COMPUTER-MEDIATED COLLABORATIVE LEARNING: THEORY AND PRACTICE

Mark Warschauer
University of Hawai'i at Mānoa
markw@hawaii.edu, http://www.lll.hawaii.edu

The rapid growth of the Internet, arguably the fastest growth of any communications technology in history, has not escaped the attention of language teachers (Warschauer, 1995a, 1995b). Even a cursory glance at the programs of regional and national conferences of language teachers indicates that the number of presentations related to online language learning has expanded geometrically in recent years. Indeed, a number of state and national meetings have been devoted particularly to this theme,[1] and special national symposia have been organized on the topic (Warschauer, 1996b). Yet this growing interest in computer-mediated collaborative language learning has not yet been matched by sufficient attention to the theoretical issues it entails, nor to the research agenda it demands.

The purpose of this paper will be to explore the nature of computer-mediated communication (CMC) and examine its potential in promoting collaborative language learning. This will be accomplished by analyzing five particular features which taken in sum distinguish CMC from other communication media. These features are that CMC is (1) text-based and computer-mediated, (2) many-to-many,[2] (3) time- and place-independent, (4) long distance, and (5) distributed via hypermedia links.

These features will be examined in terms of their relationship to theories of collaboration and interaction in education and in language teaching. In addition, published accounts of how these features have been put to use in the language classroom will be surveyed and discussed. In some cases these accounts constitute rigorous research studies; in

1 For example, the annual conference of the Hawai'i Association of Language Teachers, March 1996; the annual conference of the Association of British Columbia Teachers of English as an Additional Language, March 1996; and the national meeting of the Computer Assisted Language Instruction Consortium, May 1996.

2 Many-to-many refers to the fact that any member of a computer-mediated discussion group can address comments to all the other members, even if there are many thousand spread around the world.

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other cases they represent teachers' personal evaluations of what they have done in their classes. As this area of inquiry becomes more mature, it will of course be desirable to depend more on the former and less on the latter. However, since the entire field of computer-mediated communication is so new, a broad survey of this type can help identify issues and trends that may deserve further attention and research. By placing these trends within a conceptual framework—that of sociocultural learning theory—this article seeks to deepen understanding of the potential of computer-mediated collaborative learning and promote a research agenda which can assist in realizing that potential.

DISCOURSES OF COLLABORATION

Before beginning this examination of specific features of online learning, it is first necessary to briefly discuss the conceptual framework that will be drawn on. The Internet is so vast and varied that it could be used toward almost any means; examination of its uses and potential will thus be more fruitful if framed by a particular theoretical framework of social interaction in the language classroom.

Perhaps the best known perspective for looking at cooperative communication in the language classroom is the interactionist approach originally derived from Krashen's (1981, 1985, 1987) *Input Hypothesis*. Krashen claims that second language learning (termed *acquisition*) is almost wholly dependent on the amount of comprehensible input one receives. A number of researchers, most notably Long, 1980, 1989, 1991, in press; Long & Porter, 1985; Long & Sato, 1984), but also Pica, 1983; 1993; Pica & Doughty, 1985; Pica, Kanagy, & Faladun, 1993), Doughty (Doughty & Pica, 1986), Gass and Varonis (Gass & Varonis, 1994; Varonis & Gass, 1985), have investigated what type of conversational interactions among language learners tend to facilitate the intake of comprehensible input. In this model, language learning is viewed as the development of an individual's linguistic competence, and the purpose of interaction is to provide the input—or, in some views, the output (Swain, 1985)—to make this development possible.

This framework is useful for understanding the benefits of classroom interaction—both in general and also via computer-mediated communication. For example, researchers in this tradition have investigated the psycholinguistic effects of features such as noticing (Doughty, 1991; Long, 1991; Schmidt, 1990; Schmidt, 1992; Schmidt, 1993a; Schmidt, 1993b; Schmidt, 1994; Sharwood-Smith, 1993) and planning (Crookes, 1988; Crookes, 1989). Since written communication obviously allows different opportunities for noticing input and planning output than oral communication does, these two concepts are helpful for understanding computer-mediated language learning.

While the interactionist perspective has something to say about how students learn language, and, perhaps, learn about language, it has very little to say about how students learn *through* language—in other words, how they learn to become a competent member of a

speech community (Hymes, 1972) or social group (Schieffelin & Ochs, 1986), how they use language to learn important cultural knowledge (Kern, 1996) or content matter (Bayer, 1990; Wells & Chang-Wells, 1992), or how they use language to develop literate, critical thinking skills (Heath, 1983; Heath, 1992; Wells & Chang-Wells, 1992). To provide just one example, it is very difficult for an interactionist perspective to account for how a student becomes a better second language writer, if good writing is viewed not as mechanical correctness but rather as a critical process involving the evaluation, organization, and presentation of ideas.

In order to reveal the true potential of collaborative language learning, both in general and via CMC, it is thus necessary to turn to a more in-depth framework of social interaction in the classroom.

The sociocultural perspective, deriving in part from the concepts of Vygotsky (1962, 1978, 1981a, 1981b), fills this gap, since it illuminates the role of social interaction in creating an environment to learn language, learn about language, and learn through language. It is not in contradiction to interactionist approaches but rather examines interaction within a broader social and cultural context.

In Vygotsky's view, all human learning and development is bound up in *activity*, by which he meant purposeful actions mediated by various tools (Vygotsky, 1978; Wertsch, 1979a). The most important of these tools was language, since it represented the semiotic system which was the basis of human intellect (Halliday, 1978; Halliday, 1993; Vygotsky, 1962; Vygotsky, 1978). All higher-order functions were thus seen as developing 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, 1978, p. 57, emphasis in original).

Vygotsky (1962) stressed that collaborative learning, either among students or between students and a teacher, was essential for assisting students in advancing through their *zone of proximal development*—in other words through the gap between what they could accomplish by themselves and what they could accomplish in cooperation with others.

Vygotsky died in 1934 at the age of 37 and his ideas have been further developed by his contemporaries (see for example Leont'ev, 1979; Luria, 1961) and by a growing group of neo-Vygotskians (Bayer, 1990; John-Steiner, 1985; Lotman, 1988, 1988b; Moll, 1990; Tharp & Gallimore, 1988; Vocate, 1987; Wells, 1994; Wells & Chang-Wells, 1992; Wertsch, 1979a, 1979b, 1985a, 1985b, 1991; Wertsch, Del Rio, & Alvarez, 1995; Wertsch, Minick, & Arns, 1984; Wertsch & Toma, 1995). Within the educational sector, two main trends have emerged in Vygotskian approaches.

In the first of these, termed the *modeling* interpretation, "intermental functioning is viewed primarily in terms of how it can provide a model for tutees' individual mental processes" (Wertsch & Bivens, 1992, p. 37). In one well-known study based on this

interpretation, a teacher modeled for students an approach to leading a discussion on readings based on asking interpretive questions, which the students then successfully implemented in their own small groups (Palinscar & Brown, 1984). The modeling interpretation does "involve participation in dialogic interaction"; nevertheless, "the tendency to view the process involved in terms of modeling means that the tutee often continues to be viewed as a passive recipient" (Wertsch & Bivens, 1992, p. 39).

More interesting for understanding cooperative learning in the language classroom is the *text*-mediational interpretation of Vygotsy (Wertsch & Bivens, 1992). This interpretation de-emphasizes the tutor-tutee concept inherent in the modeling view, and instead focuses on how "all participants in intermental functioning are actively engaged in shaping this functioning" (p. 39). Texts then are not seen as links for conveying information, but rather as "thinking devices" used to collaboratively generate new meanings (Lotman, 1988b, p. 36).

The text-mediational perspective is strengthened by incorporating the views of Bakhtin (1981,1986; Volosinov, 1973), one of Vygotsky's Soviet contemporaries. Bakhtin and his circle sharply critiqued the view that language is either an abstract system of linguistic forms or an individual form of activity, positing instead that "language is a continuous generative process implemented in the social-verbal interaction of speakers" (Volosinov, 1973). For Bakhtin, all utterances (spoken or written) are filled with dialogic overtones, based on "echoes and reverberations of other utterances to which it is related by the communality" of communication (Bakhtin, 1986, p. 91). In this view, 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. 93); 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 such as Bayer (1990) and Wells (1994; Wells & Chang-Wells, 1992). Bayer's (1990) model of *collaborative-apprenticeship learning* emphasizes the use of expressive talk, expressive writing, peer collaboration, and meaningful problem-solving tasks. The teacher assists, not as a model but rather as a guide, as students collaborate together to "make connections between new ideas...and prior knowledge", "use language as a tool for learning", and develop "language and thinking competencies" (p. 7). Her model bears some similarity to whole language approaches to education (Freeman & Freeman, 1992; Goodman & Goodman, 1981a; 1981b; Newman, 1985; Rigg, 1991).

Wells (1994; Wells & Chang-Wells, 1992) describes learning as a *semiotic apprenticeship* based on the creation of a collaborative community of practice. He combines a

systemic linguistic approach of Halliday (1978, 1989, 1993; Halliday & Hasan, 1989) with the semiotic mediation concept of Vygotsky in order to analyze how learners construct knowledge together and "attain literate thinking through talk" (Wells & Chang-Wells, 1992, p. 69). This last concept builds on the work of researchers such as Bruner (1972), Scribner and Cole (1981), and Heath (1983) who have previously investigated the relationship between texts, talk, and literate thinking.

Wells examines in particular how learners talk and write about texts. As Wells (1992) points out, "by making a record of text of thought available for reflection, and, if necessary, revision, a written text serves as a 'cognitive amplifier' (Bruner, 1972), allowing the reader or writer to bootstrap his or own thinking in a more powerful manner than is normally possible in speech" (p. 122). According to Wells, though, this opportunity for cognitive amplification is too often missed in school, as texts are engaged primarily in a *performative* mode (e.g., for reading aloud) or *information* mode (e.g., as a dictionary). Wells urges that texts be engaged in an *epistemic* mode, in other words, treated "not as a representation of meaning that is already decided, given, and self-evident, but 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" (p. 139–140). When students attempt that 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" (Wells & Chang-Wells, 1992, p. 140).

By bridging 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, as we shall see below, for evaluating the potential of online education to assist that process.

TEXT-BASED AND COMPUTER-MEDIATED INTERACTION

As mentioned earlier, online learning has a number of distinguishing attributes. The first that we'll examine, and in some ways the most far-reaching, is that it is text-based and computer-mediated.

Whether in society (Halliday, 1993), academia (Harnad, 1991), or the classroom (Wells & Chang-Wells, 1992), language has two main functions: it allows us to (1) interact communicatively and (2) to "construe experience", that is to "interpret experience by organizing it into meaning" (Halliday, 1993, p. 95). Throughout human history, the interactive role has been principally played 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 again and again by a limitless number of people at different times. It is for this reason that the development of writing, and later print, are viewed as having fostered revolutions in the production of knowledge and cognition. Unfortunately, though, "the real strength of writing...was purchased at the price of becoming a much less interactive medium than speech" (Harnad, 1991, p. 42).

Yet it is precisely the intersection between interaction and reflection which is of critical importance in education. Heath, in her classic ethnographic study of language use in three communities (1983), points this out well, as she illustrates the way the middle-class townspeople use language to educate their children:

> It is as though in the drama of life, townspeople parents freeze scenes and parts of scenes at certain points along the way. Within the single frame of a scene, they focus the child's attention on objects or events in the frame, sort out referents for the child to name, give the child ordered turns for sharing talk about this referent, and then narrate a description of the scene. Through their focused language, adults make the potential stimuli in the child's environment stand still for a cooperative examination and narration between parent and child. The child learns to focus attention on a preselected referent, masters the relationships between the signifier and the signified, develops turn-taking skills in a focused conversation on the referent, and is subsequently expected to listen to, benefit from, and eventually to create narratives placing the referent in different contextual situations (Heath, 1983, p. 351).

A rereading of this paragraph gives a glimpse of why online communication is considered an intellectual amplifier (Harasim, 1990; Harnad, 1991). For the first time in history, human interaction now takes place in a text-based form—what's more, a computer-mediated form that is easily transmitted, stored, archived, re-evaluated, edited, and rewritten. The opportunities to freeze a single frame and focus attention on it are thus multiplied greatly. The students' own interactions can now become a basis for epistemic engagement. The historical divide between speech and writing has been overcome with the interactional and reflective aspects of language merged in a single medium. It is precisely this feature, the combination of writing and speech, which led cognitive scientist Steven Harnad (the founder of Brain and Behavioral Sciences) 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 evoluion of human communication and cognition: language, writing and print" (Harnad, 1991, p. 39)

The potential of text-based interaction and expression has been noted before in language pedagogy, as seen, for example, in dialogue journals (Peyton & Reed, 1990) or free writing to be shared with peers. But paper-based dialogue journals or free writing are comparably slow, clumsy ways of exchanging ideas. Furthermore, even when the writing is done on a computer, it is shared on paper, and thus cannot be easily stored, edited, and reworked by the reader. Thus dialogue journals and free-writing are quite useful for expression and for dialogue, but less so for collaboration between individuals, not to mention between a group of people located around the world. It is the computer-mediated feature of online writing which has finally unleashed the power of text-based writing.

While text-based and computer-mediated communication is magnified more by other attributes (e.g., many-to-many or place-independent communication), even when used for one-to-one communication in the same classroom it has proven of value. Kroonenberg (1994/1995), for example, has her high school French students occasionally work in pairs to discuss and debate positions in computer-mediated synchronous chat mode.[3] She observed several benefits. The synchronous communication allows students to get practice at fast interaction. Yet, when students do need to pause and reflect, the text-based mode allows them to do that, encouraging critical thinking. Kroonenberg also finds that many students are more expressive in this mode than in written composition (where every sentence weighs heavily on their minds) or in oral conversation (which deters shy students). When oral discussion follows these online chats, "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" (p. 26–27). The online chats thus serve the role of thinking devices that Lotman (1988b, p. 39) suggested are important for collaborative construction of knowledge.

MANY-TO-MANY COMMUNICATION

The second 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 affects of reactions and responses of a social audience discussed by Bakhtin (Volosinov, 1973).

On the surface of things, this feature of many-to-many communication is similar to what occurs in a group oral conversation. Yet there are two important differences. First of all, as in the situation above, the written, computer-mediated mode of the discourse facilitates a special relationship between interaction and reflection. This creates an excellent environment for a group of people to construct knowledge together by expressing themselves in print and then assessing, evaluating, comparing, and reflecting on their own views and those of others. A second and related difference is that the social dynamics of computer-mediated discussion have proven to be different than face-to-face discussion in relation to issues such as turn-taking, interruption, balance, equality, consensus, and decision-making.

Specifically, studies conducted on the social dynamics of CMC have found that it tends to result in communication which 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

[3] 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 also be online to participate in the discussion. It is contrasted to asynchronous communication, such as electronic mail, where the message might take a couple of minutes to arrive, and the receiver reads and responds to the message at his or own own convenience.

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, & Siegel (1987) found that in discussions held electronically, women made the first proposal as often as men; in face-to-face discussions men made the first proposal five times more often. Huff and King (1988) found that proposals by higher status people (graduate students compared to undergraduates) were invariably favored in face-to-face discussion groups, whereas, in electronic discussion groups, proposals by lower status and higher status people were selected equally as often.

Some of the aspects of CMC which are believed to account for this greater equality of participation include the following:

(1) CMC reduces social context clues related to race, gender, handicap, accent and status which sometime reinforce unequal participation in other types of interaction (Sproull & Kiesler, 1991).

(2) CMC reduces dynamic cues, such as frowning and hesitating, which can intimidate people (especially those with less power and authority) by reminding them that their comments are being evaluated (Finholt, Kiesler, & Sproull, 1986).

(3) CMC allows individuals to contribute at their own time and pace, neutralizing the advantage of those who tend to speak out loudest and interrupt the most (Sproull & Kiesler, 1991), and allowing students to initiate communication without seeking permission.

Despite these apparent advantages, some aspects of electronic discussion could possibly mitigate against cooperative learning. For example, Weisband (1992, cited in Sproull & Kiesler, 1991) found that it was more difficult to achieve consensus in online discussion than face-to-face. 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. In contrast, in electronic discussions, the third member's position was just as far from the final decision as the first member's was. These results suggest that electronic discussion "reduces conformity and convergence as compared with face-to-face group discussion" (Sproull & Kiesler, 1991). Weisband's experiment was conducted using electronic mail. It is likely that in the fast-paced interaction of synchronous discussion it would be even more difficult to reach a consensus. Perhaps this is one reason that teachers have used synchronous communication not so much for decision-based tasks but rather to generate discussion and ideas.

Another aspect of computer-mediated communication that could hinder cooperative learning is the prevalence of hostile language known as *flaming*, which apparently occurs due to the same above-mentioned features which encourage free expression (Sproull & Kiesler, 1991) and can have very 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 becomes "a set of asocial monologues" (Moran, 1991).

Despite these potentially negative features, the published accounts of many-to-many synchronous CMC in the classroom have been overwhelmingly positive. Since synchronous first gained popularity in the composition classroom and then spread to the foreign language classroom, its use in these two domains will be discussed in that order.

SYNCHRONOUS DISCUSSION IN THE COMPOSITION CLASSROOM

Synchronous electronic discussion has been used by English composition teachers since the late 1980s, and an extensive body of literature exists as to its outcomes (Balester, Halasek, & Peterson, 1992; Barker & Kemp, 1990; Batson, 1988, 1993; Boiarsky, 1990; Bruce, Peyton, & Batson, 1993; Bump, 1990; Cooper & Selfe, 1990; DiMatteo, 1990, 1991; Eldred, 1991; Faigley, 1990; Flores, 1990; Fox, 1990; Handa, 1990; Hawisher & LeBland, 1992; Hawisher & Selfe, 1991; Janangelo, 1991; Langston & Batson, 1990; Moran, 1990; Moran, 1991; Peyton, 1990; Selfe, 1990; Selfe & Meyer, 1991; Thompson, 1988).

Teachers report that control of discussion shifts decisively in the direction of the students, as students can speak to each other without having to wait for the teachers' permission (Balester, et al., 1992; Barker & Kemp, 1990; Batson, 1988; DiMatteo, 1990; DiMatteo, 1991; Faigley, 1990). They claim that this fosters student-student discussion and promotes cooperative relationships among students (Balester, et al., 1992; Langston & Batson, 1990). Students reportedly become better writers by having an authentic audience and a purpose (Peyton, 1990) as well as more time on task. Electronic discussion allegedly encourages "a sense of group knowledge" and "a communal process of knowledge making" (Barker & Kemp, 1990, p. 15) and encourages "critical awareness about how communication, or miscommunication, occurs" (DiMatteo, 1991).

These outcomes seem very much in line with Wells' Vygtoskian notion of collaborative communities of practice. The relationship between the role of talk and text in interaction and reflection in computer-mediated group discussion is further explained by DiMatteo (1990):

> In the absence of stable text and the authority based upon a reading of such text, my students confront a writing situation that privileges their own speech. They create intensely visible language out of what they consider to be forgettable, facile words—their own talk and conversation. They develop a sense that when they talk, they are "drafting" themselves, composing their own identities through a speech that is also a writing made utterly tangible. Such a novel and important learning experience conflicts with their traditional assumption that learning is the ability to comment on and recall the teacher's words (p. 76–77).

SYNCHRONOUS DISCUSSION IN THE FOREIGN LANGUAGE CLASSROOM

Most of the above is based on teacher reports of their classroom experiences. However, a number of research studies have now been conducted in the foreign language

classroom which lend empirical support to the above claims. These studies have place both in the second language composition class (Sullivan & Pratt, in press; Warschauer, in press) and in general foreign language classes (Chun, 1994; Kelm, 1992; Kern, 1995b).

Several studies included quantitative measures to evaluate amount of student participation and compare it to face-to-face-discussions (Chun, 1994; Kelm, 1992; Kern, 1995b; Sullivan & Pratt, in press; Warschauer, in press). All studies found a greater amount of student participation in three measures—percentage of student talk vs. teacher talk, directional focus of student talk (toward other students or toward the teacher), and equality of student participation.

Specifically, total amount of student participation in electronic discourses ranged from 85%–92% (85% in Sullivan and Pratt, in press; 86% and 88% in two classes studies by Kern, 1995b; and 92% in Kelm, 1992). In face-to-face discourse, student participation ranged from 35% (Sullivan and Pratt, in press) to 60% (Kern, 1995b).

Sullivan and Pratt (in press) found that 100% of the students participated in electronic discourse and only 50% in the face-to-face discussion. Kern (1995b) and Kelm (1992) similarly found that some students said nothing face-to-face, while all participated online. Warschauer (in press), in an experimental study comparing small group discussion online or face-to-face, found that the online groups were twice as balanced, principally because the most silent students increased their participation many-fold online.

As for directional focus of comments, Chun (1994) found that 88% of student comments and questions online were directed to each other. Kern found in one class that 232 online comments were directed to specific students, whereas only 1 face-to-face comment was similarly directed.

This data suggest important results toward the possibilities of promoting collaborative learning in the classroom. One of the main obstacles toward 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 (McTear, 1975; Mehan, 1985).[4] While electronic discussion is certainly not the only way to break this pattern, it does appear to be a very effective way.

Of course of at least equal importance to the quantity and direction discourse is the quality, and here online results have also been reported to be positive. Students took greater control over discourse management than in normal classroom discussion (Chun, 1994). They used language which was lexically and syntactically more complex (Warschauer, in press) and covered a wide range of communicative and discourse functions (Chun, 1994; Kern, 1995b). 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

[4] Also referred to as IRE — initiation, response, and evaluation.

expressions" (Chun, 1994, p. 28). Students were able to benefit from post-hoc linguistic analysis of their own interactions rather than from studying textbook examples (Kelm, 1992). The instructor noted a significant improvement in the depth and strength of student arguments following online collaborative discussion (Kern, 1995b). Students over the course of a semester using electronic discussion showed significantly greater improvement in their writing than did students in a control-group (Sullivan & Pratt, in press). Based on her study, Chun (1994) claims that electronic discussion appears to be a good bridge between writing and speaking skills, with the strengths of each domain apparently helping the other. Though far from proven, this claim is certainly worthy of further investigation.

TIME- AND PLACE-INDEPENDENT COMMUNICATION

Time- and place-independent communication is featured in electronic mail, which allows users to write and receive messages at any time of the day from any computer with an Internet connection. It is also a feature of the World Wide Web, which in addition allows for the creation of sophisticated hypermedia-based pages to be created 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, since e-mail can be answered more deliberatively than synchronous messages. Secondly, 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 e-mail with dialogue journals written on paper. She found that the students in the computer group wrote more per session than did students in the paper-and-pencil group, and the teacher wrote back in the e-mail format as well. Students in the computer group also asked more questions, responded to more questions and used a variety of language functions more frequently than did the students in the paper-and-pencil group. The electronic discussion was more conversational and informal, with students and teacher discussing various aspects of a topic back and forth.

A broader range of activities is possible when many-to-many communication is factored in to e-mail writing. For example, with a class bulletin board or e-mail discussion list, students can carry out collaborative pair, small group, or whole class work through the whole week, taking advantage of the text-based and computer-mediated features of the online environment. The asynchronous nature of e-mail makes it more suitable for more complex writing and problem-solving tasks than could be accomplished via synchronous discussion in a class.

While there is yet a paucity of research on single class e-mail activities, a number of published reports indicate the range of creative uses of this medium. For example, Lloret (1995) distributes tapes of Spanish music for her classes. The students work on transcribing

the songs and posting them to a class discussion list. Other students then write to the list to offer their comments, suggestions, or help with the transcribing.

Crotty and Brisbois (1995) work in small groups to select articles of interest from French newspapers. The groups then divide up the articles and write reaction files on the class's electronic bulletin board. Other members of the group write responses. Kroonenberg (1994/1995; 1995) has her high school French students debate controversial issues. For example, she distributed a rather contentious letter to parents from the principal about minors' leisure time alcohol consumption. Students used the computer lab during a free period, lunch, or after school, or a home computer if they had a modem, to write at length their responses, discussing the role of parents, the community, the government, the school and minors in dealing with alcoholism.

Janda (1995a, 1995b, 1995c, 1995d, 1995e, 1995f, 1995g, 1995h) developed a series of e-mail activities to help his ESL writing students "develop skills such as gaining a sense of voice and audience, knowing how to back up generalizations with concrete evidence, analyzing the beliefs and assumptions of writer and reader and taking into account the background knowledge of the reader" (Janda, 1995g, p. 75). The activities include interpreting and discussing statistics from graphs and charts; explaining, interpreting and discussing comic strips and other humor; preparing for an oral presentation by laying out and discussing each student's main points and arguments; discussing films; and solving a literary jigsaw in which different students have different amounts of information. A number of these activities are particularly difficult to accomplish over e-mail since they require students to explicitly describe something which could easily be shown in person. That though, is one of the goals—to take advantage of the medium to develop students' skills of narration, description, and interpretation. The e-mail activities create an environment for the learners to engage their texts and other materials in epistemic mode (Wells, 1992), as they struggle together to interpret meaning and construct knowledge.

LONG-DISTANCE EXCHANGES

The next feature of online learning we will consider is that it allows communication at a distance. This is an attribute which is to a certain extent distinct from place-independent communication, since some electronic systems, such as class bulletin boards, may allow place-independent communication only within a local network. The Internet though extends this capability to all corners of the globe.

The importance of long-distance, cross-cultural collaboration for helping develop a spirit of critical inquiry, is illuminated by Bakhtin (1986):

> In the realm of culture, outsideness is a most powerful factor in understanding. It is only in the eyes of *another* culture that foreign culture reveals itself fully and profoundly... 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 meaning, 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 (Bakhtin, 1986, p. 7, emphasis in original).

Long distance collaboration is well-established in models of critical, collaborative pedagogy, especially in Europe (for an excellent discussion, see Cummins & Sayers, 1995). Celestin Freinet's Modern School Movement, founded in 1924, integrated long-distance interscholastic exchanges as a central feature of a creative, meaningful education based on critical inquiry and social interaction (Clanfield & Sivell, 1990; Cummins & Sayers, 1990, 1995; Freinet, 1974; Gervilliers, Bertellot, & Lemery, 1977; Sayers, 1990, 1993). These exchanges made use of the post office to exchange individual pen pal letters, class newspapers, and cultural packages between sister classes which were matched together in pairs or clusters. The MSM founders found that these intercultural exchanges had a profound effect on students:

> Correspondence contributes in the broadest sense to learning which is rooted in life, provoking a kind of healthy reawakening. When we live very close to our surroundings and to people, we eventually come not to see them. We experience a kind of symbiosis, a phenomenon of erosion which deadens our ability to be surprised. But thanks to the questions which emanate from afar, our eyes are opened; we question, we investigate, we explore more deeply in order to respond with precise verifications to the inexhaustible curiosity of our correspondents, thanks to the natural motivation which gradually leads to an awareness of our entire geographic, historic, and human environment (Gervilliers, et al., 1977, pp. 29–30, cited in Sayers, 1990, p. 25).

Freinet's work foretold many of the efforts to develop collaborative exchanges today using computer-mediated communication (Cummins & Sayers, 1995). CMC facilitates the accomplishment of these goals in several important ways. First, it makes long-distance exchanges faster, easier, more inexpensive, and more natural, with interaction between classes occurring on a frequent rather than occasional basis. Secondly, 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 computer-mediated communication is the one-to-one exchange. The International E-Mail Tandem Network pairs students together of different languages and also provides resources and suggestions to assist the students' collaborative communication (Brammerts, 1995; Brammerts, in press). For example, a university student in Spain met up with a university student in Germany vis this network (Brammerts, in press). They correspond about twice a week, helping each other prepare for their foreign language exams, answering questions about the details of translations, and offering corrections and suggestions regarding mistakes and stylistic alterations for each other's outside correspondence, Curriculum Vitae, and other writings.

The power of a systematic one-to-one exchange for language learning was illustrated by St. John and Cash (1995) who use linguistic analysis and learner reports to describe in detail the process of an adult learner who dramatically improved his German via an e-mail exchange. The learner systematically studied the new vocabulary and phrases that he read in his incoming e-mail, and stored the e-mail messages for later study and use. When he wrote letters, he reviewed these past messages, and made special effort to put to use the new vocabulary and phrases. Through this process, he was able to correct some of his early mistakes and incorporate and learn a great variety of lexical items, syntactical devises, and idiomatic expressions. The learner compared the results he achieved via the e-mail 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 (St. John & Cash, 1995, p. 196, emphasis in original).

This exchange represents a classic example of a student learning from a more capable peer in order to advance through his zone of proximal development (Vygotsky, 1978). It also illustrates Bakhtin's point that the unique speech experience of each individual is characterized by a "process of assimilation—more or less creative—of others' words (and not the words of a language)" (1986, p. 89, emphasis in original).

MANY-TO-MANY DISTANT EXCHANGES VIA CMC

It is in many-to-many classroom partnership exchanges that the full range of CMC's capabilities are brought to bear for developing critical, literate skills in a second language (Cummins & Sayers, 1990, 1995; Sayers, 1993). Sayers (1993) suggests three types of long-distance collaborative projects which can help bring about these results: (1) shared student publications, such as newspapers or magazines; (2) comparative investigations, such as research into social or environmental problems in different parts of the world; and (3) 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 earlier 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 ample context for language learning in a sociocultural context. The exchange was based upon three essays that students in both classes wrote, proceeded and followed by ample discussion of the issues over e-mail with their international partners: (1) a descriptive essay, in which the students described their neighborhoods, cities, families, and schools; (2) a narrative essay, in which students told the story of their family origins and how they came to live where they do, including photos or other documentary evidence; and

(3) an argumentative essay, in which students grappled with the concept of nationality by discussing what it meant to be French or American.

Kern claimed that even in its beginning stages, the project had important language learning benefits—for example, the students learned from real interaction the different uses of *tu* and *vous*—but that the benefits of the project extended much further:

> 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 (Kern, 1996, p. 118).

Barson, Frommer, and Schwartz (1993) organized a series of project-oriented, student-centered collaborative e-mail exchanges among French students at three American universities. The students at these universities worked in groups to collaboratively produce target-language newspapers and videotapes. The authors, based on their action research, report that:[5]

- The exchanges, negotiations, management talk, and discussions were experienced as authentic, rather than pedagogic. This context required spontaneous use of French that was more typical of everyday language in a francophone country than what usually takes place in a conventional classroom setting. As a result, students developed a facility for speaking freely and spontaneously, although not always flawlessly.
- The students experienced deep satisfaction at being able to "manage their life" (p. 582) in the target language with a fair measure of success. They came into a sense of their own responsibilities as leaders and contributors, learning how to carry on conversations which were often at a very challenging linguistic levels.
- Students benefited substantially from the increased opportunity to practice their French outside the classroom. Some continued to correspond by e-mail with their partners.

Vilmi (1995) describes a multi-school exchange involving students of English as a foreign language from three countries. The students worked together in multi-national 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 directed toward solving the problem, including a

[5] The descriptions of this project and the Tella project below are adapted from my previous description of them in Warschauer (1995a)

descriptive report, a three-year plan, a budget, a technical report, and an abstract for a conference. 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 long-distance collaborative apprenticeship is reported by Meskill and Rangelova (Meskill & Rangelova, 1995). In that situation, Bulgarian students studied English by reading contemporary American short stories in collaboration with a class of TESOL graduate students in the U.S. The Bulgarians used e-mail to consult with the TESOL students over both linguistic and cultural issues which come up in the readings. The Bulgarians also made use of audiotaped portions of the stories provided by the TESOL students. The TESOL students benefit in turn from collective experience in dealing with the real issues and problems of language learners.

Such activities are not restricted to the university level. High school Spanish students in Wisconsin participated by Internet in the international MayaQuest 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, another high school Spanish class worked in groups to survey people in Latin America and analyze and present 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 carries out an exchange with two other elementary school classes, one in San Francisco and one in New York. The three classes—one predominately Mexican, one predominately African American and one Afro-Caribbean, exchange information about each group's folklore and end up confronting interethnic prejudice as they learn language and culture (Cummins and Sayers, 1995). Similar activities are being organized in other languages such as Japanese (Ady, 1995).

Tella (1991, 1992a, 1992b) conducted an ethnographic investigation of a semester-long exchange between high school students in Finland and England. Among the results cited by Tella were the following:

- Emphasis switched from teacher-centered, large-group sponsored teaching toward a more individualized and learner-centered working environment. The content of the class also shifted from that of a standard syllabus to the students' own writings (Tella, 1992b, p. 244).
- The e-mail communication gave a good chance for practicing language in open-ended linguistic situations. A shift from form to content was achieved, a free flow of ideas—and with it expressions, idioms, and vocabulary (Tella, 1992b, pp. 244–245).
- The whole writing process changed to some extent. Rather than writing their compositions only once, as is the norm, the Finnish students naturally edited and revised their compositions, poems, and other messages to make them appropriate for their English peers. Instead of writing most of their compositions and other work

alone, they increasingly made use of peer tutoring and other collaborative methods in order to compose their e-mails together (Tella, 1992b, pp. 244–245).

- The quality of writing improved as writing changed from teacher-sponsored and led, only to be marked and graded, to real-purpose writing with genuine audiences around the world (Tella, 1992b, p. 245).
- The modes of writing became more versatile, including not only the narrative and descriptive genres usually found in regular class, but also personal, expressive and argumentative use of language (Tella, 1992b, p. 245).
- Reading also became more public and collaborative, with students actively assisting each other in studying incoming messages. Students also used different reading strategiess to read the wide variety of messages, notices, and documents which were received (Tella, 1992b, p. 246).

HYPERMEDIA INFORMATION AND STUDENT PUBLISHING

The final feature of computer-mediated communication—that it allows multimedia documents to be published and distributed via links among computers around the world—is a particular feature of the World Wide Web. This feature has several comcomitants for collaborative learning.

First, it makes possible access to up-to-date authentic information, from distributed sites all over the world, which can then be incorporated into classroom collaboartive activities. So, 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 authentic 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 (see for example Deguchi, 1995; Rosen, 1995a, 1995b).

Again, though, the most potent collaborative activities involve not just finding and using information, but rather actively making use of technologies to construct new knowledge together. Once more a precedent for this is seen in Freinet's Modern School Movement. In addition to the previously-described long-distance exchanges, the MSM was based on a second principle: students gaining active mastery of technologies in order to publish their own documents and materials. Producing and sharing of materials, using mimeograph machines, cameras, and taping equipment, allowed the MSM students to "gain power over the same technologies which threaten their personality development" (Sayers, 1990, p. 24), "construct their personalities and reflect on their lives" (Freinet, 1974, p. 32, cited in Sayers, 1990, p. 24), and "attain new insight into life that seems to go behond...actual experience" (Freinet, 1974, p. 28, cited in Sayers, 1990, p. 24).

The World Wide Web now provides a more powerful tool for achieving similar goals. By becoming Web programmers, today's students, like those of Freinet, can overcome their "total state of passive knowledge" (Freinet, 1974, pp. 89–90, cited in Sayers, 1990, p. 23). They can also, at no extra cost, share their productions with peers anywhere in the world, thus benefiting from the critical response of distant partners. And they can even collaborate with long-distance partners in creating joint multimedia productions.

An excellent example of a one-class collaborative publishing project is provided by Jor (1995), whose EFL technical writing students organized into teams to produce a class newsletter on the Web. Collaborative efforts, accomplished both online (via a class bulletin board) and offline, included setting up an editorial board and determining standards for the newsletter, brainstorming the content and layout, determining group research projects, peer editing of group work, and technical producation of the newsletter. Similarly, Kern's (1995a) students worked together to produce a multi-media introduction to the city of Berkeley, which they then shared with their French exchange partners.

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

SITUATED LEARNING

All of the long-distance activities described above, whether involving the World Wide Web or just e-mail, 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.

The activities are all consistent with Vygotsky's (1978) view that the teaching writing is a complex cultural activity and that "writing should be meaningful for children, that an instrinsic need should be aroused in them, and that writing should be incorporated into a task that is necessary and relevant for life" (1978, p. 118). They are also consistent with another closely-related concept later incorporated into sociocultural theory, that of *situated learning* (Collins, Brown, & Newman, 1989). Situated learning represents the

opportunity for students to "carry out tasks and solve problems in an environment that reflects the multiple purposes to which their knowledge will be put in the future" (p. 487). As Collins, Brown and Newman (1989) state:

> Situated learning serves several different purposes. First, students come to understand the purposes or uses of the knowledge they are learning. Second, they learn by actively using knowledge rather than passively receiving it. Third, they learn the different conditions under which their knowledge can be applied...Students have to learn when to use a particular strategy and when not to use it (i.e., the application conditions of their knowledge). Fourth, learning in multiple contexts induces the abstraction of knowledge, so that students acquire knowledge in a dual form, both tied to the contexts of its uses and independent of any particular context. This unbinding of knowledge from a specific context fosters its transfer to new problems and new domains (Collins, et al., 1989, p. 487).

Situated learning thus occurs at a micro-level anytime a language student engages in the types of authentic communication which they will need outside the classroom. As seen above, computer-mediated communication can create opportunities for this by temporally and geographically expanding the opportunities for communicative interaction.

Cummins and Sayers (1990, 1995) claim that long-distance collaborative exchanges also bring about a more macro-level situated learning. In their view, the ability to access and interpret information from around the world in 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 seen not only as an opportunity for situated language practice, but also as a a context for developing broader skills needed of importance for students' futures (1990, 1995).[6]

CONCLUSION

The special features of online communication—that it is text-based and computer-mediated, many-to-many, time- and place-independent, and distributed via hypermedia links—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 appear to make online learning a potentially powerful 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. Research to date on CMC in the language classroom has been thin and has largely consisted of innovators reporting on the outcomes of their own teaching. A broad research agenda is called for 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

[6] A study by Warschauer (1996a) of ESL/EFL university students in three countries supports this perspective; the study found that the single most motivating factor for the students to participate in computer-based learning activities was their view that learning how to use computers was important for their careers.

practices and may even result in insights that will 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:

- How do learners construct meaning via online communications, and in what ways is that similar or different than in other media? What tools of analyzing written or spoken discourse are useful in studying online educational discourse?
- How do learners attend to content and form in online communication? What linguistic features do they tend to notice and incorporate into their own language?
- How does participation in computer-mediated collaborative work affect learners' motivation and 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?
- What is the right 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, in press) that online education entails? What types of online interaction by teachers tend to facilitate learning and what types tend to stifle student initiative?
- How do gender, ethnic, linguistic, and cultural differences reproduce themselves online, both within a classroom and in cross-cultural long-distance exchanges? How can computer-mediated collaborative work be organized so that it is most inclusive to students from a broad range of backgrounds?

While the questions before us are vast, the potential benefits are also great. Computer-mediated communication is starting to change the face of collaborative language learning. A well-motivated research effort, facilitated by the easy archiving and analysis of electronic communication, will help guarantee that changes are implemented intelligently and that we learn as much as we can from them.

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