
Perspectives on Technology in Learning and Teaching Languages

RICHARD KERN

*University of California
Berkeley, California, United States*

Rapid evolution of communication technologies has changed language pedagogy and language use, enabling new forms of discourse, new forms of authorship, and new ways to create and participate in communities. The first section of this article identifies and discusses four key issues arising from the recent technology-related literature (the status of CALL, its theoretical grounding, its cultural embeddedness, and its effectiveness). The second section synthesizes research findings from three current areas of research: computer-mediated communication, electronic literacies, and telecollaboration. The third section develops implications for teaching and research, highlighting the importance of the teacher, new understandings of language and communication, critical awareness of the relationships among technology, language, culture, and society, and new trends in research methods.

We live, work, learn, and play in a rapidly changing communication landscape. Cell phones transmit text messages and photos as well as voice, small digital cameras take sound videos as well as stills, handheld “personal digital assistants” allow us to connect to the Internet from any location served by a wireless network, webcams provide visual contact between Internet interlocutors. Images, animation, color, and visual design interact with language in Web-based communication. E-mail, instant messaging, chat rooms, Usenet groups, MOOs, blogs, and wikis enable new forms of discourse; new forms of authorship; new forms of identity construction; new ways to form, choose, and maintain learning communities and affinity groups that cross national boundaries. How do these changes affect the ways we learn, use, and teach languages?

This article explores some of the issues involved in addressing that question, identifying what we have learned so far and what we have yet to understand. Although space does not permit an exhaustive research review (for recent reviews, see Chapelle, 2003; Kern, Ware, & Warschauer, 2004; Salaberry, 2001; Thorne & Payne, 2005; Warschauer & Kern, 2000;

Zhao, 2003), I focus on key issues arising from the recent technology-related literature (mostly from the past 5 years). The first section outlines four controversies related to information and communication technologies: the status of CALL, theoretical grounding for technology-based teaching and research, notions of effectiveness, and the cultural neutrality of computer environments. The second section presents research findings from three current areas of research: computer-mediated communication, electronic literacies, and telecollaboration. I conclude by considering implications for teaching and future research.

First, however, a note on what I mean by *technology*. A truly comprehensive overview of technology and language learning would have to include the technologies of writing, sound recording, film, and video. However, because these technologies have become somewhat invisible or “normalized” (Bax, 2003, p. 23), I will restrict my discussion to digital technology. In this article, that means principally computers, although the rapid functional convergence of computers, televisions, telephones, and other telecommunications devices leads to the first controversy: how to label this area of research.

CONTROVERSIES

Should CALL Still Be Called CALL?

The following two definitions—the first from 1997 and the second from 2005—indicate important changes in perspective:

Computer-assisted language learning (CALL) may be defined as “the search for and study of applications of the computer in language teaching and learning.” (Levy, 1997, p. 1)

CALL means learners learning language in any context with, through, and around computer technologies. (Egbert, 2005, p. 4)

Whereas the first definition prioritizes “applications of the computer” in its information structure, the second definition not only prioritizes “learners learning language” but also broadens the potential types of relationships between computer technologies and language learning.

Given the high level of integration of digital technology in people’s everyday lives in many (but not all) parts of the world, Warschauer (1999a) has argued that the term *computer-assisted language learning* has outgrown its usefulness as a construct for teaching and research. The problem, Warschauer states, is that a CALL framework posits the computer as an “outside instrument rather than as part of the ecology of

language use” (n.p.). While this may have been fine in the early days of CALL when computers were used to perform structural drills, it is no longer appropriate when online communication has become a normal part of daily life. For Warschauer, the use of computers should not be framed as a special case but rather as an integral aspect of language learning and language use:

The truly powerful technologies are so integrated as to be invisible. We have no “BALL” (book-assisted language learning), no “PALL” (pen-assisted language learning), and no “LALL” (library-assisted language learning). When we have no “CALL,” computers will have taken their place as a natural and powerful part of the language learning process. (Warschauer, 1999a, n.p.)

Bax (2003) agrees, but views “normalisation” (p. 23) as an end goal of CALL rather than a current reality, given the still incomplete integration of computer technology and education. For Bax, the success of CALL integration will be marked by the disappearance of the term *CALL*.

Another dimension of the question has to do with differentiating computers from other tools. It is revealing to note that in the introduction to *CALL Research Perspectives* (Egbert & Petrie, 2005), Egbert does not explicitly mention computers in her “CALL equation”:

learners	(with their thoughts, behaviors, motivations, experiences, and understandings)
+ language	(including its status and structure)
+ context	(physical and temporal environment and the social, economic, cultural, and linguistic influences)
+ one or more tools	(and the affordances the tool provides)
+ tasks/activities	(content, structure, and organization)
+ / – peers and teachers	(or others who can affect the process)
<hr/>	
= CALL	(Egbert, 2005, p. 5)

Egbert generalizes the computer to “tool” status. The epistemological question for our profession, then, is whether computers can be broadly treated as tools, and if so, whether we need to have a special category for computer-assisted language learning.

A third dimension of the question has to do with the evolution of technology itself. As suggested in the introduction, the rapid convergence of functionality across digital devices, and our growing reliance on such devices for communication, means we may soon need to refer broadly to information and communication technologies rather than specifically to computers in our research.

Which Theories?

Another controversy related to technology and language learning research has to do with the appropriate theoretical grounding for the field. Chapelle, in her groundbreaking (1997) article titled “CALL in the Year 2000: Still in Search of Research Paradigms?,” argues that although CALL research understandably draws on theories from diverse disciplines, general theories from fields like psychology, computational linguistics, and educational technology will lack the specificity needed to design and improve CALL pedagogy. What we need, she argues, is to ground CALL in instructed SLA theories. Chapelle recommends the interactionist approach to SLA (see Pica, 1994) as a particularly productive basis for generating hypotheses, and discourse analysis as a primary research method to explore what she considers two essential questions: “What kind of language does the learner engage in during a CALL activity?” and “How good is the language experience in CALL for L2 learning?” (p. 22). Chapelle acknowledges that these are not the only questions that one could ask about CALL, but she argues that real progress in CALL depends on alignment with the questions and methods of instructed SLA researchers (p. 28).

Writing 8 years later, Chapelle (2005) cites a substantial body of CALL research in the interactionist tradition and concludes that “the use of discourse and interactionist perspectives for the study of CALL has helped to place CALL research on more solid grounding relative to other areas of applied linguistics” (p. 63).

Though this is certainly true, Egbert and Petrie (2005), the editors of Chapelle’s (2005) chapter, argue for the current need to re-enlarge the theoretical palette. Claiming that books currently used in CALL teacher education courses “generally address only one theoretical foundation (e.g., interactionist) or one research methodology (e.g., discourse analysis)” (p. ix), their goal is to present a variety of ways to think about and conduct research on computers and language learning. Egbert (2005) explains that multiple theoretical perspectives are particularly important in times of rapid change (a) as social and cultural contexts of technology use expand; (b) as technologies diversify, both in terms of devices and in terms of modes of expression and interaction; and (c) as the goals, content, and structure of CALL pedagogy evolve.

For example, one significant limitation of interactionist SLA theory is that it deals exclusively with linguistic dimensions and lacks provision for dealing with cultural dimensions of language learning. Because cross-cultural exploration is one of the important goals of many project-based applications of CALL (e.g., Brander, 2005; Furstenberg, 2003; Gray & Stockwell, 1998; Kern, 1996; Osuna, 2000), alternative theoretical frameworks are needed.

Sociocultural theory, like interactionist SLA, emphasizes the importance of learner interaction, but it is interested less in negotiation-evoked adjustments in input than in the social and cultural situatedness of learner activity, learners' agency in co-constructing meanings (as well as their own roles), and the importance of mediation by tools and signs. O'Rourke (2005) points out that features of computer-mediated environments are not fixed "givens" but are often negotiated, sometimes subverted, by their users (p. 434), and from this perspective many conventional interactionist CALL studies appear overly reductionist (p. 435). Sociocultural theory has grounded a considerable number of computer-mediated communication studies (e.g., Belz, 2002; Darhower, 2002; Osuna, 2000; Thorne, 2003; Warschauer, 1999b, 2005) and some researchers (e.g., O'Rourke, 2005) have profitably added a sociocultural dimension to interactionist approaches. In a somewhat similar vein, Felix (2005) argues for social constructivist paradigms that incorporate cognitive constructivist elements.

Systemic-functional linguistics offers another framework for CALL research, especially in studies involving advanced level learners (Mohan & Luo, 2005). Analysis of field, tenor, and mode is particularly important in understanding registers and genres for different purposes across diverse computer-mediated communication (CMC) environments. Mohan and Luo argue that the rapidly changing social dynamics and conventions of CMC are much better addressed by a systemic-functional approach than by an SLA framework (p. 95).

Anthropology, and particularly ethnographic research methodology, is becoming an especially relevant discipline as more and more technology-mediated language learning and language use takes place (a) outside of educational institutions and even outside of educational frameworks, and (b) across diverse social, cultural, socioeconomic, and political contexts. Key examples are Warschauer's (1999b) research in Hawaii and in Egypt (Warschauer, Said, & Zohry, 2002), Miller and Slater's (2000) work in Trinidad, and Lam's (2000, 2003, 2004) research in Chinese-American adolescent communities.

Since multimedia authoring arrived on the scene, semiotic theories (e.g., Halliday, 1978; Kress, 2003; Kress & van Leeuwen, 1996; Peirce, 1966) have been increasingly relied on to deal with relationships among visual, audio, and textual modes of signification (see the section in this article on electronic literacies).

In considering this issue, it is important to bear in mind that SLA is itself informed by a rich variety of theoretical frameworks and has consistently resisted a single overarching theory (Kramsch, 2000). Maintaining theoretical grounding in SLA is imperative, but this grounding need not mean privileging any single paradigm of SLA. Given the complexity and diversity of goals, contexts, and problems in CALL

research, a one size fits all approach will not work. Rather, on the micro level of the individual study researchers should rigorously work within the SLA paradigm that most adequately suits their particular research questions, and on the macro level they should look to the synergy of multiple perspectives and paradigms to best inform their understanding and future research.

Questions of Effectiveness

Do computers improve language learning? This question has traditionally driven CALL research. It is considered an important question because it is tied to funding decisions and curricular overhaul. It is not, however, a question that can be answered with a simple yes or no, any more than we could answer a similar question about the effectiveness of books, films, newspapers, or study groups. As with other learning resources, we need to refine the question to examine the myriad ways in which computers are being used, by whom, in what contexts, and for what purpose. When these parameters are pinned down, the answer is sometimes yes, often no, sometimes yes for some learners but not for others.

In his recent literature review and meta-analysis, Zhao (2003) identifies three problems with assessing the effectiveness of technology. First is the problem of defining what counts as technology (videos, CALL tutorials, and chat rooms, for example, are obviously very different). The second problem is separating a technology from its particular uses. Because any given technology may be used in a variety of ways, some effective, some not, it is difficult to generalize about the effectiveness of a technology itself. The third issue has to do with the effects of other mediating factors, such as the learners, the setting, the task(s), and the type of assessment. Zhao attempted to address these issues by performing a meta-analysis of stringently selected studies published between 1997 and 2001. Including technologies ranging from video to speech recognition to web tutorials, Zhao found a significant main effect for technology applications on student learning. However, Zhao's analysis was limited to only nine studies that provided sufficient data for a meta-analysis (whereas his original search showed almost 400 technology-related language studies published during the period). Moreover, Zhao points out that most studies had small sample sizes, seldom used random sampling, and were often directed by the students' teachers, introducing the possibility of a Pygmalion effect.

Although Zhao conducted his meta-analysis meticulously, it is hard to know how to interpret and make use of his positive finding. As Zhao himself points out and others have echoed (e.g., C. Jones, 1986), it is not

the technology per se that is effective or ineffective but the particular ways in which the technology is used.

These days, given the common presence of computers in many institutions of learning, we may be past the point of deciding whether or not to use computers in language teaching. But we still need to know how to make the best uses of them to accomplish specific goals. Moreover, it is important to ask what it means to use computers for learning and using a language, that is, to reflect critically on the social, cognitive, cultural, as well as educational implications.

If we look at language learning from a broad semiotic perspective, we will be less interested in whether learners successfully acquire a particular linguistic structure and more interested in how they attempt to deal (sometimes successfully, other times less so) with specific communicative situations and with the linguistic, cognitive, social, and material resources available to them. This perspective puts the accent on learners' agency and teacher responsibility rather than on the effect of technology itself. Questions of overall effectiveness limit us to yes-no-maybe answers that are sometimes hard to interpret without thick description of the context, content, people, and procedures involved. Looking at effectiveness also inadequately accounts for the symbolic or prestige dimension of using computers (i.e., the computer's association with progress can lead some programs and schools to promote CALL activities regardless of whether they are shown to improve student learning). In sum, the complexity of the issues involved in technology and language learning is pushing us to look beyond gross decontextualized measures of effectiveness to understand effectiveness in terms of the specifics of what people do with computers, how they do it, and what it means to them.

Computers and Culture

Some pundits like Negroponte (1995) and Rheingold (1993) portray computers as culturally neutral tools, offering universally adaptable media fostering global communication and, ultimately, global communities. A number of researchers, however, contend that digital technologies, as cultural products shaped by cultural environments, cannot be culturally neutral, and they have begun to study the cultural particularities of computer-mediated environments.

Reeder, MacFadyen, Roche, and Chase (2004), for example, identify a foundational but invisible culture of efficiency reflected in the design of WebCT (a widely used course management system) and similar Internet-based communication platforms. This culture values *speed*, *reach*, *openness*, *quick response*, *questions/debate* and *informality* in communication (p. 92). R. H. Jones (2004) notes that young computer users "almost never

use [computers] to do only one thing at one time” (p. 27) and that what he (following Scollon, Bhatia, Li, & Young, 1999) calls *polyfocality* (i.e., simultaneously following multiple attentional tracks) seems “to be part of the very *ethos* of new communication technologies” (p. 27). Bowers (2000) decries the proliferation of decontextualized data on the Internet and suggests that “computer-mediated communication should be viewed as a degraded form of symbolic interaction—one that reinforces the rootless individual who is comfortable with the expressions of self-creation that the computer industry finds profitable to encourage” (p. 47). Putting a more positive spin on the question, Kramsch, A’Ness, and Lam (2000) find that although the computer medium “imposes its own aesthetic logic on the creation of the material” (p. 95), it promotes an enhanced sense of agency among users: “authorship becomes the privilege of any language user, at equal par with any other” (p. 96).

What may be natural values to those who are well socialized into computer culture, may seem quite foreign to those who are not. Hawisher and Selfe’s (2000) collection of essays on computer-based literacy practices from countries around the world explores the interaction between global computer uses and local cultures. For example, Dragona and Handa (2000) suggest that the logic and navigational procedures of hypertext are not universally intuitive and may be “a mode of thinking that reflects cognitive constructs and connections that are particularly English” (p. 53). They speculate that the novelty of multimodal texts may short-circuit people’s critical sensibilities and make the texts appear “more as ‘pure’ information and ‘pure’ entertainment rather than a medium fraught with cultural baggage” (p. 53).

Reeder et al. (2004) found that learners’ online “self-introduction” postings differed significantly in terms of their underlying notions of how identity is established online and attributed these differences to the gap between the individual learner’s communicative culture and that of the computer (p. 93). They concluded that “the kind of e-tools for communication and education such as bulletin boards, which cater to publicity, and learning platforms such as WebCT, which are based on the notion of Western-style efficiency, are not necessarily appropriate tools for international groups of learners, even though one of the main driving forces of Internet-based learning is internationalization of education” (p. 100).

Thatcher (2005) found that his Ecuadorian students were frustrated using e-mail and hypertext because these media lacked familiar social cues. One student, who reported that “I lose all the emotion on email and the Internet . . . I cannot communicate all that I want to,” ended up using the telephone instead so that she “could be more herself” (p. 289). On the positive side, however, Thatcher notes that the lack of physical context in e-mail and hypertext permitted more abstract group discus-

sions, which many of his students found more “objective,” “reasoned,” and “productive” (p. 289). Thatcher speculates that the use of e-mail and the Internet might ultimately foster a less collective approach in other forms of Ecuadorian communications, including standard writing.

Ess (2005) discusses the idea of CMC as “computer-mediated colonialization,” that is, the notion that CMC technologies impose Western values and practices on peoples whose cultural values and communicative preferences are very different (p. 162). However, he does not capitulate to a black and white distinction between “a homogeneous McWorld and a fragmented plurality of disconnected cultures and people” (p. 162). Rather, he argues that by studying the values and communicative preferences embodied in Western CMC technologies we can succeed in developing models for “middle grounds . . . that conjoin global connectivity with a plurality of local cultural identities” (p. 162).

As educators, we need to recognize two points. First, because computer environments have their specific cultures, we need to attend to both the positive and negative valences of the value categories we create and think with. When do speed and informality become glibness? When does polyfocality become distractedness? When does agency become rootless individualism? Second, we need to recognize that computer cultures are subject to transformation not just by hardware and software design but also by computer users. As more and more people from different cultural backgrounds, speaking languages other than English, come to use computers, the communicative cultures of computer environments will change correspondingly.

CURRENT RESEARCH

The role of technology in CALL can be thought of in terms of the metaphors of tutor, tool, and medium.¹ In the *tutor* role, computers can provide instruction, feedback, and testing in grammar, vocabulary, writing, pronunciation, and other dimensions of language and culture learning (for a pedagogical and SLA-based discussion of research, see Chapelle, 1998). Voice interactive CALL (e.g., Ehsani & Knodt, 1998) can also simulate communicative interaction. In the *tool* role, computers provide ready access to written, audio, and visual materials relevant to the language and culture being studied. They also provide reference

¹ These metaphors extend Levy’s (1997) distinction between tutor and tool roles of the computer in CALL, which he in turn derived from Taylor’s (1980) distinction of tutor, tool, and tutee roles. Whereas Levy would categorize CMC applications as tools, it seems to me that *medium* (or *environment*) better reflects how users think about chat, instant messaging, e-mail, and other media.

tools such as online dictionaries, grammar and style checkers, and concordances for corpus analysis. The Internet and databases can serve as tools for research. In the *medium* role, technology provides sites for interpersonal communication, multimedia publication, distance learning, community participation, and identity formation.²

Although CALL research originally focused on tutorial applications, in the past 10 years or so the general trend in CALL research has been toward tool and especially medium roles. Hubbard and Siskin (2004) point out that despite its marginalization from the pedagogical mainstream, tutorial CALL is very much alive and well at specialist conferences. Debunking common myths about tutorial CALL, Hubbard and Siskin argue convincingly for its significant promise for developing learners' conscious knowledge of the language, for improving listening and reading comprehension, and for improving pronunciation. Although tutorial CALL is not currently a dominant area of research, it nevertheless represents an important area to observe in the future.³

Recent tool-oriented CALL research has been predominantly in the area of concordancing and corpus analysis.⁴ Corpus analysis provides data on the real-world contexts of the occurrence of words and collocations across various genres, registers, and language varieties. Pedagogically it can be used to support *data-driven learning*, that is, a learner-centered, form-focused approach aimed at consciousness raising (Rutherford, 1987), in which students are encouraged to make and test hypotheses about language features based on corpus evidence. A number of books on corpus linguistics have appeared recently (e.g., Granger, 1998; Granger & Petch-Tyson, 2003; Hunston, 2002; Partington, 1998), and a special issue of *Language Learning & Technology* (Tribble & Barlow,

² These categories are not, of course, mutually exclusive. Some of the most ambitious technology-based projects, for example Furstenberg's *A la rencontre de Philippe, Dans un quartier de Paris*, and *Cultura* (Furstenberg & Levet, 1999; Furstenberg, Levet, English, & Maillet, 2001; Furstenberg, Murray, Malone, & Farman-Farmaian, 1993), combine elements from all three metaphors.

³ A sampling of recent studies of tutorial CALL include the following topics: voice interactive CALL (Ehsani & Knodt, 1998), error correction (Heift, 2004), using software to teach intonation and prosody (Hardison, 2005; Levis & Pickering, 2004), listening comprehension (Zhao, 1997), and glossing and multimedia annotations (Al-Seghayer, 2001; Chun & Payne, 2004; Chun & Plass, 1997; L. C. Jones & Plass, 2002).

⁴ Corpus linguistics developed in the 1960s when linguists began to use computers to develop concordances for text analysis. Whereas the 1961 Brown Corpus of Standard American English consisted of 500 American texts and included a million words (W-3 Corpora Project, 1998), today's corpora are vast by comparison. For example, the Cobuild Bank of English corpus now includes hundreds of millions of words of English text from British, U.S., Australian, and Canadian sources ("Collins Cobuild Bank of English," 2004). Most corpora focus on written language, but several corpora are dedicated to spoken English (e.g., the London-Lund Corpus, the IBM/Lancaster Spoken English Corpus, the British National Corpus).

2001) is devoted to the topic. So far, however, empirical research on corpora and language learning outcomes has been sparse. Like tutorial CALL, this is an area to watch in the future.

The bulk of current research focuses on technology as medium, and most studies can be roughly grouped into three areas: CMC, electronic literacies, and telecollaboration. This line-up reflects the current dominance of interactionist SLA, discourse analysis, and sociocultural theory in discussions of technology-mediated language learning.

COMPUTER-MEDIATED COMMUNICATION

The forms and functions of CMC have been explicated most notably by Murray (1988, 1989, 1996, 2000), Herring (1996, 1999, 2001), and Crystal (2001). It is clear that CMC is not a single, uniform genre of language use, but rather a constellation of genres related partly to the particular medium (e.g., instant messaging, e-mail, chat groups, blogs, MOOs) and partly to the particular social and cultural contexts of a given act of communication.

Although certain CMC environments such as Wimba (see <http://www.horizonwimba.com>) allow speech, the bulk of CMC is still currently written via keyboard. CMC ranges along a continuum from product-oriented forms resembling paper-based writing (e.g., Web sites, most e-mail) on one end to more process-oriented interactive discourse that shares many features of speech (e.g., chat, instant messaging) on the other end (Baron, 2000, p. 158). Blogs and wikis would be situated in between, and MOO discourse would be variably placed, depending on the nature of the particular session. On the product-oriented end of the continuum, messages are composed as wholes before being released to their readership. On the process-oriented end, utterances may be more fragmentary, and multiple participants can communicate spontaneously and simultaneously (even contributing comments at the same moment), and several turns may be required to accomplish a single message. Communicative motivation or purpose tends to vary along the continuum as well: The product end is biased toward information exchange, whereas the process end is biased toward phatic communion (Malinowski, 1923), reinforcing social contact in and of itself. The interactive and fragmentary nature of chat and instant messaging makes them seem somewhat speech-like. However, unlike spoken discourse, the binary on/off nature of the communication does not allow backchanneling (*uh-huh*, *right*, shaking of head, etc.) from a partner while one is communicating. CMC lacks backchanneling because information is communicated principally in textual form, making it a leaner overall medium than face-to-face communication, where auditory, tactile, olfactory as well as

visual channels operate, allowing eye contact, context perception, gestural and prosodic information, and thereby enriching communication (Herring, 1996; Reeder et al., 2004).⁵ The relative leanness of CMC creates a different dynamic from spoken communication, and this difference may well be significant for language learning contexts that are exclusively CMC based (e.g., tandems).

From a teaching perspective, CMC clearly brings issues of register and genre to the fore. Many observers note that CMC language is often less correct, less complex, less coherent than other forms of language use. Herring (2001) points out that nonstandard features are generally not due to inattentiveness or not knowing the standard forms but are often deliberate choices to minimize typing effort, to imitate speech or sounds, or to be inventive (p. 617). Warner (2004) echoes this perspective, demonstrating the importance of language play in online communication. Crystal (2001) adds that simplification (e.g., omission of prepositions, copulas, auxiliary verbs) is not just a matter of typing economy but likely represents dialect features, reflecting the pressure to accommodate many diverse group members (p. 188). Sometimes accommodations go beyond simplification and become multicultural hybrid forms. For example, Lam (2004) documents the socialization of two bilingual immigrant Chinese girls' experiences in a chat room in which the participants develop a hybrid language variety that distinguishes them from both their English-only peers and their Cantonese-only peers. Similarly, Bloch (2004) shows how Chinese learners of English drew on Chinese rhetorical tradition when communicating in a Usenet group in English, thereby creating a hybrid form of English for that particular context.

Koutsogiannis and Mitsikopoulou (2004) point out, however, that the hybrid vernacular varieties that learners develop in CMC environments may not have much in common with the language that needs to be learned in school contexts. As they put it, "the global media of the Internet may well allow immigrants the opportunity of language socialization in a less stifling environment than that of the average school, but we must bear in mind that this process will involve forms of literacy which may differ significantly from traditional forms of school literacy" (p. 84). Furthermore, because language learners may not have any intuitions about what constitutes standard versus nonstandard forms, they may end up learning the nonstandard forms rather than the standard ones (Crystal, 2001, p. 237). From a pedagogical standpoint, this difficulty with distinguishing forms raises the issue of teaching students how to use

⁵ Speech and visual communication are becoming increasingly possible as audioconferencing and Webcams now provide audiovisual contact. See Lamy (2004) and Blake (2005).

different registers appropriately in different communicative contexts (see *Electronic Literacies*, in this article).

As noted earlier, interactionist SLA theories have been especially influential in CMC studies. CMC provides learners with the opportunity for social interaction, but because the interaction takes place primarily in writing, it also provides learners with ample opportunity to focus on form and content. A number of studies have explored the question of how best to promote meaning negotiation online. Comparing jigsaw, information-gap, and decision-making tasks, Blake (2000) found that the jigsaw tasks proved the best at promoting negotiations online. Smith (2003), on the other hand, found that decision-making tasks supported online negotiation more than jigsaw tasks. Knight (2005), experimenting with face-to-face versus e-mail performance of a hybrid jigsaw and decision-making task, found that, to preserve interactional benefits, face-to-face tasks have to be modified in CMC contexts (in this case, staggering of information). Smith (2005) studied the relationship between negotiation routine complexity, degree of uptake (i.e., learner responses to corrective feedback), and acquisition of vocabulary in a chat environment. He found that the complexity of negotiation routines did not influence uptake and that degree of uptake bore no relationship to vocabulary learning. Smith hypothesizes that uptake may play a diminished role in CMC and that we may need to attend to more subtle indications of acquisition in CMC environments.

Unlike early CALL studies that tended to test technologies, current studies more often test SLA-derived hypotheses and thus represent a considerable evolution in the field. All told, by introducing new genres of communication, CMC has complexified and problematized our notions of interaction, registers, negotiation of meaning, and uptake. As we move toward increasing degrees of multimodality in CMC environments (e.g., Blake, 2005; Lamy, 2004; Levy & Kennedy, 2004), we can expect to see communication dynamics continue to change.

Electronic Literacies

Given the predominantly text-based nature of CMC, reading and writing are obviously key modes of online language use. However, because the Internet (a) introduces multimedia dimensions that go beyond print textuality, (b) alters traditional discourse structures, (c) introduces new notions of authorship, and (d) allows users to participate in multicultural learning communities, it requires a complexified view of literacy that goes well beyond the skills of encoding and decoding texts.

To address the wide array of conventions, genres, and skills in computer use, Warschauer (2003) argues for the need to develop

electronic literacies (i.e., computer literacy, information literacy, multimedia literacy, CMC literacy). Warschauer (1999b) studied how people used electronic literacies in four contexts: an ESL course for international graduate students at a public university, an ESL class for international undergraduate students at a private Christian college, a Hawaiian language course for undergraduates at a public university, and a community college English class enrolling mostly immigrants and second language learners. He found that the sociocultural context in these settings significantly shaped the nature of online teaching and learning. Contrary to the view that technology will in and of itself transform learning, Warschauer found instead that technology had an amplifying effect, reinforcing teachers' underlying instructional approach, whether it was based on second language writing as a form of discipline, liberation, vocation, or apprenticeship.

Another of Warschauer's key findings was how seriously learners took learning new semiotic skills in online media, as compared to completing computer-based instructional tasks. Warschauer's notion of electronic literacies thus developed as an alternative to the concept of CALL when applied to online instruction. Shetzer and Warschauer (2000, 2001) further refined the notion of electronic literacies, as well as a pedagogy focused on issues of communication, construction of knowledge, research, and autonomous learning.

Lam (2000) presents an ethnographic case study of Almon, a Chinese immigrant teenager who felt negatively about his English ability despite living in the United States for 5 years. Through instant messaging (ICQ) and then through creating his own Web site about a Japanese pop music idol, Almon discovered his own expressivity in English as well as a newfound solidarity with his Internet peers. Lam argues that by appropriating, rearticulating, and redesigning discourses and narrative roles for his own purposes, Almon developed a new identity that had not been available to him in his immediate community and school in the United States. A key contribution from this study is the notion of *textual identity* for understanding how texts are composed and used to represent and reposition identity in networked computer media. In her larger dissertation study, Lam (2003) presents three additional case studies of Chinese immigrant youths, showing how they also came to occupy new social positions and identities by appropriating new discourses in online environments. Lam's research is important because it considers not only how social contexts shape language use in online environments but also, and most important, how online communication shapes social contexts and participants' identity formation. Furthermore, her work draws attention to the ways in which language functions in relation to other forms of online semiosis.

One important area of electronic literacies is dealing with multimedia.

Whereas early multimedia language environments were developed by teachers (e.g., Chun & Plass, 1996), it is increasingly common that students themselves author their own multimedia documents. Kress (2003) defines *multimodal texts* as “texts made up of elements of modes which are based on different logics” (p. 46), that is, texts that integrate writing, speech, images, color, sound, animation, and that therefore combine logics of time and space.

Digital storytelling is just one example of multimedia authoring in which textualization is a central concern. Digital storytelling involves developing filmic narratives using video, photographs, drawings, animation, voice, text, and music. Hull and Nelson (2005) report on the Digital Underground Storytelling for You(th) (DUSTY) Project in West Oakland, California, which makes multimedia composing tools available to children and adults who would not otherwise have access, and showcases local authors’ digital stories at local theaters and other public venues. Digital stories take the form of autobiographical narratives, poems, raps, reports, interviews, social commentary, or re-adaptations of stories or movies. Hull and Nelson draw on Peircian semiotic theory as well as Labovian narrative theory to study the respective logics of modalities and how they function synergistically in digital storytelling. They are particularly interested in the blendings between new and old textual forms and find that digital stories have much more in common with traditional narratives than they do with associative digital forms like hypertext. Nelson (in press) argues for the need to develop broader semiotic approaches to L2 composition. Based on Kress’s (2003) notions of transformation, transduction, and synaesthesia, Nelson works on composition principles via digital storytelling with first-year university ESL students. His analysis identifies a number of benefits of multimedia authoring, including resemiotization through repetition, recognition of language topology, and new forms of authorship. Drawbacks he noted in his study included genericization of expression and over-accommodation of audience.

Does multimedia authoring improve learners’ language use in terms of accuracy, fluency, and appropriateness in offline contexts? We don’t know. But the value of such projects may be found elsewhere. Nelson, for example, is not looking at language learning in the traditional sense of acquisition of morphosyntax or vocabulary, or even academic writing. Rather, he is looking at learners’ acquisition of a metacommunicative ability to reflect broadly on signifying practices and specifically on textualization, considering language as just one dimension of semiosis.

As Warschauer (2002, 2004) has argued, technology in English language teaching is now less about using computers as tools to teach English effectively and more about teaching English to help people use computers effectively. What is important about literacy on the Internet is

not just the ability to read and write in comprehensible language but also the ability to negotiate new roles and identities. Identity construction and socialization are inherently intertwined with language and can have either a facilitating effect (e.g., Lam's subjects) or a constraining effect (e.g., when limited to local community or school setting) on the resources learners come to acquire and use.

Telecollaboration

A recent development in network-based language teaching is a shift in focus from single classrooms to long-distance collaborations involving two or more classrooms, often in different countries. This shift expands the focus from language learning to an emphasis on culture (i.e., intercultural competence, cultural learning, and cultural literacy).

Intercultural projects have the potential to enhance learners' communication skills and to enrich their knowledge of another culture, as well as to provide a context for viewing one's own culture from another group's perspective. A number of recent studies have explored the viability of online telecollaboration for developing intercultural competence and understanding. Some of these studies have found positive results through student self-reports, interviews, or surveys (Furstenberg et al., 2001; Kinginger, 2000; Meskill & Ranglova, 2000; Müller-Hartmann, 2000; von der Emde, Schneider, & Kötter, 2001). Other studies indicate that intercultural contact in and of itself does not naturally lead to cultural understanding (Belz, 2002, 2003; Coleman, 1998; Fischer, 1998; O'Dowd, 2003; Ware, 2003, 2005), and some have questioned whether online contact can reduce stereotypes and prejudice (Ware & Kramersch, 2005). Several studies have identified potential impediments to cross-cultural understanding, such as social and institutional constraints and resource accessibility (Belz, 2002; Belz & Müller-Hartmann, 2003; O'Dowd, 2003).

In showing that intercultural understanding does not necessarily emerge from online interaction, these studies point to a number of questions: What kind of cultural contact is afforded by the technological medium? If the medium itself changes the ways in which communication takes place, what does it mean to be a competent communicator in a virtual world? A number of scholars have explored these questions, showing that differences in communicative genres (Hanna & de Nooy, 2003; Kramersch & Thorne, 2001), medium (Thorne, 2003), task type (Salaberry, 2000; Smith, 2003), linguistic style (Belz, 2003), academic cultures (Belz & Müller-Hartmann, 2003), and institutional and cultural characteristics (Belz, 2002) can all affect the degree to which language learners can negotiate meaning and cultural understanding. These

factors signal the important role of the teacher, who is familiar with both cultures and who can set appropriate goals and tasks, monitor communication, and assist in negotiating communicative difficulties.

Sometimes the problem is not one of miscommunication but of what Ware (2003, 2005) calls *missed communication*. Ware explored the factors that contributed to limited interactional involvement in a telecollaborative project linking German students of English and American students of German. She found that in the wake of misunderstandings, students tended to avert joint development of topics and instead to revert to a task-based approach to their assignments (cf. Belz, 2003). Although both groups of students participated beyond course expectations, they engaged in surprisingly little real interpersonal interaction (as marked by response to direct questions, use of second person pronouns, elaboration, etc.). In a qualitative analysis of student attitudes, Ware found that time pressures and institutional constraints negatively influenced students' communicative choices, leading to disengagement, or missed opportunities for intercultural learning. The key significance of Ware's findings is that many forms of CMC can actually facilitate missed communication. For example, the delayed response time and the lack of social consequences for dropping topics in many online contexts allows participants to be less active conversational partners. Furthermore, expectations about appropriate communication in the online medium may pose challenges for learners developing intercultural competence; an online discourse norm that often favors speed and brevity over sustained attention may impede their ability to engage in communication at a deep level of intercultural inquiry.

Language competence per se does not appear to be a key variable in the success of intercultural exchanges. Hanna and de Nooy (2003) point out that linguistic accuracy and politeness do not get one very far in an online forum in a foreign language. More important is a willingness to be socialized into and to follow the online community's discourse rules. More generally, a key ingredient for successful intercultural exchanges appears to be personal involvement. O'Dowd (2003) reports variable success of a year-long e-mail exchange between classes in Spain and Britain but notes that successful pairs tended to invest a lot of time in their messages. Specifically, they were sure to include personal (i.e., off-task) messages, to acknowledge their partners' comments, and to respond to their questions. They also tended to take the sociopragmatic rules of each other's language into account and included questions that encouraged feedback and reflection. Students were more interested (and tended to write more, to learn more, and to change their attitudes toward the other culture) when they received reactions from partners after having explained aspects of their own culture. (In the Belz and Ware studies, German students had wanted more personal involvement

from the Americans, who tended to be more task-oriented in their self-presentations.) O'Dowd also stresses the importance of teacher involvement and close guidance throughout all phases of a project.

Taken together, these studies point to (a) the importance of investigating what *successful participation* means in different contexts (e.g., different CMC contexts, different cross-cultural contexts, different pedagogical contexts), (b) the importance of the personal in intercultural projects—learners' sensitivity to one another's cultural identities and communicative styles, and (c) the importance of teacher involvement in discerning, explaining, and reflecting on culturally contingent patterns of interaction with their students.

IMPLICATIONS FOR TEACHING AND RESEARCH

Teaching

There is consensus in CALL research that it is not technology per se that affects the learning of language and culture but the particular uses of technology. This emphasis on use highlights the central importance of pedagogy and the teacher. Success in CMC, multimedia authoring, and distance-learning projects has been repeatedly shown to depend largely on teachers' efforts in coordinating learners' activities (Belz, 2003; Müller-Hartmann, 2000; O'Dowd, 2003; Parks, Huot, Hamers, & H-Lemmonier, 2003), structuring language and content learning (Levy, 1997), and helping learners to reflect critically on language, culture, and context (Kern, 2000; Ware & Kramsch, 2005). Belz and Müller-Hartmann (2003) emphasize the need to move beyond reductive accounts of the teacher as a guide on the side and stress the importance of the teacher in identifying and explaining culturally contingent patterns of interaction in electronic discourse.⁶

Technology-based language teaching is not a method but is integrated into various pedagogical approaches. Most research to date has focused on communicative task-based, project-based, and focus-on-form approaches in CMC environments, but the literature has begun to address uses of corpora in data-driven learning. Because the dynamics of interaction (and feedback-uptake relationships) in online environments differ from those in face-to-face interaction, teachers must be prepared for new ways of structuring tasks, establishing exchanges, guiding and

⁶ For practical classroom activities and projects involving technology, see Boswood (1997), Dudeney (2000), Hanson-Smith (2000), Swaffar, Romano, Markley, & Arens (1998), Warschauer (1995), and Warschauer & Kern (2000).

monitoring interaction, and evaluating performance, not to mention mastering the relevant computer applications. In the area of intercultural CMC exchanges, success has been mixed, but a number of researchers have made recommendations for optimal results. For example, Furstenberg and her colleagues (2001) identify three essential ingredients for project success: (a) an equal degree of commitment on the part of all teachers involved, (b) agreement on what will be the central focus (e.g., a particular theme), and (c) continual attention to logistics (e.g., scheduling, Web site maintenance). Müller-Hartmann (2000) and O'Dowd (2003) add that the creation of personal relationships among learners, attention to curricular integration, and close monitoring of student exchanges are also crucial to the success of telecollaborative projects.

Educators using online environments to foster cross-cultural communication also need to consider how the different groups involved relate to the electronic medium as a cultural tool of communication, to better understand how social constraints and opportunities affect intercultural communication (Lam, 2003; Thorne, 2003). Belz (2002) argues that spontaneous clashes revealing cultural fault lines should not be smoothed over or avoided but should be actively explored. Chapelle (2003) reminds us that TESOL educators “need to be critically aware of the connections among technology, culture, and ideology, and specifically about the ways in which technology amplifies and constrains aspects of language learning and research” (p. 9). Applied to pedagogy, this stance is consistent with what Kling (1996) calls the *heads-up view* of computer systems. Whereas a *heads-in view* focuses on the computer screen and the vast amounts of information it can display, a heads-up view “examines the social choices of whether and how to computerize an activity, and the relationships between computerized activity and other parts of our social worlds” (p. 2). An important component of developing a heads-up view is familiarizing oneself with the relevant research literature.

Research

Whereas early CALL research generally sought out relatively simple cause-effect relationships between human-computer interaction and learning, current research seeks to understand complex relationships among learners, teachers, content, and technology within particular social and cultural contexts. Consequently, research on technology and language learning has broadened the theoretical perspectives it draws on. Although second language acquisition remains central, it now increasingly overlaps with literacy studies, discourse analysis, sociocultural theory, sociolinguistics, and anthropology (especially ethnographic

methods). As a result, research has become on the whole less quantitative and more qualitative.

To maximize validity in CALL studies, Ortega (1997) urges researchers to diversify data sources, combining classroom and school observation, interviews, self-report data from questionnaires or think-aloud protocols, and computer-collected data to seek relationships across self-reports, observed behavior, and linguistic performance. In multiclass projects, Müller-Hartmann (2000) stresses the necessity that all teachers collaborate in research teams. The triangulation of researchers' perspectives will enhance the reliability of findings, especially when considering learning processes that involve culture as well as language. Chapelle (2003) also calls for creating teams for research and materials development by bringing together three types of people: technologically minded people (to realistically assess technical issues and feasibility), socially minded people (to deal with pragmatic and social dimensions), and critically minded people (to deal with ethical implications). By doing this, she argues, we can achieve the most balanced research. Given that the vast majority of CALL studies have been of short duration (and many have looked at very short-term treatments), it is crucial that researchers pursue more longitudinal studies of long-term linguistic development and intercultural competence.

A final methodological note concerns ethics in data collection, a critical issue in all CMC research. Given the ease with which researchers can collect data without subjects' knowledge or consent and the fuzzy boundaries between what is private and public on the Internet, it is essential that researchers obtain participants' informed consent. This issue is discussed sporadically in the literature (e.g., Crystal, 2001; Lotherington, 2005) but Frankel and Siang (1999) address it in depth.

Future Research

Transversal relationships: Over the past 15 years, we have learned a great deal about the features of learner interactions and language use within online environments, but we still know little about how those abilities might be transferred across different environments, communicative genres, and modalities. For example, does proficiency in e-mail carry over to instant messaging or chat, or even to essay writing? What benefits might multimedia authoring have for linguistic expression (or communicative potential)? Is there a relationship between, say, digital storytelling and performance of writing or face-to-face speech?

Reading and writing electronically: We know something about different genres and registers in various online environments, but we know less

about how the emergence of new discourse practices in CMC affects reading and writing processes. How are our definitions of reading and writing affected? How are people socialized into electronic literacy practices and communities? What communicative, cognitive, and social strategies do people use in CMC environments? What are the multi-media interpretation and authoring abilities that people acquire, and how do they acquire them?

Curricular issues: We know the importance of teaching electronic literacies, but what are the implications of electronic literacies for curriculum? How might we need to reframe or reconceptualize learning tasks? What are the implications for the way learners' performance is assessed?

Sociopolitical issues: We know that different groups of people have different degrees and kinds of access to technology (Dutton, 2004; Warschauer, 2003). What are the implications of differential access to electronic literacy tools and the social capital needed to use them effectively—both in educational institutions and in society at large? What are the implications of commercial versus open-source software in terms of people's access to resources and how they make use of them?

CONCLUSION

The Pew Internet and American Life Project reports that “The Web has become the ‘new normal’ in the American way of life” (Rainie & Horrigan, 2005, p. 59). Crystal (2001) muses that computer-mediated language could become “the community’s linguistic norm” (p. 241). As language educators, our job is to reflect on norms—to explore their underpinnings, their contexts of operation, and their implications—not only to make the norms understandable to our students but also to model for them the very process of reflecting critically on the social practices they participate in and observe. Technology offers us a means by which to make the familiar unfamiliar, to reframe and rethink our conceptions of language, communication, and society. It is through this process of analysis and reflection that we can best decide how we can and should use technology in language learning and teaching.

ACKNOWLEDGMENTS

My thanks to Stephen Cass, Françoise Sorgen Goldschmidt, and two anonymous reviewers for reading and commenting on an earlier draft of this article.

THE AUTHOR

Richard Kern is an associate professor of French and director of the French language program at the University of California at Berkeley, in the United States. He teaches courses in French language, linguistics, and foreign language pedagogy, and supervises graduate teaching assistants. His research interests include language acquisition, literacy, and relationships between language and technology.

REFERENCES

- Al-Seghayer, K. (2001). The effect of multimedia annotation modes on L2 vocabulary acquisition: A comparative study. *Language Learning & Technology*, 5(1), 202–232.
- Baron, N. S. (2000). *Alphabet to email: How written English evolved and where it's heading*. London: Routledge.
- Bax, S. (2003). CALL—past, present, and future. *System*, 31, 13–28.
- Belz, J. A. (2002). Social dimensions of telecollaborative foreign language study. *The Language Learning & Technology*, 6, 60–81.
- Belz, J. A. (2003). Linguistic perspectives on the development of intercultural competence in telecollaboration. *Language Learning & Technology*, 7(2), 68–99.
- Belz, J. A., & Müller-Hartmann, A. (2003). Teachers as intercultural learners: Negotiating German-American telecollaboration along the institutional fault line. *Modern Language Journal*, 87, 71–89.
- Blake, R. (2000). Computer mediated communication: A window on L2 Spanish interlanguage. *Language Learning & Technology*, 4, 120–136.
- Blake, R. (2005). Bimodal CMC: The glue of language learning at a distance. *CALICO Journal*, 22(3), 497–511.
- Bloch, J. (2004). Second language cyber rhetoric: A study of Chinese L2 writers in an online USENET group. *Language Learning & Technology*, 8(3), 66–82.
- Boswood, T. (Ed.). (1997). *New ways of using computers in language teaching*. Alexandria, VA: TESOL.
- Bowers, C. A. (2000). *Let them eat data: How computers affect education, cultural diversity, and the prospects of ecological sustainability*. Athens, GA: University of Georgia Press.
- Brander, B. G. (2005). Considering culture in CALL research. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 141–153). Mahwah, NJ: Lawrence Erlbaum.
- Chapelle, C. (1997). CALL in the year 2000: Still in search of research paradigms? *Language Learning & Technology*, 1(1), 19–43.
- Chapelle, C. (1998). Multimedia CALL: Lessons to be learned from research on instructed SLA. *Language Learning & Technology*, 2(1), 22–34.
- Chapelle, C. A. (2003). *English language learning and technology: Lectures on applied linguistics in the age of information and communication technology*. Amsterdam: John Benjamins.
- Chapelle, C. A. (2005). Interactionist SLA theory in CALL research. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 53–64). Mahwah, NJ: Lawrence Erlbaum.
- Chun, D. M., & Payne, J. S. (2004). What makes students click: Working memory and look-up behavior. *System*, 32, 481–503.
- Chun, D. M., & Plass, J. L. (1996). Facilitating reading comprehension with multimedia. *System*, 24, 503–519.
- Chun, D. M., & Plass, J. L. (1997). Research on text comprehension in multimedia environments. *Language Learning & Technology*, 1(1), 60–81.

- Coleman, J. (1998). Evolving intercultural perceptions among university language learners in Europe. In M. Byram & M. Fleming (Eds.), *Language learning in intercultural perspective: Approaches through drama and ethnography* (pp. 45–76). Cambridge, England: Cambridge University Press.
- Collins Cobuild Bank of English. (2004). Retrieved December 12, 2005, from <http://www.collins.co.uk/books.aspx?group=153>
- Crystal, D. (2001). *Language and the Internet*. Cambridge, England: Cambridge University Press.
- Darhower, M. (2002). Interactional features of synchronous computer-mediated communication in the intermediate L2 class: A sociocultural case study. *CALICO Journal*, 19, 249–277.
- Dragona, A., & Handa, C. (2000). *Xenes glosses*: Literacy and cultural implications of the Web for Greece. In G. E. Hawisher & C. L. Selfe (Eds.), *Global literacies and the World-Wide Web* (pp. 52–73). London: Routledge.
- Dudeny, G. (2000). *The Internet and the language classroom: A practical guide for teachers*. New York: Cambridge University Press.
- Dutton, W. H. (2004). *Social transformation in an information society: Rethinking access to you and the world*. Paris: UNESCO.
- Egbert, J. L. (2005). Conducting research on CALL. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 3–8). Mahwah, NJ: Lawrence Erlbaum.
- Egbert, J. L., & Petrie, G. M. (Eds.). (2005). *CALL research perspectives*. Mahwah, NJ: Lawrence Erlbaum.
- Ehsani, F., & Knodt, E. (1998). Speech technology in computer-aided language learning: Strengths and limitations of a new CALL paradigm. *Language Learning & Technology*, 2(1), 45–60.
- Ess, C. (2005). Moral imperatives for life in an intercultural global village. In R. J. Cavalier (Ed.), *The impact of the Internet on our moral lives* (pp. 161–193). Albany: State University of New York Press.
- Felix, U. (2005). E-learning pedagogy in the third millennium: The need for combining social and cognitive constructivist approaches. *ReCALL*, 17(1), 85–100.
- Fischer, G. (1998). *E-mail in foreign language teaching: Toward the creation of virtual classrooms*. Tübingen, Germany: Stauffenburg Medien.
- Frankel, M. S., & Siang, S. (1999). *Ethical and legal aspects of human subjects research on the Internet*. Washington, DC: American Association for the Advancement of Science. Also available from <http://www.aaas.org/spp/dspp/sfml/projects/intres/main.htm>
- Furstenberg, G. (2003). Reading between the cultural lines. In P. Patrikis (Ed.), *Reading between the lines: Perspectives on foreign language literacy* (pp. 74–98). New Haven, CT: Yale University Press.
- Furstenberg, G., & Levet, S. (1999). *Dans un quartier de Paris* [In a quarter of Paris]. New Haven, CT: Yale University Press.
- Furstenberg, G., Levet, S., English, K., & Maillet, K. (2001). Giving a virtual voice to the silent language of culture: The CULTURA project. *Language Learning & Technology*, 5(1), 55–102.
- Furstenberg, G., Murray, J. H., Malone, S., & Farman-Farmaian, A. (Artist). (1993). *A la rencontre de Philippe* [Videodisc]. New Haven, CT: Yale University Press.
- Granger, S. (Ed.). (1998). *Learner English on computer*. London: Longman.
- Granger, S., & Petch-Tyson, S. (Eds.). (2003). *Extending the scope of corpus-based research: New applications, new challenges*. Amsterdam: Rodopi.
- Gray, R., & Stockwell, G. (1998). Using computer mediated communication for language and culture acquisition. *On-CALL*, 12(3). Retrieved December 12, 2005, from <http://www.cltr.uq.edu.au/oncall/gray123.html>

- Halliday, M. A. K. (1978). *Language as social semiotic: The social interpretation of language and meaning*. Baltimore, MD: University Park Press.
- Hanna, B. E., & de Nooy, J. (2003). A funny thing happened on the way to the forum: Electronic discussion and foreign language learning. *Language Learning & Technology*, 7(1), 71–85.
- Hanson-Smith, E. (Ed.). (2000). *Technology-enhanced learning environments*. Alexandria, VA: TESOL.
- Hardison, D. M. (2005). Contextualized computer-based L2 prosody training: Evaluating the effects of discourse context and video input. *CALICO Journal*, 22, 175–190.
- Hawisher, G. E., & Selfe, C. L. (Eds.). (2000). *Global literacies and the World-Wide Web*. London: Routledge.
- Heift, T. (2004). Corrective feedback and learner uptake in CALL. *ReCALL*, 16(2), 416–431.
- Herring, S. C. (Ed.). (1996). *Computer-mediated communication: Linguistic, social and cross-cultural perspectives*. Amsterdam: John Benjamins.
- Herring, S. C. (1999). Interactional coherence in CMC. *Journal of Computer Mediated Communication*, 4(4). Retrieved December 12, 2005, from <http://jcmc.indiana.edu/vol4/issue4/herring.html>
- Herring, S. C. (2001). Computer-mediated discourse. In D. Schiffrin, D. Tannen, & H. E. Hamilton (Eds.), *The handbook of discourse analysis* (pp. 612–634). Malden, MA: Blackwell.
- Hubbard, P., & Siskin, C. B. (2004). Another look at tutorial CALL. *ReCALL*, 16(2), 448–461.
- Hull, G. A., & Nelson, M. E. (2005). Locating the semiotic power of multimodality. *Written Communication*, 22, 224–261.
- Hunston, S. (Ed.). (2002). *Corpora in applied linguistics*. Cambridge, England: Cambridge University Press.
- Jones, C. (1986). It's not so much the program, more what you do with it: The importance of methodology in CALL. *System*, 14, 171–178.
- Jones, L. C., & Plass, J. L. (2002). Supporting listening comprehension and vocabulary acquisition in French with multimedia annotations. *The Modern Language Journal*, 86, 546–561.
- Jones, R. H. (2004). The problem of context in computer-mediated communication. In P. LeVine & R. Scollon (Eds.), *Discourse and technology: Multimodal discourse analysis* (pp. 20–33). Washington, DC: Georgetown University Press.
- Kern, R. (1996). Computer-mediated communication: Using e-mail exchanges to explore personal histories in two cultures. In M. Warschauer (Ed.), *Telecollaboration in foreign language learning: Proceedings of the Hawaii symposium* (pp. 105–119). Honolulu: University of Hawaii Second Language Teaching and Curriculum Center.
- Kern, R. (2000). *Literacy and language teaching*. Oxford, England: Oxford University Press.
- Kern, R., Ware, P. D., & Warschauer, M. (2004). Crossing frontiers: New directions in online pedagogy and research. *Annual Review of Applied Linguistics*, 24, 243–260.
- Kinginger, C. (2000). Learning the pragmatics of solidarity in the networked foreign language classroom. In J. K. Hall & L. S. Verplaetse (Eds.), *Second and foreign language learning through classroom interaction* (pp. 23–46). Mahwah, NJ: Lawrence Erlbaum.
- Kling, R. (Ed.). (1996). *Computerization and controversy: Value conflicts and social choices* (2nd ed.). San Diego, CA: Academic Press.

- Knight, P. (2005). Learner interaction using email: The effects of task modification. *ReCALL*, 17(1), 101–121.
- Koutsogiannis, D., & Mitsikopoulou, B. (2004). The Internet as a global discourse environment: A commentary on Lam and Bloch. *Language Learning & Technology*, 8(3), 83–89.
- Kramersch, C. (2000). Second language acquisition, applied linguistics, and the teaching of foreign languages. *The Modern Language Journal*, 84, 311–326.
- Kramersch, C., A'Ness, F., & Lam, W. S. E. (2000). Authenticity and authorship in the computer-mediated acquisition of L2 literacy. *Language Learning & Technology*, 4(2), 78–104.
- Kramersch, C., & Thorne, S. L. (2001). Foreign language learning as global communicative practice. In D. Block & D. Cameron (Eds.), *Globalization and language teaching* (pp. 83–100). London: Routledge.
- Kress, G. (2003). *Literacy in the new media age*. London: Routledge.
- Kress, G., & van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. London: Routledge.
- Lam, W. S. E. (2000). L2 literacy and the design of the self: A case study of a teenager writing on the Internet. *TESOL Quarterly*, 34, 457–482.
- Lam, W. S. E. (2003). *Second language literacy and identity formation on the Internet: The case of Chinese immigrant youth in the U.S.* Unpublished dissertation, University of California, Berkeley.
- Lam, W. S. E. (2004). Second language socialization in a bilingual chat room: Global and local considerations. *Language Learning & Technology*, 8(3), 44–65.
- Lamy, M.-N. (2004). Oral conversations online: Redefining oral competence in synchronous environments. *ReCALL*, 16(2), 520–538.
- Levis, J., & Pickering, L. (2004). Teaching intonation in discourse using speech visualization technology. *System*, 32, 505–524.
- Levy, M. (1997). *Computer-assisted language learning: Context and conceptualization*. Oxford, England: Clarendon Press.
- Levy, M., & Kennedy, C. (2004). A task-cycling pedagogy using stimulated reflection and audio conferencing in foreign language learning. *Language Learning & Technology*, 8(2), 50–68.
- Lotherington, H. (2005). Authentic language in digital environments. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 109–127). Mahwah, NJ: Lawrence Erlbaum.
- Malinowski, B. (1923). The problem of meaning in primitive languages. In C. Ogden & I. Richards (Eds.), *The meaning of meaning* (pp. 296–336). London: Kegan Paul, Trench & Trubner.
- Meskill, C., & Ranglova, K. (2000). Curriculum innovation in TEFL: A study of technologies supporting socio-collaborative language learning in Bulgaria. In M. Warschauer & R. Kern (Eds.), *Network-based language teaching: Concepts and practice*. Cambridge, England: Cambridge University Press.
- Miller, D., & Slater, D. (2000). *The Internet: An ethnographic approach*. Oxford, England: Berg.
- Mohan, B., & Luo, L. (2005). A systemic functional linguistics perspective on CALL. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 87–96). Mahwah, NJ: Lawrence Erlbaum.
- Müller-Hartmann, A. (2000). The role of tasks in promoting intercultural learning in electronic learning networks. *Language Learning & Technology*, 4(2), 129–147.
- Murray, D. (1988). The context of oral and written language: A framework for mode and medium switching. *Language in Society*, 17(3), 351–373.

- Murray, D. (1989). When the medium determines turns: Turn-taking in computer conversation. In H. Coleman (Ed.), *Working with language: A multidisciplinary consideration of language use in work contexts* (pp. 319–337). Berlin: Mouton de Gruyter.
- Murray, D. (1996). Communicating for life: The social dimensions of computer-mediated communication. *Applied Linguistics Forum*, 16(2), 1–2; 7–9.
- Murray, D. (2000). Protean communication: The language of computer-mediated communication. *TESOL Quarterly*, 34, 397–421.
- Negroponte, N. (1995). *Being digital*. New York: Alfred A. Knopf.
- Nelson, M. E. (in press). Mode, meaning and synaesthesia in multimedia L2 writing. *Language Learning & Technology*.
- O'Dowd, R. (2003). Understanding the “other side”: Intercultural learning in a Spanish-English e-mail exchange. *Language Learning & Technology*, 7(2), 118–144.
- O'Rourke, B. (2005). Form-focused interaction in online tandem learning. *CALICO Journal*, 22, 433–466.
- Ortega, L. (1997). Processes and outcomes in networked classroom interaction: Defining the research agenda for L2 computer-assisted classroom discussion. *Language Learning & Technology*, 1(1), 82–93.
- Osuna, M. (2000). Promoting foreign culture acquisition via the Internet in a sociocultural context. *Journal of Educational Computing Research*, 22, 323–345.
- Parks, S., Huot, D., Hamers, J., & H.-Lemonnier, F. (2003). Crossing boundaries: Multimedia technology and pedagogical innovation in a high school class. *Language Learning & Technology*, 7(1), 28–45.
- Partington, A. (Ed.). (1998). *Patterns and meanings: Using corpora for English language research and teaching*. Amsterdam: John Benjamins.
- Peirce, C. S. (1966). *Selected writings*. New York: Dover.
- Pica, T. (1994). Questions from the language classroom: Research perspectives. *TESOL Quarterly*, 28, 49–79.
- Rainie, L., & Horrigan, J. B. (2005, January 25). A decade of adoption: How the internet has woven itself into American life. *Pew Internet and American Life Project*. Retrieved December 2, 2005, from http://www.pewinternet.org/PPF/r/148/report_display.asp
- Reeder, K., MacFadyen, L. P., Roche, J., & Chase, M. (2004). Negotiating cultures in cyberspace: Participation patterns and problematics. *Language Learning & Technology*, 8(2), 88–105.
- Rheingold, H. (1993). *The virtual community: Homesteading on the electronic frontier*. Reading, MA: Addison-Wesley.
- Rutherford, W. (1987). *Second language grammar: Teaching and learning*. London: Longman.
- Salaberry, M. R. (2000). Pedagogical design of computer mediated communication tasks: Learning objectives and technological capacities. *The Modern Language Journal*, 84, 28–37.
- Salaberry, M. R. (2001). The use of technology for second language learning and teaching: A retrospective. *The Modern Language Journal*, 85, 39–56.
- Scollon, R., Bhatia, V., Li, D., & Young, V. (1999). Blurred genres and fuzzy identities in Hong Kong public discourse: Foundational ethnographic issues in the study of reading. *Applied Linguistics*, 20, 22–43.
- Shetzer, H., & Warschauer, M. (2000). An electronic literacy approach to network-based language teaching. In M. Warschauer & R. Kern (Eds.), *Network-based language teaching: Concepts and practice* (pp. 171–185). Cambridge, England: Cambridge University Press.
- Shetzer, H., & Warschauer, M. (2001). English through Web page creation. In

- J. Murphy & P. Byrd (Eds.), *Understanding the courses we teach: Local perspectives on English language teaching* (pp. 429–445). Ann Arbor: University of Michigan Press.
- Smith, B. (2003). Computer-mediated negotiated interaction: An expanded model. *The Modern Language Journal*, 87, 38–57.
- Smith, B. (2005). The relationship between negotiated interaction, learner uptake, and lexical acquisition in task-based computer-mediated communication. *TESOL Quarterly*, 39, 33–58.
- Swaffar, J., Romano, S., Markley, P., & Arens, K. (Eds.). (1998). *Language learning online: Theory and practice in the ESL and L2 computer classroom*. Austin, TX: Daedalus Group.
- Taylor, R. (1980). *The computer in the school: Tutor, tool, tutee*. New York: Columbia Teacher's College Press.
- Thatcher, B. (2005). Situating L2 writing in global communication technologies. *Computers and Composition*, 22(3), 279–295.
- Thorne, S. L. (2003). Artifacts and cultures-of-use in intercultural communication. *Language Learning & Technology*, 7(2), 38–67.
- Thorne, S. L., & Payne, J. S. (2005). Evolutionary trajectories, Internet-mediated expression, and language education. *CALICO Journal*, 22, 371–397.
- Tribble, C., & Barlow, M. (Eds.). (2001). Using corpora in language teaching and learning [Special issue]. *Language Learning & Technology*, 5(3).
- von der Emde, S., Schneider, J., & Kötter, M. (2001). Technically speaking: Transforming language learning through virtual learning environments (MOOs). *The Modern Language Journal*, 85, 210–225.
- W-3 Corpora Project. (1998). *The Brown Corpus*. Retrieved December 2, 2005, from http://chwww.essex.ac.uk/w3c/corpus_ling/content/corpora/list/private/brown/brown.html
- Ware, P. D. (2003). *From involvement to engagement in online communication: Promoting intercultural competence in foreign language education*. Unpublished doctoral dissertation, University of California, Berkeley.
- Ware, P. D. (2005). “Missed” communication in online communication: Tensions in a German-American telecollaboration. *Language Learning & Technology*, 9(2), 64–89.
- Ware, P. D., & Kramsch, C. (2005). Toward an intercultural stance: Teaching German and English through telecollaboration. *The Modern Language Journal*, 89, 190–205.
- Warner, C. N. (2004). It's just a game, right? Types of play in foreign language CMC. *Language Learning & Technology*, 8(2), 69–87.
- Warschauer, M. (Ed.). (1995). *Virtual connections: Online activities and projects for networking language learners*. Honolulu: Second Language Teaching and Curriculum Center, University of Hawaii.
- Warschauer, M. (1999a). CALL vs. electronic literacy: Reconciling technology in the language classroom. Retrieved December 2, 2005, from <http://www.cilt.org.uk/research/resfor2/warsum1.htm>
- Warschauer, M. (1999b). *Electronic literacies: Language, culture, and power in online education*. Mahwah, NJ: Lawrence Erlbaum.
- Warschauer, M. (2002). A developmental perspective on technology in language education. *TESOL Quarterly*, 36, 453–475.
- Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide*. Cambridge, MA: MIT Press.
- Warschauer, M. (2004). Technological change and the future of CALL. In S. Fotos & C. Browne (Eds.), *New perspectives on CALL for second language classrooms* (pp. 15–26). Mahwah, NJ: Lawrence Erlbaum.

- Warschauer, M. (2005). Sociocultural perspectives on CALL. In J. L. Egbert & G. M. Petrie (Eds.), *CALL research perspectives* (pp. 41–51). Mahwah, NJ: Lawrence Erlbaum.
- Warschauer, M., & Kern, R. (Eds.). (2000). *Network-based language teaching: Concepts and practice*. Cambridge, England: Cambridge University Press.
- Warschauer, M., Said, G. R. E., & Zohry, A. (2002). Language choice online: Globalization and identity in Egypt. *Journal of Computer-Mediated Communication*, 7(4). Retrieved December 12, 2005, from <http://jcmc.indiana.edu/vol7/issue4/warschauer.html>
- Warschauer, M., Shetzer, H., & Meloni, C. (2000). *Internet for English teaching*. Alexandria, VA: TESOL.
- Zhao, Y. (1997). The effects of listeners' control of speech rate on second language comprehension. *Applied Linguistics*, 18(1), 49–68.
- Zhao, Y. (2003). Recent developments in technology and language learning: A literature review and meta-analysis. *CALICO Journal*, 21(1), 7–27.