



## Computer-Mediated Collaborative Learning: Theory and Practice

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# Computer-Mediated Collaborative Learning: Theory and Practice

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Recently interest has grown concerning the uses of online communication for language teaching. Yet this growing interest in computer-mediated collaborative language learning has not been matched by sufficient research and theory. This article introduces a conceptual framework for understanding the role of computer-mediated interaction based on a sociocultural analysis of the relationship among text, talk, and learning. The article then analyzes current research according to five features particular to online interaction.

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THE RAPID GROWTH OF THE INTERNET, arguably the fastest growth of any technology in history, has caught the attention of language teachers.<sup>1</sup> The number of regional and national presentations related to online language learning has expanded geometrically in recent years. Many state and national meetings and special symposia have been devoted to this theme.<sup>2</sup> Yet this growing interest in computer-mediated collaborative language learning has not yet been matched by sufficient attention to research and theory.

One purpose of this article is to explore the nature of computer-mediated communication (CMC) by using a conceptual framework that starts with well-known theories of input and output and leads to sociocultural learning theory.

Another purpose is to examine classroom accounts of CMC's potential for promoting collaborative language learning, with specific reference to five features that distinguish CMC from other communication media: (a) text-based and computer-mediated interaction, (b) many-to-many<sup>3</sup> communication, (c) time- and place-independence (d) long distance exchanges, and (e) hypermedia links. In some cases these accounts constitute rigorous research studies; in

other cases they are teachers' personal narratives. Because the entire field of CMC is so new, a broad survey of this type can help identify issues and trends that may deserve further attention and research.

## CONCEPTUAL FRAMEWORK

Perhaps the best known perspective for looking at cooperative communication in the language classroom was originally derived from Krashen's (1985) Input Hypothesis, but it has undergone significant additions and changes. Krashen claimed that the development of a second language (L2) is almost wholly dependent on the amount of comprehensible input that one receives. Researchers have investigated the types of conversational interactions among learners that facilitate the intake of comprehensible input (for reviews, see Long, 1996; Pica, 1994). In this model, the purpose of interaction is to provide the input—or, in some views, the output (Swain, 1985)—to make L2 development possible. This framework is useful for understanding the benefits of classroom interaction, both in general and also via CMC. For example, psycholinguistic researchers have investigated the effects of strategies such as noticing input (e.g., Doughty, 1991; Schmidt, 1993; Sharwood Smith, 1993) and planning output (Crookes, 1989).

However, this perspective does not explain precisely how students use language-related collabora-

ration for the following purposes: (a) to become competent members of a speech community (Hymes, 1972) or social group (Schieffelin & Ochs, 1986), (b) to gain important cultural knowledge (Kern, 1996) or content matter (Bayer, 1990; Wells & Chang-Wells, 1992), or (c) to develop literacy skills or critical thinking skills (Heath, 1983; Wells & Chang-Wells, 1992). A more encompassing conceptual framework is necessary: the sociocultural perspective.

The sociocultural perspective, deriving in part from the concepts of Vygotsky (Vygotsky, 1962, 1978), illuminates the role of social interaction in creating an environment to learn language, learn about language, and learn "through" language. This perspective examines interaction within a broad social and cultural context.

In Vygotsky's view, human learning and development are bound up in activity, that is, purposeful action mediated by various tools (Vygotsky, 1978; Wertsch, 1979). The most important of these tools is language, the semiotic system that is the basis of human intellect (Halliday, 1993; Vygotsky, 1978). All higher-order functions develop out of language-based, social interaction. "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; the first, between people (interpsychological), and then inside the child (intrapsychological)" (Vygotsky, 1981, p. 163).

Vygotsky (1962) stressed that collaborative learning, either among students or between students and a teacher, is essential for assisting each student in advancing through his or her own zone of proximal development, that is, the gap between what the learner could accomplish alone and what he or she could accomplish in cooperation with others who are more skilled or experienced (see Nyikos & Hashimoto in this special issue). In recent years, two main interpretations have arisen about how students traverse the zone of proximal development (Wertsch & Bivens, 1992): (a) modeling and (b) text mediation.

In the modeling interpretation, the teacher models an approach to the learning (Palincsar & Brown, 1984). The text-mediational interpretation views texts<sup>4</sup> as "thinking devices" to generate new meanings collaboratively (Lotman, 1988; Wertsch & Bivens, 1992). This interpretation focuses on how "all participants in intermental functioning are actively engaged in shaping this functioning" (Wertsch & Bivens, 1992, p. 39). The text-mediational perspective is strengthened by incorporating the views of Bakhtin (1986), one of Vygotsky's Soviet contemporaries. Bakhtin and his circle sharply critiqued the view that lan-

guage is either an abstract system of linguistic forms or an individual form of activity (Volosinov, 1973). For Bakhtin, the unique speech experience of each individual is shaped through constant interaction, and more focused interaction leads to higher forms of learning. "Words, intonations, and inner-word gestures that have undergone the experience of outward expression" acquire "a high social polish and lustre by the effect of reactions and responses, resistance or support, on the part of a social audience" (Volosinov, 1973, p. 98). This intense social interaction is also where "creative energies build up through whose agency partial or radical restructuring of ideological systems comes about" (p. 92).

The text-mediational interpretation of Vygotsky has been well developed by educators. Bayer's (1990) model of collaborative-apprenticeship learning emphasizes the use of expressive speech and writing, peer collaboration, and meaningful problem-solving tasks. The teacher assists, not as a model but rather as a guide, while students collaborate to "make connections between new ideas . . . and prior knowledge," "use language as a tool for learning," and develop "language and thinking competencies" (p. 7). Wells and Chang-Wells (1992) describe learning as a semiotic apprenticeship based on the creation of a collaborative community of practice in which learners develop their thinking through talk rather than through modeling. Wells and Chang-Wells point out that "by making a record of text of thought available for reflection, and, if necessary, revision, a written text serves as a 'cognitive amplifier' . . . , allowing the reader or writer to bootstrap his or own thinking in a more powerful manner than is normally possible in speech" (p. 122). The concept of cognitive amplification builds on the work of researchers such as Bruner (1972), Scribner and Cole (1981), and Heath (1983), who investigated the relationship among texts, talk, and literate thinking.

According to Wells and Chang-Wells (1992), the opportunity for cognitive amplification is too often missed in school, because texts are used primarily for performance (e.g., for reading aloud) or for information (e.g., for dictionary look-up). These researchers urge that texts be used epistemically, that is, treated "as a tentative and provisional attempt on the part of the writer to capture his or her current understanding . . . so that it may provoke further attempts at understanding as the writer or the reader dialogues with the text in order to interpret its meaning" (pp. 139-140). When students attempt such interpretation by writing down their responses,

they can "capture those insights and perceived connections so that they can be returned to, critically examined, reconsidered, and perhaps made the basis for the construction of a further sustained text of one's own" (p. 140).

Thus, the text-mediational view links the concepts of expression, interaction, reflection, problem-solving, critical thinking, and literacy with the various uses of talk, text, inquiry, and collaboration in the classroom. This particular socio-cultural approach provides a useful framework for understanding collaborative learning in the language classroom and for evaluating the potential of online education to assist that process.<sup>5</sup>

## REVIEW OF STUDIES

This section reviews a number of studies that touch on the power of CMC to encourage collaborative learning in the language classroom. CMC's five distinguishing features, which were mentioned earlier, serve as the organizing principles of this section: (a) text-based and computer-mediated interaction, (b) many-to-many communication, (c) time- and place-independence, (d) long distance exchanges, and (e) hypermedia links.

### *Text-Based and Computer-Mediated Interaction*

Whether in society (Halliday, 1993) or the classroom (Harnad, 1991; Wells & Chang-Wells, 1992), language has two main functions. It allows us to (a) interact communicatively and (b) "construe experience," that is, to "interpret experience by organizing it into meaning" (Halliday, 1993, p. 95). Throughout human history, the interactive role has been played principally by speech, whereas the permanence of written texts has made them powerful vehicles for interpretation and reflection (Bruner, 1972; Harnad, 1991). Writing, unlike speech, could be accessed and analyzed by many people at different times. However, "the real strength of writing [reflective cognition] . . . was purchased at the price of becoming a much less interactive medium than speech" (Harnad, 1991).

Yet the intersection between reflection and interaction is of critical importance in education. Online communication, which is labeled CMC above, is a possible cognitive amplifier (Harasim, 1990; Harnad, 1991) that can encourage both *reflection and interaction*. The historical divide between speech and writing has been overcome with the interactional and reflective aspects of language merged in a single medium: CMC. For

the first time in history, human interaction now takes place in a text-based form—moreover, a computer-mediated form that is easily transmitted, stored, archived, reevaluated, edited, and rewritten. The opportunities to freeze a single frame and focus attention on it are greatly expanded by CMC. Students' own interactions can now become a basis for epistemic engagement. Such features led one prominent cognitive scientist to describe the Internet as bringing about "the fourth revolution in the means of production of knowledge," on a par with the "three prior revolutions in the evolution of human communication and cognition: language, writing and print" (Harnad, 1991, p. 39).

The potential of text-based interaction has been noted before in language pedagogy, as seen, for example, in paper-based dialogue journals (Peyton & Reed, 1990) or free-writing to be shared with peers, but these modes are relatively slow and clumsy. When writing is shared on paper (regardless of whether the writing was composed via computer in the first place), the reader cannot easily edit and reedit the material while rapidly interacting with the writer. Thus dialogue journals and free-writing are quite useful for expression and for dialogue, but less so for collaboration between individuals or among group members located around the world. The computer-mediated feature of online writing has finally unleashed the interactive power of text-based communication.

When used for one-to-one communication in the same classroom, text-based communication via computer has value. Kroonenberg's (1994/1995) high school French students, who worked in pairs to discuss and debate ideas in a computer-mediated synchronous chat mode,<sup>6</sup> experienced several benefits. First, the synchronous communication allowed students to practice rapid interaction. Second, when students needed to pause and pay closer attention, the text-based mode permitted them to do so, thus creating opportunity for reflection in the midst of interaction. Third, many students were more expressive in this mode than in ordinary written composition (where every sentence weighs heavily on their minds) or in oral conversation (which deters shy students). According to Kroonenberg, follow-up oral discussions were enriched by prior email interaction: "The quality of the arguments is enhanced and thinking is more creative than without this kind of preparation" and "interest in listening is augmented as well" (pp. 26–27). The online chats thus served the role of thinking devices that Lotman (1988) suggested are important for collaborative construction of knowledge.

*Many-to-Many Communication*

Another major feature of online learning is that it allows many-to-many communication; in other words, any member of a group may initiate interaction with any or all of the others. This can bring about the positive social reactions, as discussed by Bakhtin (Volosinov, 1973). On the surface, CMC's feature of many-to-many interaction seems similar to what occurs in a group oral conversation, but two important differences exist. First, CMC creates the opportunity for a group of people to construct knowledge together, thus linking reflection and interaction. Second, the social dynamics of CMC have proven to be different from those of face-to-face discussion in regard to turn-taking, interruption, balance, equality, consensus, and decision making.

Studies conducted on the social dynamics of CMC have found that CMC results in communication that is more equal in participation than face-to-face discussion, with those who are traditionally shut out of discussions benefiting most from the increased participation. For example, Sproull and Kiesler (1991), using a meta-analysis of published research, found that electronic discussion groups of people of different status show approximately twice as much equality (measured by a balanced quantity of participation) as do face-to-face discussion groups. McGuire, Kiesler, and Siegel (1987) found that in discussions held electronically, women made the first proposal of a solution to a problem as often as men, whereas in face-to-face discussions men made the first proposal five times more often. Huff and King (1988) discovered that proposals by higher status people (graduate students compared to undergraduates) were invariably favored during in-person discussion groups, whereas proposals by lower status and higher status people were selected equally as often in electronic discussion groups. Why does greater equality occur? CMC (a) reduces social context clues related to race, gender, handicap, accent, and status (Sproull & Kiesler, 1991); (b) reduces nonverbal cues, such as frowning and hesitating, which can intimidate people, especially those with less power and authority (Finholt, Kiesler, & Sproull, 1986); and (c) allows individuals to contribute at their own time and pace (Sproull & Kiesler, 1991).

Despite these apparent advantages, some aspects of electronic discussion could possibly mitigate against collaboration. Weisband (1992) found that it was more difficult to achieve consensus in online discussion than in face-to-face interaction. Her study found that in face-to-face

discussions, the second speaker tended to agree with the first speaker, and the third even more so. By the time the third person spoke, the group was often close to achieving consensus. By contrast, in electronic discussions, the third member's position was just as far from the final decision as was the first member's. These results suggest that electronic discussion reduces conformity and convergence (Sproull & Kiesler, 1991).

Another aspect of CMC that could hinder cooperative learning is the prevalence of hostile language known as "flaming," which apparently occurs due to the same features that encourage free expression (Sproull & Kiesler, 1991), and which can have negative effects on classroom interaction (Janangelo, 1991). Finally, there is the problem of information overload. Discussants can be so overwhelmed with messages that they ignore what others write and the conversation devolves into monologues (Moran, 1991). These potentially negative features appear to be more than counterbalanced by positive features, according to existing research in native-language composition classrooms, where CMC first gained popularity (Balester, Halasek, & Peterson, 1992; Barker & Kemp, 1990; Batson, 1988; DiMatteo, 1990, 1991; Faigley, 1990; Peyton, 1990; Susser, 1993; Warschauer, Turbee, & Roberts, 1996).

Further empirical support for CMC arises from research in second or foreign language education classes oriented toward composition skills (Sullivan & Pratt, 1996) and general language skills (Chun, 1994; Kelm, 1992; Kern, 1995, 1995b). Several such studies (Chun, 1994; Kelm, 1992; Kern, 1995b; Sullivan & Pratt, 1996; Warschauer, 1996a) found a greater amount of student participation according to three measures: (a) percentage of student talk versus teacher talk, (b) directional focus of student talk (toward other students or toward the teacher), and (c) equality of student participation.

Sullivan and Pratt (1996) found that 100% of the students in an ESL study participated in electronic discourse and only 50% in face-to-face discussion. Focusing on learners of French (Kern, 1995b) and Portuguese (Kelm, 1992), researchers found that some students said nothing in person, while all participated online. Warschauer (1996a), in an experimental study comparing small-group ESL discussion online to discussion face-to-face, found that the online groups were twice as balanced, principally because the silent students increased their participation online.

These data suggest important results for the possibilities of promoting collaborative learning in the classroom. One of the main obstacles to-

ward a collaborative classroom is the teacher-centered nature of discussion, with classroom discourse dominated by the ubiquitous *IRF* sequence of an *initiating* move by the teacher, a *responding* move by a student, and a *follow-up* move by the teacher (Mehan, 1985).<sup>7</sup> Although electronic discussion is certainly not the only way to break this pattern, it does appear to be a very effective way.

Online results have also been reported to be positive regarding quality of discourse. Students of German took greater control over discourse management in online discussion than in normal classroom discussion (Chun, 1994). They used language that was lexically and syntactically more complex (Warschauer, 1996a) and covered a wide range of communicative and discourse functions (Chun, 1994). The types of sentences they used required "not only comprehension of the preceding discourse but also coherent thought and use of cohesive linguistic references and expressions" (Chun, 1994, p. 28). Improvements occurred in argumentation (Kern, 1995b) and in writing (Sullivan & Pratt, 1996). Based on her study, Chun (1994) claimed that electronic discussion appears to be a good bridge between writing and speaking skills, with the strengths of each domain apparently helping the other.

Kelm (1992) found that synchronous CMC was useful in developing students' linguistic accuracy. In an intermediate Portuguese course, Kelm used university students' computer-mediated messages for a grammatical review and afterwards noted an 80% reduction in certain grammatical errors (e.g., incorrect usages of gerunds and progressives). This type of post hoc analysis is difficult for oral communication, which is generally not recorded and thus is less accessible for later review.

#### *Time- and Place-Independent Communication*

Time- and place-independent communication allows users to write and receive messages at any time of the day from any computer with an Internet connection. In addition, the World Wide Web permits the creation of sophisticated, hypermedia-based information for others to access at any time. Time- and place-independent communication extends the potential of online collaboration in several ways. First, it allows for more in-depth analysis and critical reflection, because *email can be answered more deliberately than synchronous messages*. Second, it allows students to initiate communication with each other or with the teacher outside the classroom.

These two benefits can be seen in a study by Wang (1993), who compared dialogue journals written via email with dialogue journals written on paper. Compared with the paper-and-pencil group, the email group wrote more per session, asked and answered more questions, used a greater variety of language functions, applied these functions more frequently, and was less formal and more conversational with the teacher.

A broader range of activities is possible when many-to-many communication is tied to email writing. For example, with a class bulletin board or email discussion list, students can collaboratively work in pairs, small groups, or the whole class throughout the entire week. The asynchronous nature of email makes it suitable for more complex writing and problem-solving tasks than could be accomplished via synchronous discussion in a class.

Although little research exists on within-class email activities, some published reports indicate creative uses of this medium. For example, Lloret (1995) distributed tapes of Spanish language songs to her students, some of whom transcribed the songs and posted them to a class discussion list. Other students then wrote to the list to offer their comments and suggestions for the transcription. Crotty and Brisbois (1995) worked with small groups to select articles of interest from French newspapers. The groups then divided up the articles and wrote reactions and responses to the reactions on the class electronic bulletin board. In a French language class, Kroonenberg (1994/1995, 1995) distributed a contentious letter to parents from the principal about minors' alcohol consumption during their leisure time. Pairs of students used computers to write their responses in French, discussing the role of parents, the community, the government, the school, and the students in dealing with alcoholism. Janda (1995a) used email to help ESL writing students develop their analytical, narrative, and descriptive skills; their sense of "voice;" their ability to address a specific audience; and their competence in verbally interpreting pictorial material. Such email activities help learners as they struggle together to interpret meaning and construct knowledge.

#### *Long Distance Exchanges*

The long distance feature of CMC is to a certain extent distinct from place-independent communication, because some electronic systems, such as class bulletin boards, allow place-independent communication only within a local net-

work. The Internet extends this capability to all corners of the globe. Bakhtin (1986) emphasizes the cross-cultural possibilities of long distance communication:

A meaning only reveals its depths once it has encountered and come into contact with another, foreign meaning: they engage in a kind of dialogue, which surmounts the closedness and one-sidedness of these particular meanings, these cultures. We raise new questions for a foreign culture, ones that it did not raise itself; we seek answers to our own questions in it; and the foreign culture responds to us by revealing to us its new aspects and new semantic depths. (p. 7)

Long distance collaboration has been well established in models of critical, collaborative pedagogy, especially in Europe (Cummins & Sayers, 1995) since Freinet's Modern School Movement, which was founded in 1924 and included postal exchanges of letters, class newspapers, and cultural packages. Freinet's work foretold many of the efforts to develop collaborative exchanges today using CMC (Cummins & Sayers, 1995). CMC facilitates the accomplishment of these goals in several important ways. First, it makes long distance exchanges faster, easier, less expensive, and more natural, with interaction between classes occurring on a frequent rather than occasional basis. Second, by adding many-to-many communication, an entire group of students can have regular access to interacting with any or all of another group of students, and students from many different schools can interact together as well.

*One-to-One Distant Exchanges via CMC.* The simplest form of distant collaboration via CMC is the one-to-one exchange. The International Email Tandem Network pairs students of different languages and also provides resources and suggestions to assist the students' collaborative communication. For example, a university student in Spain corresponded with a university student in Germany about twice a week, using both German and Spanish to help each other prepare for their foreign language exams, improve their translations, and develop their writing styles (Brammerts, 1996). St. John and Cash (1995) used linguistic analysis and learner reports to describe the process of an adult learner who dramatically improved his German via an email exchange with a native speaker. The learner systematically studied the new vocabulary and grammatical structures in his incoming email and used this information to improve his future letters, with striking results by the end of 6 months. The learner compared the results he achieved via

the email exchange to what he was getting out of a language course taken simultaneously:

[In the course] I could not record what was said by the lecturer, then use it again, or keep it in a form useful to me. . . . There was no automatic record as there was with e-mail. The German I encountered via e-mail was harder in my opinion than that of the course, and was almost never interrupted with English. Also the course was only two hours, once a week, whereas at times I was writing e-mails nearly every day. (p. 196)

This exchange provides an excellent example of a student learning through interaction with a more capable peer (Vygotsky, 1978). It also illustrates Bakhtin's (1986) point that the unique speech experience of an individual is characterized by a "process of assimilation—more or less creative—of others' words (and not the words of a language)" (p. 89).

*Many-to-Many Distant Exchanges via CMC.* The full range of CMC's capabilities for developing L2 skills emerges in many-to-many exchanges (Cummins & Sayers, 1990, 1995). Sayers (1993) suggests three types of long distance collaborative projects that can help bring about these results: (a) shared student publications, such as newspapers or magazines; (b) comparative investigations, such as research into social or environmental problems in different parts of the world; and (c) folklore compendia and oral histories.

Kern (1996) organized an exchange between his elementary French students at the University of California-Berkeley and a history class in France. The history class students were almost all immigrants and refugees; they had published their collective stories in an award-winning book, which is what led Kern to make the initial contact. The immigrant experiences of the two groups (many of the Berkeley students were first or second generation Americans) provided a sociocultural context for language learning. The exchange involved three essays that students in both classes wrote, amplified by email discussions, photos, and documentary evidence: (a) a descriptive essay, in which the students described their neighborhoods, cities, families, and schools; (b) a narrative essay, in which students told the story of their family origins and location; and (c) an argumentative essay, in which students discussed what it meant to be French or American. Kern noted that:

While ostensibly an exercise in communicative language use, this e-mail exchange has been at least as significant in enhancing students' cultural and historical awareness as well as their overall motivation in learning French. For example, in discussing "the

French family" students are not restricted to studying textbook descriptions of fictional families—they learn about real families of various social backgrounds and traditions, living in different environments, each with their own particular perspective on the world. Students have expressed great satisfaction in learning about important historical events of which they had little or no previous knowledge, such as the Algerian war or the Armenian massacre of 1915. Many students have been pleasantly surprised to find that what they are learning in French class connects with what they are learning in their other courses in history, sociology, and anthropology. (p. 118)

Barson, Frommer, and Schwartz (1993) organized a series of project-oriented email exchanges among students of French at three American universities. Students collaboratively produced French language newspapers and videotapes. The authors reported<sup>8</sup> that (a) the exchanges were viewed as real, not pedagogical; (b) students developed free and spontaneous, though not flawless communication while using highly complex structures and vocabulary; (c) students expressed deep satisfaction at being able to manage themselves as leaders and contributors in the target language; (d) students benefited substantially from the increased opportunity to practice their French outside the classroom; and (e) some continued to correspond by email with their partners.

Vilmi (1995) described a multischool exchange involving students of English as a foreign language from three countries. The students worked together in international teams to come up with solutions to real-world environmental problems. Each team picked a problem, such as nuclear power and toxic waste disposal, and completed a series of collaborative writing assignments (a descriptive report, a 3-year plan, a budget, a technical report, and a conference abstract) related to solving the problem. In the end, the reports were shared on the World Wide Web, and the students themselves voted on the best one.

A creative example of a long distance collaboration was reported by Meskill and Rangelova (1995). Bulgarian students studied English by reading contemporary American short stories in collaboration with a class of U.S. graduate students in a program for Teaching English to Speakers of Other Languages (TESOL). The Bulgarians used email to ask TESOL students about both linguistic and cultural issues that came up in the readings and practiced with audiotapes provided by the TESOL students, who in turn benefited from dealing with real problems of language learners.

Wisconsin high school students of Spanish participated by Internet in the international Maya-Quest project, in which they followed a team of cyclists through Mayan territory and discussed with other Spanish classes issues related to Mayan myths and history (Hannan, 1995). In Michigan, a high school Spanish class surveyed people in Latin America and analyzed and presented their findings on a variety of social issues, such as AIDS, drugs, and international stereotypes (Kendall, 1995). In San Francisco, an elementary school Spanish bilingual class conducted an exchange with two other elementary school classes from different ethnic backgrounds, one in San Francisco and one in New York. The three classes exchanged information about each group's folklore and culture and confronted interethnic prejudice (Cummins & Sayers, 1995).

Tella (1991, 1992a, 1992b) conducted an ethnographic investigation of a semester-long exchange between high school students in Finland and England and discovered that: (a) emphasis switched from teacher-centered, large-group instruction to a more individualized and learner-centered working environment; (b) content moved from a standard syllabus to the students' own writings; (c) email provided practice in open expression; (d) editing and revision became more frequent and more collaborative; (e) quality of writing improved; (f) writing modes became more versatile; and (g) reading became more public and collaborative, with students assisting each other.

### *Hypermedia Links*

The final feature of CMC is that it allows multimedia documents to be published and distributed via links among computers around the world. This characteristic is related to the World Wide Web and has implications for collaborative learning.

Hypermedia can provide access to up-to-date, authentic information, which can then be incorporated into classroom collaborative activities. For example, students can work collaboratively to plan and carry out tasks or role-plays (e.g., designing and carrying out newscasts, planning travel activities) using current information (e.g., transport schedules, prices, weather, menus, cultural information, news) related to their own personal interests gathered from a variety of sites all over the world (Deguchi, 1995; Rosen, 1995a, 1995b).

The most potent collaborative activities involve



not just finding and using information, but rather actively making use of technologies to construct new knowledge together. Like Freinet's Modern School Movement, which involved publication of students' documents (Sayers, 1993), CMC permits students to create their own publications and multimedia productions. However, CMC also allows long distance collaboration and facilitates distribution virtually anywhere via the World Wide Web.

An excellent example of a one-class collaborative publishing project is provided by Jor (1995), whose technical writing students, who were learning English as a foreign language, produced a class newsletter on the Web. Collaborative efforts, accomplished both online (via a class bulletin board) and offline, included setting up an editorial board, determining publication standards, planning the content and layout, determining group research projects, peer-editing the writing, and producing and distributing the newsletter. Similarly, Kern's (1995b) students of French produced a multimedia introduction to the city of Berkeley, California, and shared this production with their French exchange partners.

An elaborate international collaborative production is described by Barson and Debski (1996), whose university students of Polish worked with a partner class in Poland, communicating and negotiating via email, to create a bilingual audiovisual Web documentary about their two universities. This long distance collaboration included negotiating about the intended audience, format, and content; writing and editing scripts, scenarios, and voice-overlays; and producing and integrating all the textual, audio, and audiovisual material together into a final Web document.

### *Comments on These Studies*

All of the long distance activities described above, whether involving the World Wide Web or just email, 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 eliminated but are instead 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. All the activities mentioned in the review of research are consistent with Vygotsky's (1978) view that the teaching of writing is a com-

plex process. "Writing should be meaningful for children, . . . an intrinsic need should be aroused in them, and . . . writing should be incorporated into a task that is necessary and relevant for life" (p. 118).

The tasks mentioned in the review are also consistent with another closely related concept later incorporated into sociocultural theory: situated learning (Collins, Brown, & Newman, 1989). Situated learning is learning that takes place (is situated) within a particular environment but that becomes useful in multiple contexts. Situated learning encourages students to conduct actively "meaningful tasks and solve meaningful problems in an environment that reflects their own personal interests as well as the multiple purposes to which their knowledge will be put in the future" (p. 487). Situated learning occurs at a microlevel anytime a language student engages in the types of authentic communication needed outside the classroom. As seen above, CMC can encourage real communication by temporally and geographically expanding the opportunities for interaction.

Cummins and Sayers (1990, 1995) claim that long distance collaborative exchanges also bring about a more macrolevel of situated learning. In their view, the ability to access and interpret information gained through communication and collaboration with people from a variety of cultures will be a critical skill for success in the 21st century. Collaborative exchange via the Internet is thus not only an opportunity for situated language practice, but also a context for developing more general skills that students will find necessary for the future (Cummins & Sayers, 1990, 1995).<sup>9</sup>

### CONCLUSIONS

The special features of online communication—that it is text-based and computer-mediated, many-to-many, time- and place-independent, usable across long distances, and distributed via hypermedia—provide an impressive array of new ways to link learners. When viewed in the context of sociocultural learning theory, which emphasizes the educational value of creating cross-cultural communities of practice and critical inquiry, these features make online learning a potentially useful tool for collaborative language learning.

However, as pointed out by Schwartz (1995), when evaluating computer-assisted language learning it is important to distinguish potential from reality. First, computer-mediated activities

can be used to reinforce traditional "transmission" approaches to teaching and learning as well as collaborative approaches (see, e.g., Warschauer, in press). Second, as Cuban (1986, 1993) has demonstrated, even when educators intend to implement technology-based innovations, they are largely constrained by institutional and societal expectations, with the result that technologies seldom have the transformational effect intended, especially when used with language and ethnic minority students.

A broad research agenda is required to gain a better understanding of the social, affective, and cognitive processes involved in computer-mediated collaborative learning. This research will help us improve classroom practice and deepen our general theoretical understanding of collaboration and social interaction for language learning.

The following is an initial list of questions that language educators and researchers may want to investigate:

1. How do learners construct meaning via online communications, and in what ways is that process similar to or different from the process evident with other media? What tools of analyzing written or spoken discourse are useful in studying online educational discourse?
2. How do learners pay attention to both content and form in online communication? What linguistic features do they tend to notice and incorporate into their own language?
3. How does participation in CMC work affect learners' motivation and sense of identity? How can computer-mediated projects be organized to assist students in seeing themselves as part of the community of speakers of the target language?
4. What is the optimal role for teachers to play in the computer-mediated learning environment? How can teachers make the effective transition from "sage on the stage" to "guide on the side" (Tella, 1996, p. 6) that online education entails? What types of online interaction by teachers facilitate learning, and what types stifle student initiative?
5. How do gender-related, ethnic, linguistic, and cultural differences reproduce (or transform) themselves online, both within a classroom and in cross-cultural long distance exchanges? How can CMC work be organized to include students from a broad range of backgrounds?

Although the questions before us are vast, the potential benefits are great. CMC is starting to change the face of collaborative language learning. A well designed, intelligently implemented

research effort, facilitated by the easy archiving and analysis of electronic communication, will help guarantee that we learn as much as possible from technological change.

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## NOTES

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<sup>1</sup> A previous version of this article was published as Research Note no. 17 by the University of Hawai'i Second Language Teaching and Curriculum Center.

<sup>2</sup> For example, the 1996 annual conferences of the Hawai'i Association of Language Teachers, the Association of British Columbia Teachers of English as an Additional Language, and the Computer-Assisted Language Instruction Colloquium were all devoted to Internet-related themes. For the proceedings of the first national Symposium on Local and Global Electronic Networking in Foreign Language Learning and Research, see Warschauer (1996b).

<sup>3</sup> Many-to-many refers to the fact that any member of a computer-mediated discussion group can address comments to all the other members, no matter how many.

<sup>4</sup> As used by Wertsch (1979) and Lotman (1988), a text is any semiotic corpus that has significance, regardless of whether it is spoken, written, or nonverbal (e.g., a painting). A text-mediational perspective focuses on verbal interaction, whether spoken or written. Wells and Chang-Wells (1992) use text to refer specifically to a written corpus. The term "text-based communication" used in this paper refers to communication in written form.

<sup>5</sup> Many L2 researchers have used a Vygotskian framework (see Brooks, 1992; Donato & Lantolf, 1991; Hall, 1995; Lantolf & Appel, 1994; Swain, 1995; and the 1994, fall issue of *The Modern Language Journal*). The relationship between written and spoken interaction, which I believe to be critical for interpreting CMC, has been studied primarily by first-language educational researchers such as Bayer (1990) and Wells and Chang-Wells (1992).

<sup>6</sup> In synchronous CMC, whatever a student types is immediately sent to other screens, usually after the student hits a send key. The receiver(s) must be online to participate in the discussion. In asynchronous CMC, such as electronic mail, the message might take a couple of minutes to arrive, and the receiver reads and responds at his or her own convenience.

<sup>7</sup> This is also called IRE: initiation, response, and evaluation.

<sup>8</sup> The descriptions of this project and the Tella project are adapted from a previous description in Warschauer (1995).

<sup>9</sup> A study by Warschauer (1996a) of ESL/EFL university students in three countries supports this perspective. The single most motivating factor was the students' view that learning how to use computers was useful for their careers.

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