
The Use of Technology for Second Language Learning and Teaching: A Retrospective

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As one of the oldest and most influential foreign language pedagogical journals, *The Modern Language Journal (MLJ)* offers valuable insights into how technological advances have affected language teaching and learning at various points in history. The present article will review the proposed pedagogical use of technological resources by means of a critical analysis of articles published in the *MLJ* since its first edition in 1916. The assessment of how previous technical capabilities have been implemented for pedagogical purposes represents a necessary background for the assessment of the pedagogical potential of present-day technologies. In this article I argue that, whereas most “new technologies” (radio, television, VCR, computers) may have been revolutionary in the overall context of human interaction, it is not clear that they have achieved equal degrees of pedagogical benefit in the realm of second language teaching. I further claim that the pedagogical effectiveness of different technologies is related to four major questions: (a) Is increased technological sophistication correlated to increased pedagogical effectiveness? (b) Which technical attributes specific to new technologies can be profitably exploited for pedagogical purposes? (c) How can new technologies be successfully integrated into the curriculum? and (d) Do new technologies provide for an efficient use of human and material resources?

THE MODERN LANGUAGE JOURNAL (*MLJ*) HAS provided second language (L2) teachers with a much-needed point of reference for the development, implementation, and assessment of sound pedagogical practices in the L2 classroom for almost a century. At the end of that century, it seems appropriate to look back at the numerous technological innovations that have substantially changed the scene where L2 instruction takes place. It seems that new technologies—revolutionary as they may be from a strictly technological point of view—are normally regarded as revolutionary from a pedagogical standpoint as well. For instance, Lindenau (1984) argued that “we are all in the midst of a microelectronic revolution,” and pointed out that ignoring the arrival of such revo-

lutions carries negative effects: “A blackboard-and-textbook system of education in the age of microelectronics will inevitably promote detrimental and far-reaching consequences” (p. 119). Other researchers have argued that there could be a potential waste of resources if pedagogy does not take advantage of new technological tools (e.g., Dunkel, 1987). Indeed, several tools have lent themselves well to incorporation in the L2 classroom, from the early uses of the phonograph to reproduce the human voice to films, videotapes, computers, teleconferencing, and the use of Internet chatrooms to increase communicative interaction with other learners.¹

The present article reviews the proposed pedagogical use of technological resources by means of a critical analysis of articles published in the *MLJ* since its first edition in 1916. The article will be divided according to salient technological attributes of the tools. Section 1 discusses the use of

prevalent audiovisual communication tools such as the phonograph, radio, and video. Section 2 analyzes the various devices that can be conceptualized as classroom teaching aids (both conventional and unconventional). Section 3 is devoted to the analysis of one of the hallmarks of technology-based instruction in the L2 classroom: the language laboratory. Sections 4 and 5 review a wide array of pedagogical claims about computer-assisted instruction and computer-mediated interaction. Finally, section 6 provides a final assessment of the role of the previously reviewed technological tools for L2 learning.

AUDIOVISUAL MEDIA

Audio

In early *MLJ* articles on the topic of technology-based instruction, several authors analyzed the pedagogical uses of the phonograph for L2 learning. For instance, Clarke (1918) argued confidently that “the true success of the speech record is in teaching pronunciation and . . . nothing else could be asked of it” (p. 118). Stocker (1921, p. 269) provided additional support for the pedagogical advantages of the phonograph for the teaching of intonation. Clarke argued further that the phonograph might bring about some benefits with regard to motivation, given the novelty of the teaching tool, and that increased interest “stimulates memory, as the same phrases repeated by himself or heard from the teacher can never do” (pp. 118–119).

The potential pedagogical uses of radio were naturally perceived as an extension of the benefits previously advanced for the use of the phonograph. Of particular importance was the delivery of instruction through distance learning (e.g., Bolinger, 1934). Distance learning, however, brought about new pedagogical challenges. Carbarga (1937) reported that “only from twenty-five to thirty percent of the number [of students] actually enrolled will send in exercises, letters, or examination papers” (p. 191). Several decades later, Garfinkel (1972) argued that radio had “the technological resources to supply any language classroom, no matter how remote, with a wealth of stimuli from all over the world” (p. 162). More important, Garfinkel analyzed “the characteristics which make [radio broadcasts] different from other media supplements” (p. 162). He pointed out that communication researchers “drew a continuum of media for learning experiences which progressed from the ‘concrete’ to the ‘abstract.’” Hence, “radio is much closer on

[the] continuum to the ‘concrete’ terminal than are the printed media so widely used in our foreign language classes” (p. 162). Although Garfinkel did not develop this idea further, it is important to note that his thought was one important step toward the analysis of media characteristics and their effect on the learning process (see Discussion). As for pedagogical applications, Mohr and Lally (1973, p. 121) suggested the implementation of a canonical two-step sequence for the use of radio broadcasts: Students wrote down all or part of the material presented orally and, subsequently, selected written portions of the material were shown with an overhead projector. A decade later, Wipf (1984) argued for the pedagogical use of shortwave broadcasts and offered a list of 13 major benefits such as access to an extended range of L2 expressions and a variety of dialects, contextualized teaching of grammar, listening to the target language spoken at normal speed, increased motivation by listening to original broadcasts, and development of an international perspective on topics selected for classroom discussion, as well as increased levels of independent learning.²

The telephone was also used for pedagogical purposes. For instance, Twarog and Pereszlenyi-Pinter (1988) described the implementation of the “telephone-assisted language program,” which used the same textbooks, audiotapes, and programmed materials that the regular course used. The only important difference was that in the telephone-assisted program students received assistance and feedback on their progress by telephone. Twarog and Pereszlenyi-Pinter argued that their assessment “*proves* [italics added] that [the telephone-assisted program] can be used effectively to learn foreign languages” (p. 433).³ Buscaglia and Holman (1980) focused on the use of the teleprompter, an enhanced telephone device to stimulate “communicative activities in the classroom.” The teleprompter consisted of “two telephone units and a loudspeaker mounted in an electronic control panel that has buttons for operating an authentic dial tone, busy signal, and ring for both telephones.” An optional tape recorder allowed teachers to “play back the conversation for corrective purposes” (p. 451). As argued by Buscaglia and Holman, this enhanced telephone device allowed the teacher to recreate realistic situations for telephone conversations, as students could be sent to different rooms or to opposite sides of the same room to obstruct visual contact (cf. recent studies on text-based, computer-mediated communication). Buscaglia and Holman explicitly argued that the use of such

telephone devices increased the communicative pressure on language practice because “the very nature of the telephone as a device for communication compels a student to want to be able to communicate a message successfully” (p. 453).

Television, Films, and Video

The use of television broadcasts for pedagogical purposes was perceived as a natural extension of the use of radio broadcasts. For instance, Shmarak and Dostal (1965, p. 209) described television teaching as a triple team effort carried out by the teaching team (especially the on-camera teacher), the technical team, and the televiewing team (students and classroom teacher): The teacher “receives the lesson, implements and expedites its teaching, translates it into correlated follow-up activities and generates keen interest and sincere enthusiasm in the classroom situation” (p. 209). Gottschalk (1965) argued that some “course materials and exercises . . . would profit from visual presentation,” because it is “considerably easier for students to absorb both the abstract material given in lectures and the visual aids [italics added] used to illustrate these abstract materials” (p. 86).

Lottmann (1961) described the advantages of using filmstrips in the L2 classroom and provided teachers with suggestions on pedagogical techniques: The teacher’s objective must be precise, teachers should see the film at least once, a 5- or 10-minute introduction should be used to focus students’ attention on specific areas of interest, students should be provided with transcripts of the film, if possible, and after first viewing, students should be allowed to ask questions. More recently, Swaffar and Vlaten (1997) proposed the pedagogical implementation of video-based activities in a sequence of five stages: initial silent viewing of the film to identify story structure (reduction of cognitive load, Stage 1), second silent viewing to identify cultural differences (Stage 2), verbalization of visual themes (Stage 3), identification of minimal linguistic differences correlated to differences in meaning (Stage 4), and students’ production in the form of role plays and group discussion based on the topics identified in the video (Stage 5).

Indeed, film in general and video programs in particular represent an inexpensive, as well as a versatile, pedagogical tool. Hanley, Herron, and Cole (1995) pointed out that it takes “virtually no time to turn on the video while it [takes] hours for [the instructor] to find appropriate pictures in magazines and to cut out and paste them for

class use” (p. 64). Swaffar and Vlaten (1997) pointed out that videos may become a useful medium because “videos expose students to authentic materials and to voices, dialects, and registers other than the teacher’s and provide cultural contexts” (p. 175).⁴ Despite such pedagogical benefits, however, Garrett (1991) argued that “teachers may not always use audio and video with maximum efficiency or imagination” (p. 77), whereas Herron (1994) argued that there is “virtually no empirical research to support the video instructional strategies currently being advocated” (p. 191).

Among the earliest empirical studies, Gottschalk (1965) assessed the pedagogical effect of the use of prerecorded television lectures in beginning German classes, but reported that the data were not conclusive due to some weaknesses in the research design (e.g., the television sections covered more material than did nontelevision sections; students in some sections scored higher on the aptitude test than did students in other sections). Among recent studies, Hanley et al. (1995) conducted a number of studies to investigate the effectiveness of using videos as advance organizers, Herron (1994) studied the use of textual information as an advance organizer to improve comprehension of video-based material, and Herron, Hanley, and Cole (1995) compared the use of text only versus text plus pictures as advance organizers to improve comprehension of video-based material. The data collected by Hanley et al. showed that the use of a dynamic visual advance organizer (i.e., video) proved to be an effective advance organizer for the comprehension and retention of a written passage in French. Herron showed that the use of a textual advance organizer (i.e., six sentences that outline major scenes from the video) improved the comprehension and retention of material presented on video. Herron et al. analyzed two different types of advance organizers on a comprehension test similar in format to the one used by Herron: description only (six sentences that describe the events in the movie) and description plus pictures (the same six sentences complemented by magazine pictures contextually related).⁵ The analysis revealed a statistically significant difference in favor of the description plus picture treatment condition. Herron et al. reasoned that such a finding “indicates that comprehension in a foreign language is facilitated by richness of context” (p. 393).⁶

Other studies published in the *MLJ* focused on the analysis of the potential pedagogical advantages of hitherto little investigated features of

TV/VCR technology such as the use of subtitles in the target language. Borrás and Lafayette (1994) pointed out that no previous study “has addressed the potential usefulness of subtitles for increasing learners’ oral communicative performance” (p. 62). Based on data from 44 fifth-semester students, Borrás and Lafayette concluded that—among other benefits—the use of subtitles “may help the foreign/L2 learner associate the aural and written forms of words more easily and quickly than video without subtitles” (p. 70).⁷

TEACHING DEVICES: CONVENTIONAL AND UNCONVENTIONAL TOOLS

The *MLJ* has also reported on the use of some conventional teaching tools. For instance, Pond (1963) described the use of blackboards and overhead projectors. Pond argued that the overhead projector represents a “language teaching tool which has been overlooked too long” although it represents “the most useful and versatile” visual aid (p. 33).⁸ Among several pedagogical advantages of overhead projectors, Pond highlighted that they (a) enable teachers to prepare materials in advance, (b) allow information written on overlays to be easily and quickly hidden (in contrast with information written on the blackboard), (c) enable the teacher to add, subtract, underline, and highlight information at will, (d) do not require that the lights be dimmed, (e) allow for simple creation of teaching materials, (f) enable the teacher to face the class while writing on transparencies, and (g) are not prone to failure or damage due to their technological simplicity.

The *MLJ* also published articles on a number of unique technological devices that have been used for pedagogical purposes in L2 classrooms. Brown, Dietz, and Fritz (1972) documented the use of the audio-active voice reflector for pedagogical purposes. Such a device—a sort of acoustic shell—“fits over the user’s lower face and deflects a portion of his voice up and rearward to the earpiece” (p. 145). Brown et al. argued that the audio-active voice reflector is useful for the improvement of pronunciation given that pronunciation practice is normally hindered by the “striking (often shocking) difference between the student’s voice as it sounds to him via the conductors and resonators of the head and as it sounds to others via conducting airwaves” (p. 144). The authors reported that the results from their empirical study showed a statistically significant difference between a treatment group and a control group in a pronunciation-mimicry test, but that

no significant difference was found in an audio discrimination test. “Accepting the validity of the testing tools,” Brown et al. surmised that there was “a form of forced self-monitoring connected, but not wholly dependent upon, hearing ability” (p. 147). Another type of unconventional pedagogical device was the spectrograph. Lantolf (1976) described the development of the sound spectrograph during the late 1940s as one technological advancement that “may prove useful for the teaching of suprasegmentals” of a L2. Lantolf described a three-step pedagogical model that used spectrograph technology, but that also incorporated a previous step in which the teacher contrasted the intonation contours of both target and source languages before students engaged in individualized practice. Lantolf cautioned, nevertheless, that “accurate imitation of native intonation in the controlled environment of the language laboratory” may not easily transfer to the environment of free conversation (p. 273).⁹

Finally, despite its apparent lack of success, it is worth mentioning what may constitute one of the most unconventional pedagogical devices: the dormiphonics technique. This technique was based on the use of an automatic record player “during the normal periods of relaxation, lying in bed with lights out, just before falling asleep” (Sherover, 1950, p. 445). Sherover claimed that “the lesson is repeated automatically, lulling [the student] to sleep and sinking deeper and deeper into his subconscious mind” (p. 446). Sherover pointed out that conditioned reflexes may be difficult to attain because “the student can patiently bear this impact for a few—say a half dozen auditory injections—but by that time his attentions fag, his thoughts wander, and the ‘stream-of-thought’ phenomenon can carry him completely away from his lesson” (p. 445). In order to solve this constraint, Sherover recommended the use of the tape recorder both before going to sleep and before waking up to play “the same lesson which [the] conscious mind has heard during the day” (p. 445). The apparent lack of pedagogical success of the dormiphonics technique is substantiated by recent theoretical work in the area of L2 acquisition, which raises questions about the possibility of unconscious learning (e.g., Schmidt, 1990, 1995).

THE AUDIOLINGUAL ERA: LANGUAGE LABORATORIES

One of the most conspicuous technological devices for L2 instruction has been the language learning laboratory. A substantial number of arti-

cles on the rationale and techniques for its use were published in the *MLJ*, especially during the 1960s and 1970s. Although, at first sight, the rapid establishment of language laboratories appeared to be the natural corollary of previous research on the pedagogical uses of the phonograph, tape recorders, and similar electronic devices (research from the 1920s to the 1960s), the popularity of language labs was not solely the consequence of teachers bringing into the classroom another apparatus in a series of audio devices. The instant spread of the language lab was the consequence of two major developments in the field: legislative support and new learning theories.

First, there was strong legislative support (and correlated federal funding) for such instructional equipment. Valdman (1964) pointed out that "since the enactment of the 1958 National Defense Education Act, the installation of language laboratories and other electro-mechanical devices has mushroomed . . . all over the United States" (p. 275), and Locke (1965) reported that the U.S. government paid up to "half the cost for any publicly-supported school" (p. 295). Second, new research proposals about language teaching methodology had a significant impact on classroom teaching: Audiolingualism became the language learning theory of the time. For instance, Anderson (1964) stated that "a main objective of the language laboratory is to afford a type of learning experience that will produce unhesitating, automatic oral responses with little or no reliance upon analytical crutches" (p. 202). For that reason, Stack (1964) argued that "the most important part about a language laboratory is the quality of the audio-lingual structured program used in it" (p. 189).¹⁰ The symbiosis between methodology and technology was so strong that Lorge (1964), referring to language labs, claimed that "here was an electronic device which might have been invented especially for the foreign language class, so well did it lend itself to language learning" and claimed further that, in a language lab, "imitative practice could be recorded, judged, erased, re-recorded, to the point of learning" (p. 409). Along the same lines, Barrick (1961) provided details on the basic stages of implementation of sound pedagogical practice in audiovisual labs, and Mathieu (1965) provided a psycholinguistic rationale for the use of language labs.¹¹

Some researchers, however, were less sanguine about the pedagogical value of the language lab. For instance, Stack (1964) stated simply that audiovisual labs make "available a great supply of authentic materials" (p. 189). Most important,

the Keating (1963) report explicitly argued that federal money used to finance the purchase of language labs was, in effect, a waste of tax dollars. The report was based on data collected among 5,000 high school students of French. Keating concluded that the nonlaboratory group outperformed the laboratory group in every test. In response to Keating's study, a 1964 special issue of the *MLJ* published four articles that attempted to show the deficiencies in theory, research design, and statistical analysis of Keating's study. Stack claimed that Keating "used tests dating from 1940 to 1955, although the first audio-lingual texts with fully programmed tapes did not appear on the market until about 1959" (p. 191). Similarly, Porter and Porter (1964) argued that Keating made no attempt at strict standardization of the equipment used for his study, used *t* tests instead of the more appropriate Analysis of Variance, and allowed for laboratory students to have one fourth to one fifth less class time than nonlaboratory students.

Along the same lines, Anderson (1964) stated that the Keating (1963) report showed that the laboratory group outperformed the nonlaboratory one in the component that effectively measured audiolingual instruction: speech production. Anderson (1964) also remarked that "from the curricular viewpoint, the unpardonable sin of the researcher is the omission of a listening comprehension test at the beginning level" (p. 199). More important, Anderson (1964) claimed that Keating's measurement was essentially based on the pronunciation of 10 critical sounds and conceded that "the traditional teacher will continue for several more years to outshine his audiolingual colleagues in training students to pronounce the ten critical sounds of French" simply because "he does not need to bother with the exhausting, time-consuming job of building the rest of the speech habits" (p. 201). Finally, Grittner (1964) echoed the concerns of the other researchers and pointed out that (a) Keating did not use materials appropriate for language labs because production of most materials designed for lab use started in 1960, (b) many teachers educated in the grammar-translation method were not properly trained to teach according to the tenets of audiolingualism, (c) the frequency of use of the lab (i.e., once a week) was not enough to generate the differences expected, and (d) the dependent variable chosen by Keating (i.e., quality of students' pronunciation of critical sounds of French) "might be an excellent test for a class in French phonetics" (p. 209), but not necessarily of the expected speech abilities of L2 learners.

Criticism of the Keating (1963) report was followed by empirical research that attempted to counteract the original claims of the report. Lorge (1964) published the results of two experimental studies that purported to offer strong empirical support for the use of language labs for L2 instruction. In the first study, Lorge compared the effect of laboratory work (60 minutes per week within a 5-hour a week schedule) on students enrolled in first-, second-, and third-year high school French classes. Differences between groups were tested on several variables: reading a passage from a French newspaper (pronunciation, fluency, and intonation), answering questions in French (fluency and structural correctness), listening to slow and fast speech, and taking a written multiple-choice and fill-in-the-blanks test (vocabulary, grammar, reading comprehension). Lorge (1964) reported that *t* tests revealed differences in favor of the laboratory group on fluency (for first year), on both fluency and intonation (for second year), and on listening comprehension at both slow and fast speech (for third year). Lorge (1964) claimed that the lack of differences between groups on the measurement of the written test provided "a reassuring answer to the question as to whether aural skills were developed at the expense of conventional skills" (p. 413). A second study conducted by Lorge (1964) analyzed potential differences between audio-active and recording-play-back instruction in a language lab (20% and 50% of total instruction time) and a control group with no access to the language lab. For the reading test (including the mimicry test), the differences were not statistically significant. In contrast with the previous study, it is surprising that the control group outperformed the two laboratory groups (statistically significant differences) on the measurement of oral questions and answers. Lorge (1964) commented that given that "pre-recorded lesson-tapes require that the scriptwriter foresee the students' response . . . it is possible that this specific exercise may remain more satisfactorily handled in the 'live' class situation than in laboratory sessions" (p. 416).

The purported advantages of language laboratories continued to be upheld throughout the 1960s and 1970s. For instance, Angelis (1973) stated that labs "can be used to advantage in learning to hear what are usually difficult sounds or sound sequences" (p. 104). Along the same lines, Church (1986) argued that "language laboratories, if well used, can drill the students on the oral aspects and provide stimuli or cues for some written work" (p. 251). Holmes (1980, p. 197),

however, pointed out that many L2 teachers were disenchanted with the use of language laboratories and summarized a number of factors that contributed to such negative attitudes: poorly produced commercial tapes, insufficient effort to make structural drills meaningful, selection of materials without learner appeal, lack of programs for advanced students, and little faculty involvement.¹² It is not surprising that the demise of the language lab appears to have been accompanied by the emergence of the "new kid on the block" in technology-assisted learning: computer-assisted instruction (CAI).¹³

CAI: THE DRILL AND (S)KILL STAGE

The early uses of computers in L2 learning constituted a natural extension of the work done in the audiovisual language labs. In effect, Ornstein (1968) argued that "programmed instruction and its analog, computer-based teaching, have stirred the field of education with an almost Messianic promise of a breakthrough, ever since the appearance of Skinner's book *Verbal Behavior* in 1957" (p. 401).¹⁴ Ornstein also pointed out that the above-mentioned theoretical goals of L2 instruction had been previously implemented with other technological devices such as "phonograph discs, wire recorders, magnetic tape recorders in soundproof laboratories, dormiphonics, and other technical modalities" (p. 401). Such parallels with other technological breakthroughs and their correlated unfulfilled promises, however, were hardly assessed in detail.¹⁵ On the contrary, the promises and expectations of the pedagogical effectiveness of CAI began to increase in direct proportion to the development of the capacities of hard drives and RAM. For instance, Adams, Morrison, and Reedy (1968) claimed that CAI "has the potential in its capability both to supervise student performance and to monitor, record, analyze, and summarize data about that performance" (p. 3). Following the trend of increased hopes about the integration of computer technology in the L2 curriculum, the *MLJ* started a short-lived section entitled the "MLJ Computer Corner" (1985–1987). The section addressed the concerns of "the foreign language professional charged with computerizing a language program" (Brink, 1986, p. 42). Brink provided readers of the *MLJ* with useful information that spanned a number of areas from general information about computer technology to predictions on future developments in the field.

The early CAI programs were mostly delivered through central computer systems such as Pro-

grammed Logic for Automatic Teaching Operations (PLATO). Activities implemented in a PLATO system are representative of the archetypal computer drill: The program provides students with questions or options and, following the student's response, the computer provides feedback or help until the student arrives at the correct solution (see Curtin, Clayton, & Finch, 1972). Early implementations of CAI were usually delivered as adjuncts to a central curriculum. For instance, Locke (1965) reported that "complete courses of study which integrate classroom, laboratory, and homework into an intelligent whole have been badly needed and are beginning to appear" (p. 297). A few years later, Adams et al. (1968) described the implementation of a CAI program that was developed as an adjunct to a popular textbook of the time. Even more recently, Brink (1986) argued that the integration of CAI activities with the rest of language instruction constituted sound pedagogical practice. Subsequent reports on the use of CAI have focused on the appropriate pedagogical implementation of CAI activities according to technological capabilities (e.g., computational speed, seamless integration of media, immediate feedback). For instance, Keller (1987) highlighted the speed of electronic dictionaries because they are "noticeably faster than paging manually through a conventional one" and they also provide a "multidimensional presentation of the English translations and other explanatory information" (p. 12). Keller also pointed out that the large storage capacity of computers meant that electronic dictionaries could provide a "full range of synonyms as well as grammatical and stylistic information" in an efficient manner (p. 12). Along the same lines, Decker (1976) argued that CAI most significantly provides "instant feedback correcting drill exercises and tests, and immediate explanation of errors" (p. 263). Hence, he recommended a three-step instructional sequence for the teaching of grammar with CAI: illustration of the intended operation, drill and comparison of student input with results provided by the computer, and testing of the target feature. Church (1986) claimed that "computer control of presentation and evaluation of exercises allows teachers to give students much more of this valuable practice in a highly efficient mode without hours of drudgery correcting the exercises" (p. 256).¹⁶

Despite heightened expectations about the pedagogical potential of computer applications, the use of CAI did not spread rapidly. Early on, Adams et al. (1968) argued that CAI "has the potential, when further developed, to take on a

significant burden of the more mechanical portions of early foreign language instruction," but conceded that "we are still at a stage of trying to determine what CAI can do, as much as how well it can be done" (p. 16). Olsen (1980) identified a series of factors that arguably deterred some departments from incorporating the use of CAI into the regular curriculum: (a) the high cost of computer programs, (b) the lack of technical support personnel, and (c) the negative attitudes of many teachers towards the use of CAI in the L2 curriculum.¹⁷ By the late 1980s, Dunkel (1987) presented arguments similar to Olsen's to explain the limited use of CAI in the L2 classroom: (a) the start-up costs of computer hardware, (b) a dearth of quality courseware, and (c) widespread skepticism about the teaching effectiveness of CAI, the educational system, and teachers' perceptions.¹⁸ Dunkel (1987) predicted that the "computer will be just another in a series of highly touted technological tools that have neither revolutionized learning nor lived up to initial promises" (p. 254). Kleinman (1987) assessed the state of the promises of CAI and also concluded, rather negatively, that "most of the software programs are drill-practice and tutorial in nature, amounting to little more than electronic textbooks" (p. 271). Kleinman claimed that even if such software were to be improved, "CAI does not appear to be more effective than similarly constructed instructional programs that lack a CAI component" (p. 271). More recently, Garrett (1991) echoed these concerns about the proto-stage of pedagogical uses of CAI for L2 learning: "The development of the potential of technology-based materials is still in its early stages, where software lessons tend to follow familiar designs for conventional purposes" (p. 95). The dissatisfaction with the CAI programs of the 1970s and 1980s led researchers to look for alternative answers, which came to be associated with Computer Assisted Language Learning (CALL).

CALL: BEYOND DRILLS

Boyle, Flint Smith, and Eckert (1976) argued that although CAI has the potential for becoming an important educational tool, its use is currently limited given the high cost of hardware and the "extensive programming effort necessary to support even a limited source of instructional material" (p. 430). Nevertheless, researchers continued to look for improvements in computer technology that were likely to bring about substantial changes in pedagogical processes. For instance, Dunkel (1987) argued that "the utilization

of the speech-generating capability of computers stands to make them viable second/foreign language tutors" (p. 251). Along the same lines, Nagata (1993) focused on the analysis of capabilities of human language not addressed by previous CALL software for the implementation of Intelligent CALL. However, other researchers started to look beyond the perceived advantages of computers per se and focused on the new and upcoming computer add-ons, such as the interactive video-disc.¹⁹ Finally, some researchers even analyzed the capabilities of communication environments brought about by new computer technology (i.e., computer-mediated communication).

New Conceptualizations of Advanced Multimedia Platforms

Some early studies analyzed the role of different ways of presenting information through a variety of media instantiated in various technological tools. For instance, Pederson (1986) argued that the effectiveness of computer technology is directly related to the extent that it allows L2 teachers to implement effectively specific pedagogical tasks that may be difficult to achieve in other environments. In particular, Pederson distinguished the content of instructional software from the ways in which content is delivered in such software. That is, different ways of delivering content represent coding options (e.g., color, sound, graphics, feedback, branching, and auto-control) that may become crucial factors to enhance the learning process. Pederson claimed further that "since little research on computer-assisted second-language learning has been conducted, most decisions about coding options are based on intuition and extrapolation" (p. 36). In order to assess the effectiveness of the manipulation of coding options, Pederson specifically investigated the coding option of passage availability: whether the text is available or not available for inspection while the student answers comprehension questions on a reading passage. Pederson argued that, in principle, there are no guarantees that when reading from printed paper, students will not look back at a passage while answering questions interspersed in the text. In contrast, "the computer has the capability . . . of controlling whether learners can re-inspect reading passages" (p. 36). The results of Pederson's study showed that learners who did not have access to the reading passage while answering comprehension questions were able to recall more of the content of the passages than learners who did have access to the same reading passages while

answering the questions. Despite such apparent support for his claim, Pederson warned that "no coding element, including passage unavailability, can be expected to be best for all second-language learners in all circumstances" (p. 41).²⁰

The capabilities of computer technology have also been used for the purpose of assessment of L2 teaching and learning processes. For instance, Bland, Noblitt, Armington, and Gay (1990) used newly developed computer technologies in order to investigate the extent to which L2 learners rely on a one-to-one lexical match for the translation of words and expressions (the naive lexical hypothesis). For that purpose, they developed a tracking system that kept records of the students' dictionary and grammar queries while they composed a text in the L2. In particular, the authors focused their attention on the queries based on the association of grammatical concepts and lexical representations. Bland et al. claimed that in order "to help students realize that lexical representations and grammatical concepts are mutually dependent, we need to create direct links between learner queries and pedagogical explanations of related grammatical, semantic, or pragmatic issues" (p. 448). Bland et al. argued further that a "CALL environment is particularly amenable to the creation of such links because of the multiple and immediate ways to access electronic information" (p. 448). Some empirical evidence in support of these claims has been provided by Chun and Plass (1996) and Grace (1998).

Chun and Plass (1996) analyzed the effect of the use of multimedia annotations in a reading passage in order to increase retention of vocabulary. The passage was implemented in a Macintosh multimedia program (*CyberBuch*) that presented students with the text of a L2 German passage (762 words presented in 11 pages) on the right-hand side of the screen and the multimedia annotations for up to 82 words on the left-hand side. The test consisted of 36 vocabulary items with multimedia annotations evenly divided into three conditions (text only, text plus video, and text plus pictures).²¹ The percentage of correct responses (English equivalent of German word) for the three conditions of text only, text plus picture, and text plus video conditions were 17.9%, 31.2%, and 23% respectively, with statistically significant differences for all comparisons. In a similar study, Grace (1998) analyzed the potential pedagogical advantages of multimedia environments on the retention of French vocabulary among English-speaking students. The multimedia lesson was devised by the researcher and consisted of over 40 dialogues based on con-

tent from the French comic book *Astérix*. The test bank consisted of 48 vocabulary items presented in the lessons that included concrete nouns, abstract nouns, verbs, and adjectives. The results showed that learners who had access to translations obtained higher scores than students who did not have access to such translations. Grace argued that the advantage for the translation group may be a consequence of the effect of elaborated processing (see Anderson, 1990): access to “a greater number of associations and a more extensive and elaborate analysis of the stimulus” (p. 540).

The power of computer technology has also been harnessed for tasks such as assessment and testing.²² For instance, Dunkel (1991) claimed that “a potential use [of CAI] that has received far less attention is computer-assisted or computer-adaptive testing (CAT)” (p. 251). Dunkel argued that CATs provide teachers and administrators with a number of substantial benefits such as “a reduction in testing time, a decrease in test boredom and frustration, immediate analysis of results, self-pacing, the need for fewer test administrators, and improved security” (p. 256). Following advances in computer technologies of the mid-1980s (e.g., increase of hard disk space; marketability of CD-ROM and videodiscs) Dunkel implemented the first prototype of a test of nonparticipatory listening comprehension (i.e., without interaction).²³ The test takers (college-level ESL students) listened to “computer-generated segments of speech” and subsequent questions based on the previous discourse. Using the keyboard, test takers selected the best answer from two, three, or four multiple-choice options. As part of the assessment of the project, 19 ESL students reported their attitudes towards using the prototype test. Dunkel commented that “overall, subjects’ sentiments . . . were positive” (p. 255).

Intelligent CALL

Pedagogical applications of computer technology have also relied on rather sophisticated features such as Intelligent CALL. Nagata (1993) claimed that conventional CALL programs (e.g., PLATO) “simply compare the [students’] response with a machine-stored correct or incorrect version by a simple pattern matching technique, and canned feedback is presented if the learner’s response matches an anticipated error” (p. 334). In contrast, Intelligent CALL programs are fundamentally different from typical CALL programs because they incorporate a Natural Language Processor that is capable of analyzing

students’ responses, comparing them to an analysis of the target grammar rules and identifying problematic areas in the response.

Nagata (1993) tested her claim in an experimental study with 34 students enrolled in a second-year Japanese course taught at the university level. The study was based on the correct suppli-ance of particles, vocabulary, conjunctions, and nominal modifiers. The results showed a statistically significant difference between groups on the measurement of only one of the above-mentioned dependent variables (particles). Nagata proposed that these results “suggest that the traditional feedback may be as good as the intelligent feedback for helping learners to correct word-level errors (e.g., vocabulary and conjugation errors), while the intelligent feedback may be more helpful for understanding and correcting sentence-level errors (e.g., particle errors)” (p. 337). Nagata’s conclusions, however, must be taken with caution because there are methodological, as well as theoretical, problems with her analysis. First, there is no independent evidence to substantiate Nagata’s contention that verb conjugations are a word-level error: Except for some lexically related phenomena (e.g., subcategorization, lexical aspect) verb conjugations cannot be described as a word-level phenomenon (see Smith, 1991; Tenny, 1991, *inter alia*). Second, the assumption that some grammatical items require more cognitive processing than other represents a post hoc analysis of the data that is not linked to any previous references that could independently substantiate such a theoretical claim. Most important, one should note that there is a difference between the type of feedback provided by human tutors and machine tutors, and that intelligent CALL represents an explicit attempt at mimicking the highly contextualized nature of feedback provided by humans. It is questionable, however, whether Intelligent CALL may be able to offer the type of feedback that humans normally provide. For instance, Crook (1994) stated that “effective tutorial dialogues are embedded in more extensive contexts of shared classroom experience. Such dialogues are normally made possible by the history of this experience” (p. 15). In essence, such a broad contextual backdrop may not be easily implemented with current computational power (e.g., Holland, Kaplan, & Sams, 1995).²⁴

Computer-Mediated Communication and Teleconferencing

A potential way to circumvent the inherent limitations of natural language processing pars-

ers for the design of pedagogical activities for L2 instruction is the use of computer-mediated communication (CMC). Kern (1995) pointed out that most CAI studies from the 1970s and 1980s were overly concerned with the effectiveness of individualized instruction and student-machine interaction. He acknowledged, however, that L2 software supports individualized instruction by "offering the student the freedom to choose topics, to repeat input, to increase or to decrease task difficulty, and to get help whenever it is needed" (p. 457). Kern investigated a hitherto neglected aspect of computer technology for L2 learning: computer-mediated interaction with other human beings. In particular, he empirically analyzed differences in classroom discussions in face-to-face versus electronic environments. The study was implemented with the help of the collaborative writing software *Daedalus InterChange*. Important differences between these two environments justified Kern's interest. First, synchronous written interaction in an electronic environment relaxes important cognitive constraints normally prevalent in face-to-face interaction. For instance, the availability of more planning time to produce utterances "makes possible reflection and analysis of direct interpersonal communication" (p. 459) (e.g., Skehan, 1998; Willis, 1996). Second, electronic interaction represents a new communication medium as "new medium-specific conventions . . . compensate for the absence of prosodic and paralinguistic features found in face-to-face oral communication" (p. 459). Furthermore, turn-taking appears to be negotiated differently as "fully elaborated turns [in synchronic electronic communication] can occur simultaneously" (p. 459).

Kern (1995) hypothesized that interaction which is implemented in a synchronous electronic environment in comparison to nonsynchronous interaction would generate more opportunities for students to participate, a greater amount of language production, more time to develop and refine comments, more collaboration among interlocutors, increased motivation, and reduced anxiety.²⁵ Although Kern's data confirmed most of these research hypotheses, it is difficult to generalize his findings due to some limitations of the research design. First, as acknowledged by Kern, one of the major drawbacks of his study was the sequential application of treatments: Interaction in the electronic environment preceded the session in which face-to-face discussion of the same topic was implemented. Second, there is a high likelihood of obtaining spurious results in the data (Hawthorne effect)

because one of the two treatments (interaction in an electronic environment) represented a novel pedagogical environment. Third, the selection of a teacher-led discussion (lockstep) may not be the most appropriate condition to represent oral discussions in comparison with exchanges implemented through collaborative writing software. Interaction in the electronic environment occurs almost simultaneously, whereas in a teacher-led discussion only one person at a time can "hold the floor."²⁶ Despite these caveats, Kern's study provided a model for subsequent studies in the area of CMC.

Apart from text-based telecommunication, it is possible to implement face-to-face exchanges through two-way simultaneous videoconferencing. Kinginger (1998) analyzed the effect of such a medium in an exchange between English-speaking and French-speaking students in two different locations (United States and France). There were two 60-minute sessions on the topic of content and perspectives of American and French movies (among other related topics). The first half-hour of the videoconference took place in French and the second in English (Kinger analyzed the portion in French only). The interaction was structured based on a set of prepared questions: An English-speaking student read a question and a French-speaking student answered it. Kinginger claimed that the students were unsuccessful in profiting from the interaction due to two potential reasons: (a) heightened anxiety and (b) a mismatch between various features of the standard written-based variety of French taught in class and the spoken French variety used by the native speakers. Kinginger commented that these difficulties were addressed in subsequent classroom sessions through a post hoc analysis of the videotape of the interaction. She claimed that the post hoc analysis limited anxiety and focused the students' attention on their own production, leading them to notice a mismatch between their own language variety (mostly written French) and the one used by native speakers (spoken conversational French). For instance, students realized that such conversational features as turn-taking were very important for achieving communicative goals.

These empirical analyses of different types of technology-mediated interaction require a close look at their theoretical foundation. Warschauer (1997) delineated a possible theoretical rationale to bolster the claim that CMC is an effective pedagogical tool.²⁷ He argued that online communication "encourages collaborative learning in the language classroom" (p. 472). Warschauer also

pointed out that online communication increases the chances for interaction with other human beings because there are no time or place constraints, as opposed to normal face-to-face communication. He claimed further that the World Wide Web represents an optimally efficient system for publication and distribution of multimedia documents (hypermedia). An increased level of interaction and different types of interaction have important implications for L2 learning because “CMC creates the opportunity for a group to construct knowledge together, thus linking reflection and interaction” (Warschauer, p. 473). Most important, online communication (especially text-based communication) represents a new communication medium in which interaction in CMC environments is managed differently with respect to “turn-taking, interruption, balance, equality, consensus, and decision making” (p. 473). As a consequence, Warschauer claimed that online communication brings about equality in participation (e.g., reduced time and place constraints, immediate access), while at the same time it reduces conformity and convergence (e.g., hostile language known as “flaming” and the high likelihood of information overload).

Despite Warschauer’s (1997) assertion, a number of recent communication models have challenged the strong emphasis on what CMC environments do not provide with regard to face-to-face contact. For instance, Walther, Anderson, and Park (1994) challenged the notion that lack of access to nonverbal and paralinguistic information in media such as Email “filters out” rich interpersonal information. Instead, Walther et al. claimed 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). Furthermore, Spears and Lea (1994) argued that “CMC differentially blocks interpersonal cues but not necessarily social category information that reflects social and power differentials” (p. 455).

DISCUSSION

The Evidence in Favor of Pedagogical Effectiveness

Despite the impressive amount of publications about perceived pedagogical benefits of newly developed technological tools, several authors have demanded caution in the implementation of implicit or explicit pedagogical recommenda-

tions (e.g., Ornstein, 1968; Meredith, 1983; Kleinman, 1987). Most of the assessment of the pedagogical value of newly introduced technologies in the L2 curriculum has been carried out with the help of surveys, questionnaires, and descriptive accounts. For instance, Ornstein reported on the results of a survey covering the 2-year period of 1963 to 1965 on the use of “teaching machines” (i.e., language labs) to deliver programmed instruction. Several years later, Olsen (1980) conducted a similar survey on the use of CAI in departments of foreign languages across the United States. Olsen’s report, in particular, showed that some of the support for the use of CAI was based on the perceived effect of the use of CAI on students’ motivation and attitudes: “One respondent reports that his students are ‘equal in proficiency to traditional control groups, *but far superior in positive attitude*’ [italics added]” (p. 345). Moreover, Olsen reported that there were distinct perceptions about the advantages of using CAI: “Users agree that the computer enables the student to learn more in a shorter time than is usual in a regular course” (p. 344). However, little or no empirical evidence—let alone theoretical analysis—supported such a categorical contention in favor of the effectiveness of CAI at the time that Olsen’s survey was conducted.

The findings from Ornstein (1968) and Olsen (1980) were not unique. For instance, Mohr and Lally’s (1973) assessment of the effectiveness of the use of short-wave broadcasts for L2 learning was based on impressionistic evidence succinctly summarized as follows: “All the students showed enthusiasm for the course” (p. 123). Along the same lines, Holmes (1980)—reporting on the relative success of the use of audiotaped comedy sketches—claimed that “97% [of students] found the comedy sketches more enjoyable than other laboratory exercises” and that “65% said the sketches had actually increased their desire to attend lab sessions” (p. 201). Church (1986) explicitly acknowledged that “although we have no statistically reliable evidence that computer exercises necessarily result in higher grades, students nevertheless clearly believe that the exercises help improve their work” (p. 251). Without discounting the importance of teachers’ and students’ attitudes, caution should be exercised when pedagogical recommendations about the use of novel technological tools in the L2 classroom are restricted solely to the analysis of students’ and teachers’ perceptions (or misperceptions).²⁸

When attention is directed toward empirical analyses, important limitations are also evident.

As pointed out in previous sections, there have been problems with the collection, scoring, and analysis of data: apparent lack of control groups; lack of long-term studies; lack of systematic analysis of empirical research questions; and use of post hoc explanations that, in some cases, contradict the analysis of the data gathered for the specific study. For instance, early empirical studies did not properly identify the theoretical construct to be studied or failed to control for intervening variables. In fact, Garrett (1991) lamented that “studies comparing computer-assisted learning per se are therefore no more helpful than would be studies comparing textbook-assisted with non-textbook-assisted learning” (p. 75). There are also noticeable deficiencies in the research design of several studies. For instance, in the pilot study from Adams et al. (1968), the pretest scores of the control group were assessed on one course section but the posttest scores were measured on a different group used as a control. More important, the dependent variable—final grades for the course—did not provide enough discrimination to assess the effect of the treatment factor because the same instructor taught the treatment and control groups and assigned final grades on different criteria for each group. Other studies have revealed problems with the analysis of data and, specifically, on the criteria used to score data. For instance, in the study conducted by Lorge (1965) on the proposed effectiveness of language labs, the ratings were based on the judgments of human raters. However, Lorge (1965) did not specify what scale was used by the raters, nor did she specify the criteria that raters used to judge the speech samples. Another major difficulty inherent in the analysis of the introduction of new technologies has been the spurious influence of the Hawthorne effect (Brown, 1954). Although the novelty brought about by the introduction of new teaching tools can be profitably exploited by L2 teachers for the creative implementation of pedagogical activities, it is important to differentiate the effect of two separate independent variables in the research design of empirical studies. The effects of the novelty of the medium represent an intervening factor that should be distinguished from the effects of the independent variable of the communication environment (related to the use of the new teaching tool) in which a pedagogical activity is implemented.

Apart from directly controlling the above-mentioned factors, it is also possible to use carefully designed qualitative studies for the analysis of the multitude of factors that should be taken into ac-

count in the evaluation of newly introduced technologies. One of the major concerns of future research will be the analysis of the use of technological resources in the wider framework of educational activity. Crook (1994) stated that “we must go beyond the input-output designs that characterize much research in this area” (p. 9). In other words, we need to understand the broader educational context of technology-enhanced learning. For that awareness to take place, van Lier (1999) claimed that a “methodology adapted from cause-effect research in the physical sciences will not be sufficient, since it cannot deal with the multitude of rapidly changing contextual factors involved” (p. 17). Instead, van Lier claimed that at this stage it is important to look “for ways to understand what is going on and the kinds of differences human effort is making and may be capable of making” (p. 17).²⁹ In fact, it is clear that the analysis of new communication environments instantiated in CMC (see Kern, 1995; Kinginger, 1998; Warschauer, 1997) will require a substantial amount of investigation before reliable pedagogical guidelines may be developed. In particular, Kinginger stated that “the availability of telecommunications technology forces certain dilemmas of communicative language teaching out of abstract theory and into the daily life of classroom learning” (p. 510). For instance, it appears that technologies associated with the VCR (as a storytelling tool) have not been adequately explored. As an example, the use of camcorders allows teachers to produce their own videotapes of students’ roleplays, interviews, surveys, and so forth. The use of fairly inexpensive and user-friendly technology generates some potentially beneficial—and so far intriguing—possibilities to increase students’ reflection on their own language.

Sound Pedagogical Rationale

Although matters of research design and empirical analysis are important, it is possible that the most important challenge posed by technology-assisted language learning will be the identification of the pedagogical objective that technology-based teaching is intended to fulfill. For instance, Crook (1994) pointed out that practitioners tend to assimilate the use of new technologies to prevailing educational practices and stated that “this inertia is unfortunate in that it reflects a failure to seize new opportunities” (p. 13). Therefore, I argue that the concept of the pedagogical objective of technology-based instruction must be identified as a separate theoretical construct from the features that define technological resources. For

instance, Lorge (1964) conceptualized the language laboratory “as a teaching aid to be used as part of class instruction for additional aural experience, *somewhat as the blackboard provides additional visual experience* [italics added]” (p. 409). In addition, Lindenau (1984), quoting other educational researchers, underlined the importance of identifying viable educational uses of television: “This instrument can teach, it can illuminate, yes, can even inspire. But, it can do so only to the extent that humans are determined to use it to those ends. Otherwise, it is merely lights and wires in a box” (p. 121).

The concern about the pedagogical effectiveness of different technologies is related to the following four major questions:

1. Is increased technological sophistication correlated to increased effectiveness to achieve pedagogical objectives? (i.e., technology-driven vs. principle-oriented pedagogy)

2. What technical attributes specific to the new technologies can be profitably exploited for pedagogical purposes? (e.g., coding options specific to each medium)

3. How can new technologies be successfully integrated into the curriculum? (e.g., interaction “with” the computer versus interaction “around” the computer)

4. Do new technologies provide for an efficient use of human and material resources? (e.g., use of blackboard vs. overhead projector vs. PowerPoint for presentations)

With respect to the first question, I believe that previous research on the efficacy of the use of technological tools for pedagogical purposes has been excessively focused on the technical capabilities of tools: technology-driven instruction (see critical reviews in Crook, 1994; Levy, 1997; Salaberry, 1999; vanLier, 1999). It is not surprising that Thrush and Thrush (1984) argued that “too often programs are developed from a practical or technical bias and lack sufficient educational planning” (p. 23). Examples of technology-driven pedagogy are represented in the early CALL programs that reproduced textbook exercises in the form of electronic workbooks. In contrast, a principle-oriented approach uses the new technologies only to the extent that they serve a pedagogical purpose. Hence, teachers are expected to delineate clearly specific pedagogical objectives in order to select the appropriate tool.

The second question refers to the identification and analysis of the specific attributes of new technologies that render tools useful for pedagogical purposes. For instance, almost a decade ago, Gar-

rett (1991) claimed that “reading comprehension is the skill for which the computer is most obviously suited” (p. 83). Although Garrett’s remark may be outdated, given the rapid evolution of computer and communications technology (e.g., development of video tools for delivery via the Internet), her argument is rightfully based on the evaluation of specific features of the technological tool. That is, Garrett claimed that software programs may be designed to promote the use of a wide variety of reading strategies such as skimming, scanning, inferring, predicting, and so forth that reinforce the use of top-down as well as bottom-up reading strategies. The adequate exploration of the pedagogical possibilities that new technologies provide can proceed only through careful scrutiny of potentially useful, inherent attributes of technological tools. Along these lines, further research in the area of what Pederson (1986) has called “coding options” will be a necessary component of a research agenda that looks into the pedagogical options for using technology in the L2 classroom (p. 36). Salaberry (2000) claimed that the analysis of theoretical constructs such 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 for pedagogical purposes.

The third question refers to the pedagogical integration of new technologies to the learning process and, consequently, to the curriculum. The success of a technology-driven activity will likely depend as much, or more, on the successful accomplishment of pre- and postactivities than on the technology activity itself. For instance, the success of a pedagogical activity based on the analysis of information retrieved from a textbook, a videotaped program, or the Internet is inherently dependent on the type of processing generated by task demands placed upon the learner, rather than the number of resources consulted or the comprehensive nature of the information retrieved (e.g., Skehan, 1998; Willis, 1996). Not too long ago, Lindenau (1984) argued that “libraries and resource centers house technologies; their purpose is *to provide not to integrate* technology into the learning process. It is with integration that teachers need help” (p. 121). In fact, van Lier (1999) talked about “open software” as “programs that allow for the creative construction of multimedia projects or other open-ended work” in contrast to “closed applications . . . that look a little bit like textbooks on screen” (p. 9). Thus, I argue that one of the most understudied and perhaps underrated consequences of the use of

new technologies has been the interaction among learners generated by activities based on the use of new technologies. This interaction is what I proposed (Salaberry, 1999) should be considered one of the central components of a research agenda for CALL in the years to come.

Finally, the fourth question refers to the adequate and efficient use of resources. The principled pedagogical exploitation of inherent features of tools for the purpose of building a coherent and integrated curriculum is only part of the picture. As Garrett (1991) succinctly asked "... Is [using a technology] worth the time, effort, and cost?" (p. 74). Heeding such concern, authors have identified implementation factors that make some tools more efficient than others. For instance, Meredith (1983) identified four major constraints (financial, legal, technical, and pedagogical) that had to be overcome if the use of new technologies were to be successfully applied for the purpose of L2 teaching and learning.

CONCLUSION

The previous review of studies in the area of technology-based instruction—as represented in the pages of the *MLJ* throughout the last century—provides a useful background for future studies in this area of research and pedagogy. Whereas most "new technologies" (radio, television, VCR, computers) may have been revolutionary in the overall context of human interaction, it is not clear whether they have achieved parallel degrees of pedagogical benefit in the realm of L2 teaching. In fact, Dunkel (1987) pointed out that "myriad teachers have seen students hauled into language labs, or have seen radios, TVs, film projectors, cassette recorders and programmed teaching machines hauled into the classroom, and hauled out back again, without noting the wondrous learning gains expected" (p. 252). Indeed, a healthy dose of skepticism about the pedagogical effectiveness of many current technological tools appears to be well justified if one considers the perhaps overly enthusiastic reaction to previous technological breakthroughs. For instance, Ornstein (1968) argued that "after a period of unbridled enthusiasm when the 'teaching machine' was hailed as an almost magic-type solution to all educational problems, a more critical and sane attitude is emerging" (p. 407). However, judging by the overly optimistic claims about the teaching machine of the 1970s and 1980s (i.e., CAI), it is questionable that such a critical attitude actually emerged. Readers of the *MLJ* at the beginning of this millennium may find solace in rec-

ognizing that the search for pedagogical applications of new technologies—as is the case of the immensely popular Internet—has been a common challenge presented to *MLJ* readers and contributors for many years. The careful assessment of the prospects provided by technologies of yesteryear and the extent to which those capabilities were actually harnessed may lead to a more judicious assessment of the pedagogical potential of modern technologies for future applications in L2 teaching and learning.

The *MLJ* has addressed—throughout its long history—many of the questions that the introduction of new technologies bring about in the area of L2 teaching and learning. At a time when new specialist journals are expanding the scope of inquiry of the use of new technologies, it is important to ponder the future role of the *MLJ*. I believe that the *MLJ*, as a generalist journal that reaches a vast number of readers, should continue to play a pivotal role in the L2 teaching field by means of critically assessing the pedagogical value of new technologies. As I argued above, the (rapid) introduction of new technologies brings about a heightened level of complexity in the analysis of pedagogical options. In order to assess and outline the pedagogical opportunities brought about by new tools, in the short period of time in which these tools are put to use, it is necessary to have access to multiple and diverse perspectives. Through the perspectives it offers, the *MLJ* can continue to provide its readers with the latest information on new lines of inquiry in the search for a sound pedagogical rationale for the use of new technologies. For instance, the outline of questions reviewed in the previous section may provide the starting point for an expanded research agenda that readers and contributors to the *MLJ* may want to explore in the future.

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NOTES

¹ Given that the prevalent technologies used in the L2 classroom have been predominantly electronic-based technologies, this paper is focused mostly on the analy-

sis of these types of tools. Also, it is important to point out that the term *technology* is necessarily defined by the specific theoretical framework used for the analysis of pedagogical applications. For instance, from a sociocultural perspective, Crook (1994) argued that “literacy is a technology in the sense that it involves deploying a symbol system (the written word) to mediate interactions between ourselves and our material and social environment” (p. 36). I address this issue in more detail in the Discussion section.

² It is interesting that Wipf (1984) noted that short-wave receivers may not be as efficient as printed media for pedagogical purposes: “Recording and preparing broadcasts for the classroom will often require more time than the equivalent task using conventional print materials” (p. 8).

³ However, the use of course grades to determine the effect of the treatment variable may be too crude a measurement to assess the effectiveness of instruction in either group. Furthermore, the effect of the novelty of the new medium of communication or the lack of appropriate control for previous knowledge, motivation, and so forth may have influenced the results of the analysis of course exams or course grades.

⁴ The use of the Internet provides learners with access to the most current information in a variety of audiovisual media (e.g., pictures, text, video, sound) and from a wide variety of cultural centers (anywhere in the world).

⁵ In essence, the study carried out by Herron et al. (1995) constituted a replication of the one conducted by Herron (1994). It was also an improvement over the one from Herron because the latter did not control for the Hawthorne effect as effectively as Herron et al. did.

⁶ Herron (1994) reported that in the experimental condition Advance Organizer plus Video “the teacher began the lesson by reading aloud six sentences *written in French on the board*” [italics added] (p. 192). In contrast, in the replication study reported in Herron, et al. (1995) “*the sentences were not written on the board*, [italics added] forcing the students to rely on their listening skills for comprehension of the advance organizer” (p. 389). This methodological difference renders inappropriate any comparison of findings across these studies.

⁷ It is important to point out, however, two methodological limitations of the study. First, the students who had access to subtitles spent less time watching the video segments than did students without access to subtitles (i.e., they spent the extra time responding to comprehension questions, drafting their oral sample, and recording it). Second, there is a potential influence of the Hawthorne effect (i.e., novelty of the medium): The results of a questionnaire on students’ attitudes toward practice with multimedia software turned out to be significantly higher for those students who saw the video with subtitles.

⁸ In a similar study, Hazelett (1961) described the pedagogical uses of a magnifying glass and presented an argument in favor of the pedagogical effectiveness of using interlinear microprint: “the insertion of translation between lines of ordinary text type” (p. 307).

⁹ Subsequent research—notably Tarone (1983, 1985, 1988)—has substantiated such a cautionary remark.

¹⁰ In fact, Anderson (1964) referred, quite seriously, to the practical needs that substantiate the pedagogical approach advocated by audiolingualism: “Fifty million Frenchmen just prefer not to wait indefinitely for the correct sound or phrase to be ground out through some mechanical process” (p. 202).

¹¹ Mathieu (1965) supported the use of tapes without pauses that allowed teachers to control with a lever the length of pauses between the stimulus and the student’s response: “The pause lever provides for the implementation of the fourth principle of programmed learning, namely, that each student should have the opportunity to learn at his own rate” (p. 40).

¹² In 1964, Valdman pointed out that “programmed learning and self-instruction is still possible without a language laboratory: The recorded program’s the thing” (p. 284).

¹³ One reviewer correctly pointed out that the use of language labs continues to be of importance in L2 instruction as one can witness from the exhibit halls of conferences such as ACTFL. Whereas it is true that the use of language labs is still prevalent in many educational institutions, its pedagogical use may no longer be assessed from the perspective of the audiolingual framework within which it was originally implemented. First, current language labs may be better conceptualized as multimedia or hypermedia centers that comprise what may have, at one point, been considered computer labs only. Second, even when language labs are reconceptualized as multimedia centers, their role as centralized units is irreversibly losing support due to the recent advances of Internet technology. A symptom of the reduced relevance of language labs is the change of the name of the International Association for Learning Labs (IALL), first established in 1965, to International Association for Language Learning Technology (change effected in 1990).

¹⁴ Chomsky’s critique of Skinner’s (1957) book appeared in 1959.

¹⁵ For instance, presentations that could be done with an overhead projector and transparencies can now be implemented with the help of user-friendly computer software such as PowerPoint. However, the analysis of the advantages of one tool over another should not blur the distinction between the assessment of the features of the tool and the assessment of how to achieve the pedagogical objective (see Salaberry, 2000).

¹⁶ However, Church (1986) also claimed that “students who have had computer exercises tend to neglect oral-aural practice in the language laboratory.”

¹⁷ It is worthy of note that some of Olsen’s (1980) respondents predicted that “time-sharing will soon be obsolete, since the distributed or decentralized processing movement is so far superior to what was available when CAI began” (p. 345). In fact, the use of centralized systems like PLATO effectively diminished to the point of extinction except, perhaps, for some types of pedagogical applications based on the use of collaborative-writing software (e.g., Kern, 1995).

¹⁸ Most important was Dunkel's (1987) concern about the possibility that the "CAI initiative will dry up unless the 'trickle' of high-quality software augments to a 'flood'" (p. 252). Such concern was directly related to the issue of the perceived pedagogical benefits of any type of CAI.

¹⁹ It is interesting that in the mid-1960s Locke (1965) predicted something similar for the teaching laboratory of the future decade: ". . . a greater emphasis on the visual . . ." (p. 304).

²⁰ The data from Pederson's (1986) study may also be explained with reference to theoretical constructs related to, but not necessarily subsumed by, the factor identified by Pederson (i.e., coding option). For instance, it is possible that the demands of the passage-unavailable condition generated more cognitive activity (i.e., depth of processing according to Craik & Lockhart, 1972; or elaboratedness of processing according to Anderson, 1990).

²¹ Video annotations ranged between approximately 2 and 11 seconds.

²² The advantages of scoring and testing machines that predated the appearance of computer technology were reported by Gottschalk (1964). In the machine described by Gottschalk (1964), workbook exercises "are typed on a continuous strip of fan-folded paper" and one item is presented at a time (p. 357). First, students write words or phrases required to complete each test item, then they move "a slider to a position which lowers a transparent cover over [their] written words and simultaneously reveals the desired correct response" (p. 357).

²³ The project was implemented on an IBM 286 computer with an 80-megabyte storage capacity.

²⁴ For a comparison of the effect of human and machine feedback, see Anderson (1990) and Weizenbaum (1976); for a discussion of the effect of human feedback on L2 acquisition in particular, see Aljaafreh and Lantolf (1994).

²⁵ Kern (1995) argued that "greater precision and sophistication of expression" is a possible consequence of the relaxation of time constraints to plan and produce utterances (p. 461). However, Kern's prediction was not a direct concern of his study, nor did his data analysis offer support for such an argument.

²⁶ It is also possible to implement the oral discussion treatment in small groups—as opposed to whole group discussion. In principle, the latter setting could produce equal, if not greater, amounts of language production as interaction that occurs in a collaborative writing program.

²⁷ See Salaberry (1996) for a principled distinction between interaction and communication for the purpose of developing an adequate theoretical foundation for the pedagogy of CMC.

²⁸ Locke (1965) claimed that "young people do learn to speak and understand spoken language better with the aid of a laboratory, *provided the teacher is interested [italics added]*" (pp. 296–297).

²⁹ As pointed out by one anonymous reviewer, "new technologies will inevitably be used; ergo, the question is not whether, but how best, to use them."

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