on the discussion board did have a relationship to the written assignment for students in the high interactive grouping.

Social Presence and Performance. In comparing student perceptions of social presence with actual performance measures, the results are somewhat different. The overall conclusion is that student perception of social presence did not have a statistically significant relationship to performance on the examination, while student perception of social presence had a positive, statistically significant relationship to performance on the written assignment.

Student Perceptions of Interaction and Actual Participation. The last area for analysis in this study was the relationship between the perceived interaction of students and actual interaction. While the perceptions of the number of postings of the moderate interaction group of students are consistent with their actual postings, the low interaction group perceived themselves to have made a higher number of postings than they actually did and the high interaction group perceived themselves to have made fewer postings than they actually did. The results indicate that student perceptions of their interaction in a course need to be viewed with a bit of caution.

Daughenbaugh et al. (2002) sought to determine if different personality types express more or less satisfaction with courses delivered online versus those delivered in the classroom. The methodology employed two online surveys—the Keirsey Temperament Sorter (KTS) and a course satisfaction instrument. The four hypotheses are that Introvert, Intuition, Thinking, and Perceiving personalities express greater satisfaction with online courses than Extrovert, Sensing, Feeling, and Judging personalities. Both descriptive and inferential statistics were used in the study.

This study resulted in a statistically significant difference between the preference for online courses between Introvert personalities and Extrovert personalities. However, the findings of this study were exactly opposite of what had been hypothesized. Extroverts expressed stronger preference for online courses than did Introverts. No statistically significant difference was found in the preference for online courses between students with predominately Intuition personalities and those with predominately Sensing personalities, between students with predominately Thinking personalities and those with predominately Feeling personalities, and between students with predominately Perceiving personalities and those with predominately Judging personalities.

There were, however, six other interesting findings of this study.

1. There were statistically significant differences in the responses to certain course satisfaction variables among those in the Extrovert/Introvert temperament group.
2. There were statistically significant differences in the responses to certain course satisfaction variables among those in the Intuition/Sensing temperament group.
3. There were no statistically significant differences in the responses to any course satisfaction variables among those in the Thinking/Feeling temperament group.
4. There were statistically significant differences in the responses to certain course satisfaction variables among those in the Perceiving/Judging temperament group.
5. There was a statistically significant difference in satisfaction with student interaction between students taking online courses and those taking in-class courses. Students taking in-class courses had greater satisfaction with their level of student interaction than students in online courses.
6. There was no statistically significant difference related to gender in the preference for online or in-class courses. Females and males in this study expressed nearly identical levels of preference for online or in-class course.

Based on the findings of this study, the authors recommend that instructors teaching online (a) should consider the

personality types of students in their courses and (b) should provide a variety of ways for students to interact with each other.

15.4.2 Teacher Related Questions

15.4.2.1 Faculty Participation Issues. Most of the literature on Asynchronous Learning Networks (ALNs) has focused on the pedagogical and technological advantages of this educational delivery mode and the way ALNs can respond to the changing demands and pressures placed on institutions of higher education. However, there are considerable obstacles preventing the widespread implementation of ALNs. These obstacles, and the associated forms of opposition and resistance, were analyzed by Jaffee (1998) in an organizational context that examines the prevailing academic culture and the widely institutionalized value placed on classroom-based teaching and learning. The writer argues that the recognition of the classroom as a "sacred institution in higher education, and a major source of professorial identity," is a necessary first step toward developing strategies for organizational change and pedagogical transformation.

Various strategies for change are discussed, with the objective to convert what may be outright hostility and a perception that ALNs are totally illegitimate into a greater acceptance of ALNs on the basis of their ability to address some of the pedagogical problems faced by all faculty. While faculty members may be unwilling to relinquish their attachment and devotion to the conventional classroom institution, they can better appreciate the reasons why other faculty might want to experiment with ALNs and they may even be interested in developing some kind of on-line web conference for their classroom course as a way to extend the classroom beyond the spatial and temporal confines of four walls and seventy-five minute time limits. This is an important intermediate application of instructional technology between the pure classroom and the exclusively online delivery modes. As human organizations, institutions of higher education are constrained by habit, tradition, and culture. These represent the most significant obstacles to organizational change and they therefore must be recognized and addressed in order to realize genuine pedagogical and institutional transformation.

Schifter (2000) compares the top five motivating and inhibiting factors for faculty participation in Asynchronous Learning Networks or CMC as reported by faculty participators and non-participators, and administrators. While faculty and administrators agreed strongly on what inhibits faculty from participating in such programs, there were significantly different perceptions on what motivates faculty to participate. "Personal motivation to use technology" was a strong motive for participating in ALN/DE at this institution, as noted by all parties involved. The faculty, participators and non-participators, rated issues that could be considered intrinsic factors as motivating for participation in DE, while administrators indicated a perception that faculty would be more motivated by factors that could be considered extrinsic.

The top inhibiting factors were rated very similarly across groups and all five top inhibiting factors appear to be more extrinsic in nature than intrinsic. Determining what factors would deter faculty from participating in ALN/DE appears easier than what would motivate. The results of this study suggest that faculty are more likely to participate in CMC programs due to interest in using computers in teaching, interest in exploring new opportunities for programs and students and interest in the intellectual challenge, rather than monetary or personal rewards.

Hislop and Atwood (2000) surveyed teacher attitudes and behaviors in CMC courses in the College of Information Science and Technology (IST) at Drexel University that began a long-term initiative in early 1994 to develop online teaching capabilities. The survey consisted primarily of a series of statements to which respondents were asked to indicate their agreement or disagreement using a seven-point scale. In addition to the quantitative response, the survey allowed for comments on each statement and included several open-ended questions inviting comment about concerns and potential of ALN. The researchers received 19 responses out of a possible 26.

Overall the survey seems to show broad support for online education among the faculty, tempered by some sources of concern. There is strong agreement that the College should continue work in this area, although there are clearly differences in the types of degrees the faculty feel are most appropriate for online delivery. There is some concern about the effectiveness of online education compared to traditional education. There is also some personal preference for teaching face-to-face. However, many of the faculty are willing to have a substantial portion of their teaching assignment be online.

Full-time faculty members have been involved with all phases of the project from course conversion to teaching, development, administration, and evaluation. A variety of factors were found to affect faculty motivation for the online program.

- The faculty who started the project formed a natural group of early adopters.
- All of the faculty members teaching in the program have substantial technical ability and generally enjoy working with new technologies.
- Courses taught online count as a part of regular faculty teaching load, with online and traditional courses counting the same. To provide some additional incentive, faculty members teaching online also receive extra compensation.
- New faculty members are hired with the understanding that they are likely to teach in the online program. On the other hand, all faculty members who teach online also teach traditional classes.
- Participation by faculty members in the online program is recognized as a desirable activity in the university performance appraisal process for faculty.

Berg (2000) investigated the compensation practices for faculty developing and teaching distance learning courses. The research divides itself into two basic lines of inquiry: direct and indirect compensation (including royalties, training, and professional recognition). Also, economic models for distance learning are examined with a view towards understanding faculty

compensation within attempts to reduce labor costs. The primary questions this research attempts to answer are:

- What are the current policies and practices in higher education for compensating faculty who develop and teach distance learning format courses?
- Will the increased use of distance learning format courses alter overall labor conditions for American faculty? If so, how?

Although information is limited, it is found that faculty work in both developing and teaching CMC courses tends thus far to be seen as work-for-hire under regular load with little additional indirect compensation or royalty arrangements.

15.4.2.2 Teacher Opinions—Some Case Studies. The State University of New York (SUNY) Learning Network (SLN) is the on-line instructional program created for the 64 colleges and nearly 400,000 students of SUNY. The foundation of the program is "freedom from schedule and location constraints for faculty and students." The primary goals of the SLN are to bring SUNY's diverse and high-quality instructional programs within the reach of learners everywhere, and to be the best provider of asynchronous instruction for learners in New York State and beyond.

Fredericksen et al. (2000) examine the factors that have contributed to the high level of faculty satisfaction we have achieved in the SLN. A faculty satisfaction survey revealed a number of indicators that address the issue of teaching satisfaction. Eighty-three percent responded that they found their online teaching experiences very satisfying and 17 percent found them somewhat satisfying. One-hundred percent of the faculty responded that they plan to continue teaching online courses. Asked to evaluate the effectiveness of the online teaching strategies they used, 83 percent responded that they were very satisfied. Sixty-seven percent of the faculty characterized the quantity of student-to-student interaction, and student-to-professor interaction as "more than in the classroom." In response to a question about the quality of interaction, 67 percent said that the quality of student-to student interaction was higher than in the classroom, and 50 percent responded that the quality of student-to-professor interaction was higher than in the classroom.

When asked why some mainstream faculty might resist online teaching, they gave the following responses:

- Afraid of the technology. Unsure of the pedagogy. Questions the authenticity.
- Afraid of the unknown and the potential work involved in trying something new.
- It threatens the territory they have become comfortable in.
- Technophobia and not having thorough knowledge or exposure to the methodology.
- Online teaching is too impersonal and does not allow for meaningful interaction.

Asked what could be done to break down this resistance, they replied:

- Demonstrate effective pedagogy. Testimonials from respected colleagues.
- Roundtable discussions with experienced onliners.
- Set a good example and outline the positive features of teaching via the Internet.
- Convince them it's not a threat, just an enhancement.
- Professional development seminars where faculty are interactive within a course.
- One-on-one demonstrations with faculty who are cautious but interested.
- Show them a course and answer their questions.
- Suggest they take a course online themselves before teaching one.

Hartman, Dziuban, and Moskal (2000) describe relationships among infrastructure, student outcomes, and faculty satisfaction at the University of Central Florida (UCF). The model focuses on a developmental process that progresses from courses with some Web presence to those that are driven by CMC. Faculty receive support for online teaching in the form of release time for training and development, upgraded hardware, and complete course development services. The results of the impact evaluation at UCF indicate that faculty feel that their teaching is more flexible and that interaction increases in the ALN environment. On the other hand, they are concerned that online teaching may not fit into the academy culture. Uniformly, faculty using the CMC environments indicate that their workload increases along with the amount and quality of the interaction with and between students.

Kashy et al. (2000) present a case study that describes the implementation and continued operation of a large on-campus CMC system for a 500-student course in introductory physics. A highly positive impact on student success rates was achieved. Factors that increased faculty satisfaction and instances of dissatisfaction are presented. The potential increase in the latter with technology is of some concern. To put the faculty satisfaction issues in perspective, the researchers interviewed faculty, including some who have not used CMC in their disciplines and looked at previous studies of issues that affect faculty satisfaction. The principal factors, which emerge include collegiality, workload, and autonomy. An interesting observation concerns the role conflict that occurs at the intersection between faculty and administrative domains of responsibility. While it does not appear to affect general faculty satisfaction, it can be a source of disaffection and dissatisfaction. The authors describe several specific cases of such critical factors.

Arvan and Musumeci (2000) present the results of interviews with the principal investigators of the current Sloan Center for Asynchronous Learning Environments (SCALE) Efficiency Projects. There are six such projects: Spanish, microbiology, economics, math, chemistry, and physics. The paper reviews each project individually, summarizes the results, and then discusses some common lessons learned as well as some still open issues. The paper considers satisfaction both from the perspective of the course director/designer and from the perspective of other instructors and graduate teaching assistants. The evidence

appears to show that all of these groups are satisfied with ALN, relative to the prior situation. Nonetheless, it is not clear whether these results would translate to other high enrollment courses.

Almeda and Rose (2000) investigated instructor satisfaction in 14 online courses in freshman-level composition and literature, business writing, and ESL offered in the University of California (UC) Extension's online program. The results of an informal instructor survey also are discussed. Obstacles to adoption, effective and problematic practices, and critical programmatic and individual course factors gleaned from this analysis are outlined. The obstacles identified include: lack of face-to-face interaction; the workload is greater than in other teaching experiences; compensation is seen as inadequate.

The paper by Turgeon, Di Biase, and Miller (2000) describes two of the distance education programs offered through the Penn State World Campus during its first year of operation in 1998. Detailed information is provided on how these programs were selected and supported, the nature of the students who enrolled and the faculty who developed and taught the courses, and the technology and infrastructure employed for delivering content and engaging students in collaborative learning. The organization of the World Campus, the evolution of these programs, and the results obtained from them during the first 18 months of operation are presented. Several contemporary issues are addressed from a faculty perspective, including: teaching effectiveness, relationship with students, satisfaction with product, compatibility with other responsibilities, ethical concerns, incentives and rewards, team efforts, support services, perceptions by colleagues, scholarly value, opportunity cost for faculty, intellectual property concerns, and compensation.

15.5 RESEARCH METHODOLOGIES

The methods used to research the theory and practice of CMC applications in education have evolved over the 15 years or so that the medium has been available. As the technologies have matured and become more widespread, a greater range of researchers have become interested in investigating all aspects of their educational use. In the 1980s and early 1990s, much research seems to have been grounded in positivistic paradigms, while from the mid-1990s onwards, there has been a shift to much more use of qualitative methods. In addition, there has been a move away from experimental environments, so that much more use is made of data from real-life interactions between CMC students, rather than quasi-scientific laboratory studies of user reactions. CMC researchers now, on the whole, are taking a naturalistic approach to the collection and interpretation of data. Early researchers shied away from analyzing the content of messages, partly because there were no precedents or methods for carrying out the task, and partly because it was highly time consuming. However these barriers have been overcome and the field has, finally, moved away from the situation wherein real data from CMC interactions is "paradoxically the least used" (Mason, 1991).

15.5.1 Evolving Approaches to CMC Research

Much of the early research on CMC focused on quantitative measures such as numbers of messages per participant, message length and frequency, and particularly message maps showing patterns of response to key inputs. Furthermore, early adopters seemed to feel it necessary to prove that studying online produced the same results—measured by examination results—as campus based education. The massive amount of research of this kind has now been collected together on the "No significant difference" web site at http://teleeducation.nb.ca/nosignificantdifference/.

Many early researchers drew on the automatic computer-based recording of communications transactions, and examined usage and interaction. Harasim (1987) used mainframe computer records to analyze student access times and dispersion of participation in a graduate computer conference. There was, up to the early 1990s, relatively little use of qualitative approaches based in observation and interviewing of CMC users—survey questionnaires were the preferred method. Some studies did begin to use these methods in the early 1990s (e.g., Burge, 1993; Eastmond, 1993).

The variety of methods and approaches to CMC research that began to develop in the mid-1990s is reflected in two volumes in particular. Ess' (1996a) book examines a range of issues in the analysis, application and development of CMC. In particular, the volume addresses philosophical issues and the effect of gender on CMC use. It presents a range of philosophical approaches and frameworks for the analysis, including poststructuralist perspectives (e.g., Yoon, 1996), semiotics (Shank & Cunningham, 1996), critical theory (Ess, 1996b), and ethnography (Herring, 1996b).

Herring's (1996c) collection of essays on linguistic, social and other issues in CMC presents more analyses based in mixed methods and philosophical approaches and frameworks. These include conversation and discourse analyses and ethnographic studies of online communities. While there does seem to be a general convergence of methods for researching CMC, some researchers note that "CMC is not homogeneous, but like any communication modality, manifests itself in different styles and genres" (Herring, 1996c).

15.5.1.1 Content Analysis. Various forms of content analysis, some grounded in specific theoretical frameworks and others not, have been used over at least the past 10 years in CMC studies. The need to move away from gathering quantitative data and to analyze the interactive exchanges of CMC and to demonstrate the effects and advantages of interactive exchange in learning is now well established in the research community.

An early solution (Henri, 1991) was a model and analytic framework that analysed the text of the messages from a number of dimensions, including levels of participation, social aspects of the interactions, types and levels of interaction and intertextuality, and evidence of cognitive and metacognitive aspects of the messages. While a step towards some of the more integrated, qualitative methods developed, this analysis seems to have taken the text in isolation, rather than including

consideration of the social and other contexts within which the messages were being exchanged.

Bowers (1997), the listowner of a psychiatric nursing discussion list, presents a content analysis of discussions on the list during the first 16 months of its existence. His findings are congruent with other studies from that era (e.g., Murray, 1996), noting the use of discussions to explore and challenge current practice.

Some attempts have also been made to use postmodern and poststructuralist approaches or frameworks in the analysis of CMC. Aycock (1995) explored synchronous CMC (Usenet) discussions within Foucault's (1988) concept of the technologies of self. Other researchers (e.g., Baym, 1995) have moved away from focusing on building predictive models of CMC, and favor more naturalistic, ethnographic, and microanalytic research to refine our understanding of both influences and outcomes.

A review of the issues and methodologies related to CMC content analysis has been carried out by Rourke, Anderson, Garrison, and Archer (2001a). Their paper explores six fundamental issues of content analysis: criteria of objectivity, reliability, replicability, and systematic consistency in quantitative content analysis; descriptive and experimental research designs; manifest content and latent content; the unit of analysis in content analysis of transcripts; software packages to facilitate the process and ethical issues. They note:

The analysis of computer conference transcripts is beset with a number of significant difficulties, which is why this technique is more often praised than practiced. First, it is impossible to avoid some degree of subjectivity in the coding of segments of transcripts into categories; however, the degree of subjectivity must be kept to a minimum, or the value of the study will be seriously compromised. Second, the value of quantitative studies that do not report the reliability of their coding (and many do not) is also questionable . . .

When the content being analysed is manifest in the transcript—e.g., when the researcher is counting the number of times participants address each other by name—then reliability is a much less significant problem and the analysis can in at least some cases be automated. However, in most cases the researcher is interested in variables that are latent—i.e., have to be inferred from the words that appear in the transcript. Various techniques have been developed for dealing with such variables. The most popular has been to define the latent variables and then deduce manifest indicators of those variables. This is the technique that has been used by our own research group, as well as a number of the other researchers whose work we examined. (Archer, Garrison, Anderson, & Rourke, 2001, p. 6)

Content analysis is one of the key areas of research in the CMC field. It is beginning to develop theoretical foundations and a variety of frameworks within which analysis can be situated.

15.5.1.2 Case Study Methodologies.
However, by far the majority of research papers on CMC are case studies and are usually based on survey research, through electronic or conventionally distributed questionnaires (e.g., Phillips, 1990; Phillips & Pease, 1987; Ryan, 1992). While this kind of research is appropriate and necessary in a newly developing field such as CMC was in the early 1990s, there is now an urgent need for methodologies that provide generalizable evidence and meta-analyses that build upon the results of the extensive case study literature.

An example of a case study that makes good use of the methodology is a paper by Creanor (2002), in which she compares her experience of tutoring on two contrasting courses. While much of the paper is inevitably descriptive, the author does use the five-stage model of online interactivity as defined by Salmon (2000), to understand the differences between the two courses. Her conclusion is indicative of the kind of results that case study methodologies produce:

Measures of success are relative to the learning context. As online education reaches out to homes, communities and workplaces on a global scale, factors such as those described are more likely to impact on success or failure than the technology itself. Issues such as the preparation of tutors through specialist training and the links between tutor and student engagement certainly merit further research, perhaps through wider comparative studies. There can be no doubt, however, that the experienced tutor with well-developed moderating skills, organisation abilities, and above all an awareness of the external influences will become highly prized as the keystone of the e-learning experience. (Creanor, 2002, p 67)

Despite this weakness in CMC research, there are outstanding examples of appropriate methodologies being applied and adapted to the CMC environment. Three such methods are: ethnography, surveys and focus groups.

15.5.1.3 Ethnographic Methodologies.
Ethnographic perspectives, through using interviews and participant observation (Murray, 2002; Schrum, 1995) in the study of asynchronous CMC are becoming increasingly popular. Similar approaches have been adopted in the study of synchronous interactions (e.g., Waskul & Douglass, 1997).

A classic example of the application of ethnographic methodologies to the CMC field is the paper by McConnell (2002). Using over 1000 messages running to 240 pages of text, McConnell adapted a grounded theory approach of reading and rereading the data from a postgraduate problem-based online MEd. He sought to answer the questions, "How does a group of distributed learners negotiate its way through the problem that it is working on? How does it come to define its problem, produce a method for investigating it, and produce a final 'product'?" He describes his method of working thus:

As a category emerged from the analysis, I would make a note of it and proceed with the analysis of the transcript, trying to find evidence that might support or refute each category being included in the final set of categories. I would then look in depth at these emerging categories, re-read the margin annotations and notes to myself, moving back and forward from the text of the transcripts to my notes. A new set of notes was made on the particular category, clarifying, for example, who said what or who did what, how others reacted to that, and how the group worked with members' ideas and suggestions. (McConnell, 2002, p. 65)

In this way, categories were re-worked and reconceptualized on the basis of analysis of the transcripts, and the final categories and emergent theories were grounded in rigorous analysis of the data. In addition, he developed a flow chart indicating the work of the online students, detailing significant events, agreements reached and steps in understanding. This acted as an aide-memoire for him as he read through the transcripts and

refined his categories. For triangulation of results, he carried out face-to-face interviews with students, which he recorded and transcribed. These also were subjected to grounded theory analysis.

McConnell then goes on to use the categories and phases his research has produced to discuss the implications of his analysis for practice—both his own and that of other CMC tutors and instructors. The depth and groundedness of his research method lends weight to his conclusions and substance to his generalizations.

Research of this kind—open ended, exploratory, descriptive, grounded in real learning situations and contexts, addressing both broad themes and micro issues—helps us understand the complexity of learning and teaching in distributed Problem Based Learning environments and offers insights which can be useful in developing our practice. (McConnell, 2002, p. 80)

Ethnographic research is inevitably labor intensive and time consuming, but is ideally suited to providing a rich understanding of the nature of learning in the CMC environment.

15.5.1.3.1 Survey Methodologies. Survey research is very commonly used in studying educational computer conferencing, but is most effective when used with large numbers of students. The shortcomings of surveys—superficiality of the data, reliability of individual answers—are less problematic, and the scale of the responses provide a broad overview of the issues addressed. Where it is used with 20–50 students, as it too often is in CMC research, it tends to raise far more questions than it ever answers. Two good examples of effective use of survey questionnaires are an Australian study of online education across all universities, sponsored by the Australian Department of Education, Science and Training (Bell, Bush, Nicholson, O'Brien, & Tran, 2002), and a paper by an American academic interested in measuring the development of community in online courses (Rovai, 2002b).

The Australian study had a simple aim: to ascertain the current extent of online education in Australian universities. All universities were sent a questionnaire and 40 out of 43 responded. This high response rate is one of the factors which contributes to the effectiveness of the study. Many other research reports using survey questionnaires base results on return rates of 60 percent and some make do with return rates below 50 percent! One of the problems is that with the proliferation of surveys, people are less and less willing to fill them out and return them. Another problem is the reliability of the responses. A statement of the limitations perceived by the survey are common in most research papers. The Australian report notes:

The quality of responses was not always as high as expected. For instance, data was not divided into undergraduate and postgraduate figures; data was missing; errors in calculating percentages were common; information was not always returned in the form required. In one case, the university's system of recording units made it difficult to extract the number of units without double-counting. (Bell et al., 2002, p. 8)

Because the report sought factual information, the aim was well matched with the methodology. Questionnaires asking students to reflect on their use of CMC or worse still, to categorize their feelings based on Likert scale responses, are usually less satisfactory. The fact that the Australian survey went to 100 percent of universities adds to the validity of the findings. The report provides comprehensive figures on the numbers and types of online courses, the systems used to manage online interaction and other support services such as library, administration, and fee payment.

The article by Rovai (2002b) aimed to develop and field-test an instrument to measure classroom community with university students taking courses online. The survey questions did ask students to rate their feelings about community on 1–5 Likert scales. However, the strength of the research lies in the development of a Classroom Community Scale measuring sense of community in a learning environment. It aims to help educators identify ways of promoting the development of community. Data were collected from 375 students enrolled in 28 different courses, offered to postgraduates learning online.

The 40-item questionnaire was developed by several means: a review of the literature on the characteristics of sense of community, use of both face-to-face and virtual classroom indicators of community and finally ratings from a panel of experts in educational psychology on the validity of each item in the scale. Half of the items related to feelings of connectedness and half related to feelings regarding the use of interaction within the community to construct understanding, and to the extent to which learning goals were being satisfied in the online learning environment. The findings lack the depth and richness of those resulting from the McConnell ethnographic study, but they provide breadth from the relatively large sample studied and a sort of dip stick methodology for educators to easily assess the growth of community. The researcher provides further suggestions for strengthening the research:

In the future, other target populations, such as traditional students and high school students, as well as other university populations, could be used for the purpose of norming the Classroom Community Scale. Other forms of distance education, such as broadcast television, video and audio teleconferencing could also be examined. Resultant scores could then be standardized for ease of interpretation. (Rovai, 2002b, p. 208)

Survey questionnaires are likely to be used increasingly in CMC research, if only because the numbers of students studying via CMC is increasing. It is interesting to compare the findings of the Rovai research with those of a study on the same topic—the process of community building in online courses—which used ethnographic methodologies (extensive interviews, analysis of conference interactions, coding of the data into categories based on rereading and refining the emergent issues (Brown, 2001). The paper presents rich and reliable outputs:

Nine themes or categories emerged through open coding that characterized community-building in asynchronous text-based distance education graduate classes . . . Relationships between categories were explored through axial coding. A paradigm model was developed that portrayed the interrelationships of the axial coding categories by using the following headings: causal conditions, phenomenon, context, intervening conditions, strategies and consequences. From this, selective

coding generated a theory which is shown as a visual model with accompanying explanation. (Brown, 2001, p. 4)

The researcher was able to generate theoretical propositions grounded in the data, to identify a variety of levels of community engagement in the online environment, and to develop a community building paradigm.

15.5.1.4 Focus Groups.

As a methodology, the focus group is a form of structured group discussion that offers the potential of richer and broader feedback than individual interviews. Whether face-to-face or online, focus groups use a facilitator to manage a structured protocol in facilitating group discussion. The aim is usually to obtain qualitative, affective information from the group. In many ways, the method is ideally suited to the online medium because it supports distributed, reflective, asynchronous interaction. Not surprisingly, online focus groups are being used in a wide range of contexts: for universities to gather feedback from students, and for organizations of all kinds to collect the views of their clients or stakeholders. In many cases, the onus is on users to join a focus group. In formal research studies, it is more usual for the researchers to select the participants according to a set of appropriate criteria.

A study by Killingsworth, Schellenberger and Kleckley (2000) reports on the experiences and associated benefits of using face-to-face focus groups, in this case to design and develop a U.S. labor exchange system to be used on the Internet. The researchers note:

If focus groups are to provide useful information it is necessary to use valid and effective methods. Selection of facilitators and selection of the focus group members are critical to ultimate success. If possible, an experienced and properly trained contractor should be selected to conduct the focus groups. Adequate planning time must be provided . . . It is also important to identify all stakeholder groups so that all can be represented. Finally it is necessary to conduct sessions with multiple focus groups. (Killingsworth et al., pp. 2–3)

Greenbaum (2000), an experienced focus group leader, makes a case against online focus groups as a tool for gathering marketing information:

The authority role of the moderator is one of the most important reasons why traditional focus groups are so important. An experienced moderator is in complete charge of the group activities and is able to ensure that everyone participates and that the focus of the discussion remains on target.

It is virtually impossible to establish authority from behind a computer screen.

One of the major benefits of traditional focus groups is the interaction among the various participants. A well conducted focus group utilizes this interaction to explore topics in more detail and to draw out the feelings of each of the participants based on their reactions to what others in the room have said.

This is not viable in an Internet environment.

A competent focus group moderator will use non-verbal cues from participants to direct the discussion in the room. Often the non-verbal inputs can be as important as the verbal in determining the reactions to various ideas.

It is impossible to address non-verbal reactions in an online focus group. (Greenbaum, 2000, p. 1)

Nevertheless, for educational research online focus groups are increasingly the source of innovative studies. For example, a paper by Rezabek (2000) used online focus groups to formulate the key issues and questions to be explored in a large scale questionnaire survey and in small scale in-depth interviews.

The members of the focus group were first asked to consider a question, respond with their thoughts, feelings, experiences and suggestions, and then react to the responses given by the various members of the group. In this way, a discussion was generated, resulting in a rich environment of thought and idea formation.

The focus group discussion commenced with an invitation to present some biographical information as an introduction of each person. Then, an initial question from this researcher was presented. The discussion and concept threads then evolved as the members of the focus group considered the question and responded with their thoughts, feelings, and experiences. They were then asked to also react to the responses given by the various members of the group. Subsequent questions were then posed to the group after everyone had had a chance to comment and react to the others' comments. (Rezabek, 2000, paragraphs 30–31)

15.5.2 Ethical Issues and Intellectual Property in CMC Research

In an area as relatively new (compared with the history of methods for face-to-face research techniques) as CMC research, one would expect methods and conventions around ethical issues, especially those of accessing sources of data, quoting communications, etc., to be in an early stage of development. This is certainly the case. There are still ongoing debates on the ethics of CMC research, especially in terms of the rights of the researcher and the researched, and of who owns or should give permission for the use of materials from online discussions, be they from closed educational conferences or open access discussion lists. Little seems to have changed or been resolved in the years since Mason (1988) said that "quoting from a conference raises the vexed question of privacy and ownership of messages . . . issues that have yet to be settled formally by the conferencing community." Different researchers have adopted positions depending, often, on their own research traditions and methods, and the particular studies they have undertaken. The thorny issue of precisely whose permission might be needed to use a particular contribution to a list discussion, or other form of CMC, still lies generally unresolved. This may be no bad thing, and a plurality of approaches may be needed, depending on the nature and context of any particular study. This plurality is, however, situated within the context of general ethical principles of research, of doing no harm to participants, (e.g., Herring 1996a), and the time and virtual space within which the research is conducted.

This seems akin to the ethical principle of beneficence (i.e., maximizing possible benefit and minimizing possible harm from one's actions; Engelhardt & Wildes, 1994), a principle that seems to underpin implicitly, if not explicitly, the views of many CMC researchers. Coupled with this it seems to be common practice to consider anything posted to any list or newsgroup as public information. One early view (Howard, 1993) was that completing the study and then going back to seek permission

to quote was both labor-intensive and inefficient. To overcome the problems, Howard (1993) decided not to seek authors' specific permission, but always to anonymize any quoted materials, while providing sufficient material to establish context.

The issues of ownership and permission are compounded by the fact that much of the communication is across national boundaries, each of which may have their own peculiarities of copyright, and more recently of data protection legislation. Whose permission is needed, for example, for a researcher based in the United Kingdom to use a message posted by a participant in Australia to a list that is distributed via a computer in Canada? And what if the researcher happens to be in the United States or France when they access the message? Is it that of the original author, the contributor who has included part of that message in their own response, the list owner, or the general consent of all who have been party to the discussions through their reading, or by virtue of being a member of the list, whether they have been active participant or lurker? This is reflected in the fact that, at the beginning of the 21st century we are seeing attempts by national and international legislation to catch up with developments as the reality of e-commerce, technological change and CMC continue to evolve faster than laws.

In relation to the ownership of messages in discussion lists and other forms of CMC, a distinction between publicly accessible and publicly distributed messages is suggested (Waskul & Douglass, 1996). The same researchers also question the nature and possibility of informed consent in a CMC group that is in a constant state of flux in terms of its membership. They acknowledge that, in reality, online interactions often render attempting to obtain informed consent a practical impossibility.

Not all CMC researchers would advocate a cautious approach. In one of the pivotal publications addressing the area (a special edition of the journal *The Information Society*), Thomas (1996) summarized key points of the issues raised in a variety of articles and views. These included the statements that:

- Research in cyberspace provides no special dispensation to ignore ethical precepts;
- There may not be exact analogues in the offline world to ethical issues in cyberspace;
- While certain research activities may be possible, or not precluded, this doesn't mean they are necessarily allowable or ethical; and
- The ultimate responsibility lies with the individual researcher for honesty and ethical integrity.

Some recommendations on the approach to be taken reveal opposing views, with each seeming to assume only one particular type of CMC and seeking to generalize recommendations based on that type to other forms of CMC (Herring, 1996d). One view, from a legal perspective, sees all CMC as published work, protected by copyright law, and thus necessitating full referencing if used, including authors' names and other identifying details (Cavazos & Morin, 1994).

Few CMC researchers would adopt this viewpoint, which is in direct contradiction of the usual anonymization of sources in much research. King's (1996) standpoint is that all messages in online discussion groups are potentially private, and so if used in research should be totally anonymized, even to the extent of not identifying the discussion group itself and paraphrasing, in preference to directly quoting, the contributions. Obviously, such paraphrasing would make many of the forms of textual, linguistic and discourse analysis that have been employed impossible to use on CMC interactions. Herring (1996a) criticizes both extremes of absolutist position as untenable in the reality of CMC research, as they assume only one form of CMC exists, or one approach to CMC research. They also imply that generalizations from one form can be applied to all other variants and forms. She also criticizes both sets as not allowing for critical research, excluding the complex reality of both cyberspace and research, and excluding legitimate forms of research on CMC.

Schrum (1995) proposes a set of guidelines (Fig. 15.1) for the conduct of ethical electronic research, using an amalgam of techniques, including an ethnographic perspective, use of interviews and participant observation, and the need to maintain a delicate balance between protecting the subjects and the freedoms of the researcher.

15.6   A RESEARCH AGENDA

15.6.1   Mobile Learning

We are beginning to move from e-learning environments, where despite the flexibility offered, learners are still tied to a place-based mode of educational delivery, to the possibility of more mobile access to education. With the rise in use of mobile telephones, and their convergence with PDAs (personal digital assistants) and similar devices, new vista are opened for the intersection of communication and education.

Few would have predicted, for example, the extent to which text messaging via mobile phones is now a common part of the everyday life of many young people, people who are, or soon will be, our students. It is a form of CMC, and while some universities have used text alerts to students as reminders of submission dates, for example, there has yet been little study of the potential of this form of interaction. The European Commission, through its Information Society initiatives, has funded some research and development projects that are exploring the use of mobile devices for providing distance education.

In addition to the range of technological issues to be explored in enabling truly mobile education, there are many interesting social issues that probably present more opportunities for research and the development of new ways of education. If students can provide instant text responses, are they likely to do so, and perhaps not engage in reflection on issues before providing such a response?

Mobile and wireless networks might have additional effects on personalisation and/or intimacy of the learning experience if the student is truly able to study anywhere, anytime, and both receive information and provide information and interaction wherever they may be.

Researchers:

1. Must begin with an understanding of the basic tenets of conducting ethical qualitative research;

2. Should consider the respondents and participants as owners of the materials; the respondents should have the ability to modify or correct statements for spelling, substance, or language;

3. Need to describe in detail the goals of the research, the purposes to which the results will be put, plans of the researcher to protect participants, and recourse open to those who feel mistreated;

4. Should strive to create a climate of trust, collaboration, and equality with electronic community members, within an environment that is non-evaluative and safe;

5. Should negotiate their entry into an electronic community, beginning with the owner of the discussion, if one exists. After gaining entry, they should make their presence known in any electronic community (e.g., a listserv, specialized discussion group, or electronic class format) as frequently as necessary to inform all participants of their presence and engagement in electronic research;

6. Should treat electronic mail as private correspondence that is not to be forwarded, shared, or used as research data unless express permission is given;

7. Have an obligation to begin by informing participants as much as possible about the purposes, activities, benefits, and burdens that may result from their being studied;

8. Must inform participants as to any risks that might result from their agreeing to be part of the study—especially psychological or social risks;

9. Researchers must respect the identity of the members of the community, with special efforts to mask the origins of the communication, unless express permission to use identifying information is given;

10. Must be aware of the steep learning curve for electronic communications. Information about the research should be placed in a variety of accessible formats; and

11. Have an obligation to the electronic community in which they work and participate to communicate back the results of their work.

FIGURE 15.1. Schrum's ethical electronic research guidelines (from Schrum, 1995).

15.6.2 Vicarious Learning and Informal Discussion Environments

Communities of practice may be formally constituted, but there is increasing scope, with the widespread adoption of flexible approaches to continuing professional education and the recording of supporting evidence, for more informal approaches, generated from the needs of practitioners. McKendree et al. (1998) discuss vicarious learning and the fact that much real learning occurs through observation of other learners engaged in active dialogues. Murray's (2002) research identified a number of the issues arising, including the potential benefits of lurking. Boyle and Cook (2001) have used assessed online discussion groups to attempt to foster a community of enquiry (Lipman, 1991) and to foster vicarious learning. Many issues around the nature and extent of such vicarious learning would seem to be ripe for research over the coming years.

15.6.3 Structured Learning Activities

Asynchronous discussions and individual messaging are an important component of most models of online courses (Mason, 1998). In order to encourage discussion, in practical implementation of discussion within taught courses, it has been found to be important for course designers to structure the online environment. This involves devising stimulating individual and group activities, providing small group discussion areas and supporting students through facilitative rather than instructive moderating (Salmon, 2000).

Coomey and Stephenson (2001) stress the importance of dialogue, involvement and support in learning online, identifying four major features essential for good practice. They also state that dialogue must be carefully structured into a course to be successful, with the role of the moderator being, in part, to facilitate active participation through dialogue, in-depth reflection and thoughtful responses. Involvement through structured tasks, support, including periodic face to face contact, online tutor supervision, peer support, and advice from experts are seen to be important components, while the extent to which learners have control of key learning activities, and the extent to which students are encouraged to exercise that control have been shown, from the existing research, to facilitate online learning through CMC (Coomey & Stephenson 2001).

However, this evidence of a need for structure may seem to be at odds with the opportunities introduced above for informal learning opportunities, with potentially much less structured development. The possible tension between these two approaches is an important area of future research, as it may be that quite different processes are at work in the different environments.

15.6.4 Assessment Based on CMC

Much of the assessment of e-learning, as with many of the teaching and learning methods, used essentially offline methods, usually with little variation. Many current forms of online assessment are based on what we have used in the classroom for decades, including quizzes and submission of essays. The benefits of online assessment are measured in terms of automation and time and cost savings (McCormack & Jones, 1998). There has been relatively little attempt to explore new forms of assessment that might be made possible by online interaction, especially among groups of learners. Online assessment is a vital area for research over the next few years, in terms of investigating not only the appropriateness of transferring offline methods to e-learning, but also the development of new assessment methods grounded in the opportunities offered by the online world. Joint assessment and group web work are only two of the possibilities that have had some exploration so far, but which merit much more. Some collaborative CMC projects, which might form the basis of assessments, are suggested by Collis (1996), such as discussion of news items from the viewpoints of different cultural contexts, or exploring issues of cultural sensitivity through exploration of customs and lifestyles among students in a culturally diverse, international group.

As Mason (1998) notes, in group work integrated with assessment and examination, most students overcome their inhibitions and play their part in joint activities. The assessment procedures currently used in tertiary education are particularly ill suited to the digital age in which the ways people use information are more important than simply rote learning and regurgitation. She adds a further challenge that reusing material should be viewed as a skill to be encouraged, not as academic plagiarism to be despised. Through taking this approach, novel assessment methods might be developed, for example, through devising assignments and assessment procedures that reflect team working ability and knowledge management skills. These might also include the assessment of new knowledge jointly generated by students through online discussions.

15.6.5 Different Learners

For learners who come to e-learning from a cultural tradition that is based around a teacher-centered approach, rote learning or individual as opposed to group achievement, collaboration and discussion may not work well, and research will be needed into how best to use CMC within multicultural and unicultural groups.

Similarly, gender differences between and among online learners has received some attention within the CMC research (e.g., Spender, 1995), but there are still many areas to be examined. Different approaches to the use of CMC and collaborative learning between different professional groups, or within professions, merit much further work.

It is suggested that e-learning facilitates different learning styles, but research is needed into the practical application of different learning styles in the development of e-learning. Related questions include whether, or to what extent, different types of learner need to belong to a community in order to maximize the chances of success in both the development of the learning community and the meeting of individuals' learning needs.

15.6.6 Beyond Replicating Face-to-Face Teaching

Much CMC use has been grounded in replication of what can be done offline, in face-to-face encounters or by those mediated by other technologies, such as the telephone. However, just as the ways in which telephone use changed after it became widespread within the population, and in some unexpected ways, so we should expect that the use of CMC will change. Dillenbourg & Schneider (2002) state that, currently, most e-learning is in a stage of design-by-imitation, often reproducing classroom activities and with virtual campuses mimicking physical campuses. Practically-oriented texts on the development of online education (e.g., Collis, 1996; McCormack & Jones, 1998) tend to base their approaches in modeling classroom-based methods and interactions in the online environment.

What Mason (1998) terms "pedagogical evolution" refers not to a notion of teaching getting better, or the invention of new and different methods, but working with the technology (itself a moving target) and with course participants to arrive at new perspectives on how learning is best encouraged and supported in the online environment. Whether such new perspectives can be achieved is, to some degree, an assumption, and itself needs testing in the crucible of practice-based research. Two concepts that may emerge from research-based examination of the

potential of the technologies, and new learning environments are a break down of the distinction between teacher and taught, and the collective construction of the educational course and, more broadly, of new knowledge. The online environment, with its resources, places to interact and people to contact, can form the backdrop against which a learning community comes together briefly to collaborate in a shared course.

Dillenbourg and Schneider (2002) view the most promising work in e-learning as investigating functionalities that do not exist in face-to-face interactions, for instance the possibility for learners to analyze their own interactions, or to see a display of their group dynamics. A group of learners and their e-learning tools might constitute a distributed system which self-organizes in a different way than a group of learners face to face. To investigate, and perhaps realize, some of this vision, is the greatest challenge facing the research and policy agendas for educators. This is especially so when we seem to be in a climate where funders of education provision are seeking materials and courses linked to specific occupational skills, rather than education for its own sake.

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