Pedagogical Design of Computer Mediated Communication Tasks: Learning Objectives and Technological Capabilities

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It has been claimed that the recent emergence of internet-based communication constitutes a technological innovation with the potential to create a paradigmatic shift in teaching and learning second languages (e.g., Berge & Collins, 1995; Dede, 1993; Harasim, 1990). However, for this shift to happen, materials designers need to assess critically the effects of the technological capabilities of Computer Mediated Communication (CMC) as well as the features that characterize a potentially new type of literacy. Such a critical assessment will have to be based on the analysis of how specific pedagogical objectives are achieved through the design and implementation of instructional activities in CMC environments. In this respect, the analysis of such theoretical constructs as the grounding criterion and the principle of least collaborative effort (Clark & Brennan, 1991) provides a useful framework for the examination of factors that affect the choice of communication medium. In particular, different learning objectives may be achieved with a variety of technological tools (e.g., from word processors to collaborative writing software) that exhibit a range of levels of technical sophistication.

IT HAS BEEN CLAIMED THAT THE RECENT emergence of internet-based communication constitutes a technological innovation with the potential to create a paradigmatic shift in teaching and learning second languages (e.g., Berge & Collins, 1995; Dede, 1993; Harasim, 1990). A number of recent articles have proposed that Computer Mediated Communication (CMC) represents an ideal medium for promoting second language (L2) acquisition (e.g., Higgins, 1988; Paulsen, 1995; Salaberry, 1996, 1999; Zhao, 1996). Most notably, CMC leads to increased access to information databases (e.g., online newspapers), increased access to exchanges with native and near-native speakers (e.g., electronic bulletin boards), as well as increased functional demands on language exchanges (e.g., MOOs or multi-user object-oriented domains). However, the potential pedagogical benefits of such extended access to exchanges in the target language through CMC (i.e., instruction is based on information exchange) may not be as easy to obtain as originally claimed.

First, it is questionable whether a real paradigmatic shift may actually occur. Berge and Collins (1995), for example, argued that CMC is changing instruction in two ways: (a) by generating improved technological tools to use a full range of interactive methodologies and (b) by focusing teachers' perspectives on the appropriate learner-centered design of instruction. However, it is doubtful that these two advantages brought about by CMC will generate a true paradigmatic shift because such factors are not exclusively determined by the technological capabilities of the medium. That is, an increase in interaction or a

more obvious focus on pedagogical principles may be considered quantitative, rather than qualitative, changes.

Second, several early empirical studies on the pedagogical applications of Computer Assisted Language Learning (CALL) did not properly control for the confounding effect of independent variables such as motivation or novelty of the new medium (i.e., the Hawthorne effect) in the research design (for a critique, see Reeves, 1993; Salaberry, 1996). The limitations of these previous empirical studies raise questions about the validity of similar pedagogical claims for pedagogical proposals based on CMC applications.

Finally, the allegedly beneficial outcome of extensive functional (meaning-focused) interaction in computer-mediated exchanges may be limited, given the recent claims from researchers in L2 acquisition. Although efficient, a meaning-focused system may rely on an underdeveloped L2 system that will perhaps prevent further development of the L2 (e.g., Higgs & Clifford, 1982; Johnson, 1996; Klein & Perdue, 1992; Loschky & Bley-Vroman, 1993; Schumann, 1987; Skehan, 1998). For example, Klein (1986) stated that although communication requirements force learners to rely on stable—but perhaps not target-like—rules (efficient communication), learners must at the same time "be prepared to control, to revise and even to drop" those rules (p. 147). In essence, the conflicting purposes of communication and learning requirements may not be addressed adequately if the design of the pedagogical activities that are implemented in CMC is not analyzed from the perspective of a pedagogical framework.

It is possible that the alleged pedagogical benefits of CALL or CMC may not be realized as expected because previous pedagogical claims focused primarily on the technological capabilities of the new medium and neglected to analyze the pedagogical design of instructional activities (see analysis in Bates, 1995; Higgins, 1988; Künzel, 1995; Price, 1987; Romiszowski, 1990; Underwood, 1984). For instance, Bates (1995) warned that, "after an initial period of awe and high expectations, computers would eventually become as significant to the learner as the electricity that carries power to the refrigerator" (p. 227). In fact, it appears that we are already witnessing a disenchantment with what was previously perceived as the revolutionary pedagogical potential of computers as the latter have increasingly become an ever-present tool, much like electricity in the modern world. Specifically in the pedagogical realm, about a decade ago, Higgins

(1988) predicted that "computers will gradually enter language classrooms in their most menial roles, as word processors, as database. . . . In ten years' time we will look back on this debate and wonder what the fuss was about" (p. 103). Ten years have passed, and it looks as if Higgins's prediction has been confirmed: The metaphor of the tutor (i.e., previous CALL applications) is gradually being replaced by the metaphor of the tool (i.e., internet-based communication and applications). Nevertheless, the emergence of a new communication medium (variously represented in CMC) introduces the need for developing new communication skills (a new type of literacy). Hence, it is necessary to assess the nature of such a new medium of communication as well as the ways in which such literacy will be developed and implemented for the pedagogical design of L2 learning activities.

THE DESIGN OF PEDAGOGICAL TASKS

Effectiveness and Efficiency in Instructional Design

The incorporation of new technological resources into the process of pedagogical design may lead to two distinctive types of change: effectiveness and efficiency. In principle, an increase in the efficiency of accomplishing a pedagogical task does not necessarily imply an associated increase in instructional effectiveness. In fact, the conflation of factors related to efficiency and effectiveness in pedagogical tasks is a common misconception about the nature of the L2 learning process. For example, there is a popularly held belief that the easy access to the target language data in a variety of formats (e.g., image, audio, and video stored in a CD-ROM) will lead to substantial gains in learning over that obtained through traditional methods of instruction (e.g., textbooks, audiotapes, or videotapes). This claim is an argument in favor of the efficiency with which the delivery of information is brought about by CALL applications (e.g., an electronic workbook with links to a grammar database). However, such efficiency does not necessarily entail an increase in the effectiveness of the instruction delivered in this way.[1]

The foundational principle that the pedagogical objective of a learning task should guide the actual implementation of the task may be exemplified with any type of technological device—including relatively low-tech options such as overhead projectors, short-wave radios, videotape players, and so forth. For example, let us analyze the advantages of using a photocopy machine

over using the less technologically advanced blackboard in the simple academic task of distributing information in the form of a reading passage. We can write the reading passage on the blackboard and have students copy it, or, we can prepare a written or typed handout with the reading passage and photocopy it. Using the blackboard is cost-effective but time-consuming, whereas using the photocopied handout is more expensive but less costly in terms of time investment on the part of both teacher and learners. In essence, this type of analysis looks into the overall efficiency of the selected process in accomplishing the intended task.[2]

We may also analyze the previous scenario from the perspective of teaching/learning effectiveness. That is, irrespective of the time and resources spent on the delivery of information, we should ask ourselves whether there is a differential outcome in learning effects brought about by either procedure. This is a crucial question that should not be confused with concerns related to the efficiency of the process. In order to focus on effectiveness, it is essential to go beyond the choice of tools and analyze the overall process of acquisition. In this respect, the analysis of processing constraints brought about by the pedagogical task is crucial for the achievement of the learning objective.[3] For instance, the manipulation and establishment of time limits or planning time for the completion of a task may have differential effects on the accomplishment of pedagogical objectives. What is more important than these effects, however, is that the manipulation of time constraints is, in principle, independent of the tool used to carry out the task. It is not surprising, therefore, that several researchers have argued that the exploitation of such task-processing factors is necessary for the implementation of pedagogical activities such as metalinguistic awareness tasks (e.g., the dictogloss technique described in Wajnrib, 1990, and used experimentally in Swain & Lapkin, 1995), structural communicative tasks (Loschky & Bley-Vroman, 1993), and task-based learning in general (Johnson, 1996; Skehan, 1998; Willis, 1996).[4]

In essence, in a technology-led approach to materials design, the technological capabilities of tools provide the foundation for the design of pedagogical tasks. The problem with this approach is, precisely, that the learning objectives are determined by the technical features of the tool. Notwithstanding the importance of technological features and capabilities, such an approach may lead us to neglect important factors related to the effective implementation of the pedagogical procedure. For example, in the case of simulations implemented in a CALL environment, Crookall, Coleman, and Versluis (1990) stated that the use of the power of computers to "simplify or enhance simulation procedures" (p. 166) may lead to neglecting the role of the learner or the learning process. Similarly, Romiszowski (1990) stated that presenting reading activities in the form of online hypertext may help to "facilitate the students' research task, cut time, increase the number of items of information accessed and presented, etc. But that alone does not make the exercise a better example of instruction" (p. 326).

The Fit between Learning Objectives and Technological Capabilities

The rejection of a technology-driven approach to pedagogical design does not necessarily imply a theory-driven approach. Levy (1997), for instance, claimed that requiring CALL instructional design to be theory-driven is unnecessarily restrictive. In turn, Levy argued that what is essential is the *fit* between the capabilities of technology and the demands of the learning objective. Hence, "this implies early consideration of the technology to be used" (p. 53). Levy argued that this pattern confirms Richards and Rodgers's (1986) claim that the design of pedagogical activities may start at any one of the three levels proposed in their model (i.e., theoretical approach, pedagogical design, or teaching procedure). More specifically, Levy claimed that the development of pedagogical materials may start at the level of teaching procedures and not necessarily at the level of theoretical approach or pedagogical design. One should note, however, that Levy's proposed fit between pedagogical objectives and the selection of tools used to achieve the objectives does not rule out the possibility that the pedagogical objective may remain the primary purpose for the implementation of the pedagogical activity. Furthermore, whether the selection of the tool occurs at the level of procedure, design, or approach, the implementation of a pedagogical activity or task will still entail the existence of a pedagogical objective at all levels.[5]

I will provide an example of how the interplay of pedagogical objectives and the capabilities of technological tools may guide the implementation of new pedagogical activities. An instructor may use a word processor specifically designed for L2 learning (e.g., *Système D* for French or *Atajo* for Spanish) and rely on inherent features of the tool (e.g., spell check, thesaurus, and grammar

explanations) to obtain particular pedagogical objectives (e.g., to write compositions). However, the manipulation of a variety of defining features of the word processor is not the only way such a tool may be used for pedagogical purposes. In particular, the built-in limitations of word processors may also be profitably exploited pedagogically. For example, learners may be given a paragraph, in the target language, that has mistakes to be corrected with the help of the word processing program. This is, in fact, a normal task that native speakers perform when they check for mistakes in texts written in their native language. The pedagogical trick may be in the types of mistakes to be included in this instructional task. As we know, the word processing program will most likely identify some mistakes, such as lexicon or spelling, more consistently and more reliably than others, such as syntactic word order or morphosyntax. A pedagogical task based on the latter component is likely to increase the metalinguistic awareness of students and force them to spot potentially crucial differences between their native language and the target language (i.e., the word processor's response is unreliable and must be critically assessed by the learner instead of being accepted at face value).[6] Thus, an apparent drawback of the word processing program can be used to the advantage of the designer of pedagogical activities. In essence, a change implemented at the procedural level may generate distinct pedagogical outcomes without needing to rely on approach or methodology.[7]

THE DESIGN OF PEDAGOGICAL ACTIVITIES IN CMC ENVIRONMENTS

The previous discussion established the need for clear pedagogical objectives in the use of technological resources for L2 teaching; in this section, I will build upon the preceding argument, and I will examine the resources and constraints of CMC vis-à-vis specific pedagogical tasks. In this respect, the principled design of pedagogical activities for L2 acquisition in the context of CMC should be attentive to three main areas of research: (a) the identification and analysis of the relevant features that define the majority of CMC environments; (b) the identification and analysis of specific features that define particular CMC environments, such as text-based telecommunications (e.g., email, bulletin boards); and (c) the principled distinction between the vehicle of communication (e.g., CMC environment) and the pedagogical applications that are based on the defining features of CMC environments.

First, it is important to identify the particular features that distinguish CMC from other communication media in general. For example, in an earlier work (Salaberry, 1996), I presented a list of several features of CMC that are expected to have an effect on the design of L2 pedagogical activities. These features may be organized into two major subcomponents that define CMC insofar as pedagogical design is concerned: the increased access to interaction and the emergence of a new communication medium. As an example, email represents a medium of communication that has expanded the range of interaction formats (e.g., email as opposed to face-to-face interaction, letter correspondence, or phone conversations) and increased the number of interactions (e.g., avoidance of time and space constraints). Furthermore, CMC represents a new medium of communication that possibly introduces a new type of literacy defined by, for instance, new asynchronous modes of communication (e.g., email) and new discursive environments (turn-taking is negotiated in longer timeframes).

Second, it is also necessary to identify the particular constraints brought about by the specific environment in which CMC takes place. For instance, text-based telecommunications represent a subset of CMC exemplified in a wide range of communication media, most typically email, MOOs, electronic bulletin boards, and collaborative writing software. In turn, these media also differ from each other in various ways: Email represents an asynchronous mode of communication whereas MOOs are synchronous, real-time platforms of communication. In all cases, what unifies these media is that they all rely mostly on text to relay information from one user to another, irrespective of location or time constraints.[8]

Finally, it is important to analyze the potential pedagogical benefits of the instructional activities implemented in CMC. As mentioned above, even though the design of pedagogical tasks depends, to a large extent, on the features that define the communication medium in which the tasks will be implemented (i.e., technology-led design), the pedagogical objectives are not entirely dependent on the features of the communication medium. That is, the use of technological resources serves the pedagogical design of learning activities—with the caveat that the design must incorporate the (technological) constraints of the medium. Given that L2 interaction in CMC environments does not contain any built-in pedagogical objective, the instructional goals and the

implementation of the procedures to achieve those goals will be the responsibility of L2 pedagogues. For instance, Romiszowski (1990) stated that informational systems such as hypertext documents "designed to make information easy to retrieve, or to create" are not—but may become—"components of instructional systems, if designed to foster the achievement of *specified learning goals* [italics added]" (p. 327).[9]

The Effect of Communication Medium on Interaction

As stated above, the analysis of the defining features of CMC environments, such as text-based telecommunications, will be relevant for the design of pedagogical activities. As an example, it may be argued that the functional communication constraints (i.e., reduced means of expression) represented in email communication may force learners to focus on the morphological features of L2 grammars more than they would in other communication settings, such as face-to-face contacts. In fact, Sato (1990) argued that "it appears doubtful that conversational interaction is sufficient for learners to develop the full range of morphosyntactic structures comprising the L2 system" (p. 118). As a consequence, the elaboration of research proposals will have to be attentive to the distinction between communication constraints representative of different communication media and the pedagogical uses of such constraints.[10] In this respect, the rapid emergence of CMC has revived the debate over the effects on human communication brought about by the medium in which interaction occurs. This debate has been particularly intense in communication theory research. For example, Spears and Lea (1994) claimed that "as with earlier technological advances such as printing and the telephone, CMC introduces the possibility of revolutionary social and structural changes in the ways people communicate and relate to each other" (p. 427). It is not surprising that an already growing body of literature from communication theory research has started to analyze the features that differentiate CMC from other communication media (e.g., Rheingold, 1994; Short, Williams, & Christie, 1976; Spears & Lea, 1994; Sproull & Kiesler, 1986; Trevino, Lengel, & Daft, 1987; Walther, Anderson, & Park, 1994).

Early theoretical models emphasized the deficiencies of text-based CMC environments, in particular, how they provided only limited access to the nonverbal information found in face-to-face communication. For instance, Short, Williams, and Christie (1976) proposed the social presence model: Different communication tasks were associated with different media. More recently, Sproull and Kiesler (1986) presented an even stronger argument: Lack of nonverbal information impairs interaction (the reduced social cues model). Trevino et al. (1987) provided a more comprehensive model in which media choice can be related to three independent variables: the degree of ambiguity of the message, the symbolic cues carried by the medium, and situational constraints (e.g., time pressure, distance, expediency). They argued that the level of ambiguity of a given message leads to diverging interpretations and that different media increase or decrease such ambiguity. They proposed that face-to-face communication "is *the richest medium* [italics added] because it has the capacity for immediate feedback, multiple cues, and natural language. Therefore, it has the potential for decreasing ambiguity more quickly than other media" (p. 557). A second factor to be considered concerns the symbolic cues conveyed by the communication medium: Messages carry not only meaning but also symbolic meaning. For example, the concern and care of a manager for a major achievement by a subordinate may be more appropriately conveyed through face-to-face contact than through email interaction (although a more permanent recognition of that effort may be accomplished with written documents). Finally, situational constraints such as physical distance between speaker and addressee, number of receivers, and urgency may also affect the selection of the medium of communication. For instance, whereas interlocutors in close proximity may choose to meet personally, interlocutors facing long geographical distances may more appropriately rely on email or teleconference services.

Although Trevino et al. (1987) did not analyze the potential interaction among the factors they described, their analysis appears to preserve the notion that face-to-face communication is the richest medium, as proposed in the early models from Short et al. (1976) and Sproull and Kiesler (1986). However, several recent models have challenged the strong emphasis on what CMC environments do not provide vis-à-vis face-to-face contact in particular. Walther et al. (1994), for example, challenged the notion that lack of access to nonverbal and paralinguistic information in media such as email filters out rich interpersonal information. Instead, they argued that "due to cue limitations of CMC, the medium cannot convey all the task-related as well as social information in as little time as multichannel face-to-face communication" (p. 465). Hence, the

critical difference between face-to-face and CMC media "is a question of rate, not capability" (p. 465). Similarly, Spears and Lea (1994) argued that "CMC differentially blocks interpersonal cues but not necessarily social category information that reflects social and power differentials" (p. 452). They highlighted the existence of a new medium of communication in its own right: "If we do not regard the message as simply what is transmitted or omitted, but more generally what is made salient and meaningful in context, we have a more powerful and flexible theoretical tool for understanding the wide-ranging effects of CMC" (p. 452).

In sum, the analysis of previous research from communication theory reveals that the medium of communication does not appear to impair interaction, but rather seems to create a new environment with different features for the exchange and creation of information (e.g., Spears & Lea, 1994; Walther et al., 1994). Furthermore, the consideration of factors other than simply the number of channels available (e.g., nonverbal and paralinguistic cues), such as situational constraints and the symbolic status of the medium, also helps us determine the choice of communication medium (e.g., Trevino et al., 1987). In the next section I will turn to the analysis of the constraints that govern communication media and the purpose in communication, with special reference to text-based CMC.

The Grounding Criterion and the Principle of Least Collaborative Effort

Clark and Brennan (1991) analyzed the nature of asynchronous electronic communication (i.e., email) from the perspective of *grounding*. The grounding criterion establishes that "the contributor and his or her partners mutually believe that the partners have understood what the contributor meant to a criterion sufficient for current purposes" (p. 129).[11] In addition, they proposed the principle of least collaborative effort: Try to ground with as little combined effort as needed. The principle of least collaborative effort is an elaboration of the principle of least effort proposed by Grice (1975). However, there is a substantial distinction between these two proposals. Clark and Brennan argued that the Gricean proposal ignores the fact that time-pressure, errors, and ignorance mean that one cannot guarantee flawless, trouble-free presentations (as is the case when nonnative speakers communicate with native speakers or other nonnative speakers). Hence, speakers can only aspire to the least col-

laborative effort instead of simply the least effort. Clark and Brennan also argued that their "prediction is straightforward: People should ground with those techniques available in a medium that lead to the least collaborative effort" (p. 140). In turn, the determination of what takes less or more effort (the cost of grounding) will be directly associated with the constraints that govern different communication media as well as with the purpose of communication. In essence, the choice of medium of communication depends on: (a) the medium selected for grounding and (b) the participants' purposes in the interaction.[12]

In order to achieve grounding with the minimum collaborative effort, the characteristics of the medium will have to be assessed—either explicitly or implicitly. In this respect, the number of constraints that are directly applicable to each specific medium defines the different media. Clark and Brennan (1991) listed a number of factors that constrain grounding—copresence, visibility, audibility, cotemporality, simultaneity, sequentiality, reviewability, and revisability (p. 142). For instance, copresence and visibility define face-to-face interaction but are irrelevant for telephone conversations (see also the analysis on the marketing of the videophone below). Similarly, letters and email may both be reviewed and revised, whereas face-to-face interaction and phone contacts do not allow review and revision.[13] It follows, then, that when a medium lacks, or is deficient in, one of the above mentioned factors, it generally forces interlocutors to use alternative grounding techniques. A second independent factor is related to communicative purpose. That is, some particular communicative functions will be preferentially restricted to specific communication media. For instance, on the one hand, reprimanding, negotiating, and reaching consensus are normally conducted in face-to-face contact because the latter medium allows for the fine-tuning of paralinguistic cues (e.g., speech suprasegmentals such as intonation) and nonlinguistic cues (e.g., gestures, body posture). On the other hand, exchanges by phone and letter are more conducive to turning down invitations and refusing unreasonable requests because they help to save face (Brown & Levinson, 1987). For instance, email contacts are useful for the coordination of schedules, assigning tasks, making progress reports, and other informal exchanges that require some type of documentation for record keeping without losing efficiency (avoidance of spatial and time constraints).

The combined effect of (a) the factors that constrain the medium of communication and (b) the

purpose for such interaction allows both speaker and addressee to assess cost trade-offs in the use of various communication media. Clark and Brennan (1991) listed 11 types of cost that enter into the formulation of cost trade-offs: formulation, production, reception, understanding, start-up, delay, asynchrony, speaker change, display, fault, and repair (pp. 142–145). Some costs (e.g., formulation, production, start-up costs, delay costs) affect mostly the speaker; others (e.g., reception, understanding) affect mostly the addressee, whereas still others (e.g., asynchrony, display, fault, and repair costs) affect both speaker and addressee. For instance, the cost associated with the production of utterances is directly related to the medium of communication (e.g., speaking is generally easier than typing on a keyboard). Similarly, the cost of delay is minimal in media without cotemporality constraints (e.g., email and letters) but high in media heavily constrained by cotemporality (e.g., face-to-face conversation and synchronous networked environments such as Daedalus or Aspects). Finally, display costs will be high in email communication but low in face-to-face contact with reference to the use of physical gestures such as nodding, pointing (i.e., deictic markers), and the like. In this respect, the early appearance of emoticons or smileys in email communication constitutes the natural consequence of limitations introduced by display costs. I would like to argue that several cases of the application of newly developed technological tools can be analyzed profitably from the perspective of the theoretical framework provided by Clark and Brennan. For example, such an analysis may help us understand the failure of marketing efforts to introduce the video telephone in the 1960s and 1970s (Noll, 1992).

A Case Study: The Video-Telephone

The so-called picturephone was intended to become a viable medium of communication and was marketed and tested by AT&T several times, starting in the early 1920s but especially in the 1960s and 1970s. A two-way color videophone was used experimentally in the 1920s and later shown at the Chicago World's Fair in 1933. Subsequently, an improved trial videophone, developed in 1956, was later shown at the New York World's Fair in 1964. Market introduction started in the late 1960s in a variety of business firms. Expectations for the success of this new medium of communication were high: The picturephone was predicted to be a billion-dollar business by 1980, to displace other means of communication,

and to make trips unnecessary by the turn of the century. None of these predictions came true.

It is interesting to note that one of the findings of market research done in the early 1970s showed high demand for a communication medium that would allow for the exchange of graphical information, hard copy documents, and so forth. It is ironic, as Noll (1992) argued, that the success of the fax machine proved this needs assessment to be correct. Where the market researchers failed was in identifying the videophone as the technology needed to accomplish that goal. In effect, Noll explained that the reason for the failure of the videophone was neither technology nor cost, but rather the supposed lack of any incremental communicative value provided by the two-way videophone. As Noll said, "people might say that they do not like too much business travel, but the personal presence of actually being there—of being able to 'feel' the other person—can be very important to the conduct of much business" (p. 311). Furthermore, as Noll pointed out, "many business decisions are made not at the actual formal meeting but at lunch and at informal discussions preceding and during the meeting" (p. 311). It is arguable that the theoretical framework provided by the grounding criterion and the principle of least collaborative effort, as described above, could have provided market research analysts of the 1970s with a useful tool to assess more accurately the unjustified predictions about the potential success of the videophone.

The lessons learned from the analysis of commercially unsuccessful technologies, such as the videophone, may be informative for L2 pedagogical designers. In particular, different learning objectives may be achieved with different technological tools (e.g., from word processors to collaborative writing software) that exhibit a variety of levels of technical sophistication. Consequently, the dichotomy between theory-driven and technology-driven paradigms of pedagogical design may be profitably replaced by a model that focuses on the achievement of pedagogical objectives, irrespective of the medium used for that purpose. Such a model would be detailed following a principled analysis of the characteristics of each technological medium.

Cost Trade-Offs in Communication Media
and Pedagogical Tasks

The previous discussion leads us to consider the following question: Is the pedagogical use of new technologies for L2 teaching (e.g., text-based telecommunication) conducive to pedagogical effi-

ciency, pedagogical effectiveness, or both? In order to answer this question we will have to analyze in more detail (a) the specific features of CMC as a new medium of communication, (b) the functional demands and pedagogical objectives of the task, and (c) the fit between learning objectives and technological capabilities (Levy, 1997). In this respect, the analysis of cost trade-offs (Clark & Brennan, 1991) in the selection of communication media will be essential for assessing the validity of technology-based activities. In order to illustrate how the assessment of cost trade-offs can be used to the advantage of the designer of pedagogical activities, I will describe the use of collaborative writing software, given that this technological tool has been previously analyzed in several empirical studies (e.g., Beauvois, 1997; Kern, 1995).

In order to achieve grounding with the minimum (or least) collaborative effort—as argued by Clark and Brennan (1991)—the analysis of several features of collaborative writing programs will be essential for the design of pedagogical activities. This analysis may be carried out along two broad dimensions: (a) the factors that constrain the medium of communication and (b) the purpose for such interaction. With respect to the first factor, Beauvois (1997) discussed the difficulty of dealing with the "sometimes unwieldy nature of student output" (p. 63) in Daedalus-mediated interaction in a classroom setting. Beauvois's assessment of the nature of interaction in such a communication setting is related to the fact that, in her study, interlocutors had access to fewer cues to decide the timing of turn-taking than did the interlocutors in the face-to-face session. That is, speaker change cost (see above) is high in written interaction that is implemented in synchronous local area networks (LANs) when it is compared to that of face-to-face contact.[14] In essence, the particular constraints brought about by the technological medium in which communication takes place will be instrumental for the design of a successful pedagogical activity. For instance, it may turn out that, due to constraints brought about by the specific medium, collaborative writing environments, such as Daedalus and recent Web-based versions, are not appropriate for group interaction but may, instead, be better used in one-on-one or small group interactions.

The analysis of the pedagogical capabilities (or affordances) of the communication medium may also be done along the lines of how specific communicative purposes are accomplished. In this respect, the use of synchronous collaborative writing programs for L2 learning—as argued by Kern (1995) and Warschauer (1997) among others—

increases the likelihood that learners will engage more regularly and more actively in functional exchanges using the target language than learners who rely only on noncollaborative writing. However, as in any other pedagogical task that focuses students' attention primarily on the functional demands of the pedagogical activity, attention to language form may be low in such tasks (e.g., Johnson, 1996; Klein & Perdue, 1992; Loschky & Bley-Vroman, 1993; Schumann, 1987; Skehan, 1998). This limitation is representative of the distinction between communication systems and instructional systems (e.g., Romiszowski, 1990). Therefore, in order to achieve pedagogical goals that are based on tasks implemented in computer-mediated interactions, such as LANs, it is necessary to manipulate the task objectives effectively. For example, an instructor using collaborative writing software may set up a preliminary pedagogical task that carries high functional demands (i.e., learners are required to focus primarily on meaning). The correlated low focus on form during the initial stages of such a task may eventually be compensated by the implementation of a subsequent posttask activity that reverses the learners' focus of attention (i.e., from meaning to form). For example, the instructor may save the transcripts of the CMC session and subsequently distribute them at the end of the activity to the students in order to have them identify specific target grammatical items, correct their own errors, correct errors in other learners' transcripts, summarize the discussion in the form of a written essay, and so forth. One should note that, in the above mentioned sequence of tasks, learners are first led to communicate with limited resources. Only after that stage are they required to focus on the apparent limitations of their knowledge about linguistic structures and to search for alternatives to overcome those limitations. In fact, the previous example of a pedagogical activity falls within the scope of the analysis proposed in recent models of task-based instruction that incorporate pre- and posttask pedagogical activities (e.g., Skehan, 1998; Willis, 1996).

CONCLUSION

It is not yet evident that the newly emerging communication environment represented in CMC will create a paradigm shift in L2 teaching and learning. For this to happen, materials designers need to assess critically both the features that characterize a potentially new type of literacy and the effects of the pedagogical application of such technological capabilities. Such critical as-

sessments will have to be based on the analysis of how specific pedagogical objectives (i.e., communication purposes) are achieved by means of the manipulation of specific characteristics of the technological tools (i.e., technical constraints) inherent to CMC environments. In this article, I have specifically argued that theoretical constructs, such as the grounding criterion and the principle of least collaborative effort, provide a useful framework for the analysis of factors that affect the choice of communication medium for the purpose of principled design of pedagogical tasks for L2 learning. The development of future empirical studies along the lines of such theoretical frameworks appears promising for studies on L2 pedagogy, especially when one considers the inherent difficulties in communication across languages and cultures (i.e., the application of the principle of least collaborative effort).

NOTES

[1] It is also claimed that CALL may offer individualized and immediate feedback. However, one should notice that the availability of feedback is not exclusive to CALL. In fact, if anything, human tutors appear to be better than machine tutors (see Anderson, 1980, for a general review and Aljaafreh & Lantolf, 1994, for the analysis of L2 acquisition in particular).

[2] We should bear in mind, however, that proponents of CALL often point out that increased efficiency brought about by the incorporation of improved technological capabilities has a nontrivial cumulative effect. That is, time savings from clerical chores (i.e., copying information on the blackboard) may be used for other, more relevant, pedagogical activities. Notice, however, that this claim amounts to shifting the burden of proof from one task to another. In other words, we have not yet answered the question about the effectiveness of a pedagogical task regardless of how many tasks we can implement in a given period, or how much time we can spend on a given task.

[3] The access (or lack of access) to technological capabilities represents a valid factor to be analyzed and manipulated for pedagogical purposes.

[4] For instance, Skehan (1998), among others, points out that the distinction among accuracy, fluency, and complexity should be taken into account in the design of pedagogical activities.

[5] It is also important to note that the development of pedagogical materials is likely to be influenced not only by explicit theoretical approaches, but also by implicit perspectives. In other words, the lack of explicit articulation of one's language learning theory does not mean that material developers design activities with no reference to some consistent framework (Woods, 1996).

[6] I am not aware of any empirical study on this topic.

The present argument is made on the grounds of logic considering the postulates of modern linguistic theory.

[7] Crookall et al. (1990) described a similar example based on the pedagogical use of the program "Aunt Sadie."

[8] It is also possible to analyze text-based telecommunications when they are combined with a variety of other media (e.g., image/video/audio links such as CU-SeeMe and the like).

[9] In this respect, the use of internet-based communication is no different from the use of audio- or videotapes for the purpose of pedagogy: The vehicle used to convey information does not contain any built-in pedagogical objectives. For instance, showing a videotape to students does not constitute a pedagogical task (at most it may represent a very rudimentary one).

[10] The argument about the pedagogical benefits of text-based electronic communication is especially valid for the development of L2 lexicon, morphology, and syntax, but not particularly useful for the acquisition of phonetics/phonology for obvious reasons.

[11] As we can see, this criterion is ambiguous enough that it may lead to different interpretations of what is sufficient to lead to understanding (see also Reddy, 1979).

[12] Incidentally, these elements are presented in no particular order because they are probably assessed in a cyclical fashion: The selection of medium constrains purposes of communication and vice versa.

[13] In this context, the potential recording of conversations is not being regarded as a defining feature of this medium of communication.

[14] Along the same lines, the cost associated with turn-taking will be even higher in email interaction due to the asynchronous nature of the communication medium (i.e., delay cost).

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