The Development of CALL
and Current Options

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Computer-assisted language learning (CALL[1]) has been defined as "the search for and study of applications on the computer in language teaching and learning" (Levy, 1997, p. 1) and is now used routinely in a variety of instructional situations. As a result, language teachers are increasingly required to possess CALL expertise that includes both practical skills and a thorough understanding of information technology (IT) theory. Teachers may need to design, implement, and evaluate CALL activities in their classrooms, they may be asked to supervise an institution-wide project or to work with other institutions to develop CALL-based exchange programs, or they may be put in charge of setting up and operating a multimedia language laboratory. It is thus becoming essential for teachers to be familiar with CALL options within the classroom, at the institutional level, and at the broader level of inter-institutional collaboration.

   In this introductory chapter we review the rise of CALL and its applications by considering the historical context of computers and their changing role in second language (L2) learning. We note the growing body of research demonstrating CALL's effectiveness in promoting both fluency and accuracy in the target language as well as improving motivation and learner autonomy. We then consider the changes in CALL models concomitant

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[1]Chapelle (2001) reported that use of the term CALL for computers in language learning was agreed on by early practitioners who met at the 1983 Teachers of English to Speakers of Other Languages (TESOL) conference.

with changes in language-learning pedagogy in general. We also present a broad classification of CALL activities, indicating the chapters in this volume that discuss these activities from the practitioner's perspective.

AN OVERVIEW OF COMPUTER USE IN L2 LEARNING

Developed in the mid 1940s from earlier work in the 1930s and early 1940s, large mainframe computers were used during World War II for missile guidance and cryptography and were thus involved with language processes from the very start. Mechanical translations appeared in the 1940s as a spinoff from cryptography but proved to be inadequate; as a result, U.S. government funding for computer research initially decreased after the war (Last, 1992). However, because of the improved systems and programming languages that were developed throughout the 1950s, by the 1960s linguists were using computers to create concordances for text analysis. The first electronic corpus, the Brown Corpus of Standard American English was developed during this period. It consisted of about 1 million words, the minimum number required to provide a stable word-frequency list.[2]

Until the invention of microcomputers, language learners had to work noninteractively with mainframe computers by punching their data on cards, running the program, then waiting for the results. Despite these limitations, simple CALL programs for drill and testing appeared as early as the 1950s, and a number of pioneer CALL projects existed by the 1960s (see Chapelle, 2001; Levy, 1997, for descriptions). Early, programs required the learner to choose one of two answers and the score was presented after the data had been processed. This linear type of program was the first generation of CALL software, and both researchers and educators acknowledged its limitations. The challenge was to create a learner interface that presented the computer as an interactive tutor evaluating the student and providing subsequent activities, a model characterizing CALL from its inception (Kern & Warschauer, 2000; Levy, 1997; Taylor, 1980).

This first phase of CALL has been termed be havioristic CALL (Kern & Warschauer, 2000; Warschauer, 1996a). It dominated the 1960s and 1970s and replicated the teaching techniques of structural linguistics and the audio-lingual method, a behaviorist model of language learning based on habit formation (Richards & Rodgers, 2001). Emulating techniques used in language laboratories at the time, CALL consisted mainly of drill-and-practice

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[2]Although the creation of the million-word Brown corpus was considered a feat at the time, the sophistication and power of modem computers is demonstrated by the greatly increased size and complexity of modem corpora such as the Cobuild Bank of English, which as of 2002 consisted of more than 450 million words.

programs and was regarded as a supplement to classroom instruction rather than its replacement. However, it should be noted that even today numerous drill programs still exist for vocabulary study and grammar practice because repeated exposure to such material has been shown to promote its acquisition, and the computer provides both immediate feedback and presents material at the learner's pace, thereby encouraging learner autonomy (Chapelle, 2001; Ellis, 2002; Fotos, 2001; Healy, 1999).

By the end of the 1970s, however, behaviorist approaches to language learning were challenged by communicative approaches based on meaning-focused language use rather than formal instruction (Richards & Rodgets, 2001). The emergence of increasingly powerful microcomputers in the 1980s presented a greater range of possibilities for learner interaction, and pioneer books on CALL methodology, such as Higgins and Johns' influential *Computers in Language Learning* (1984), Underwood's seminal Linguistics, *Computers and the Language Teacher* (1984), and Ahmad, Greville, Rogers, and Sussex's *Computers, Language Learning and Language Teaching* (1985) began to appear.[3] This period also witnessed the establishment of key professional organization such as the Computer Assisted Language Instruction Consortium (CALICO) in the United States and the European Association for Computer Assisted Language Learning (EuroCALL) in Europe, and publication of their journals, *CALICO Journal* and *ReCALL*. In addition, language teachers themselves began to write language-learning software using programs such as Hypercard, which were based on a nonlinear concept of interactivity-one of the key concepts driving the subsequent development of the Internet (Levy, 1997). This next generation of CALL software was characterized as communicative CALL (Kern & Warschauer, 2000; Underwood, 1984; Warschauer, 1996a) because it emphasized communicative use of the language rather than mastery of isolated forms. Programs consisted of language games, reading and writing practice, text reconstruction, doze tests, and puzzles. However, once again the prevailing model was the computer as tutor for the student, a "teacher in the machine" (Levy, 1997), and some researchers evaluating CALL questioned whether this technology was truly compatible with communicative methodology (see Dunkel, 1991; Underwood, 1984).

In reaction to criticisms that CALL was limited to mechanistic drills and lacked the ability to give learners essential feedback, the early 1990s was characterized by a different model, the computer as stimulus (Kern & Warschauer, 2000; Warschauer,1996a). Here, software followed a cognitive model of language learning that aimed to stimulate students' motivation,

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[3]See early works by Ahmad et al. (1985) and Higgins and Johns (1984), as well as Levy (1997) and Chapelle (2001) for full discussions of the history of early CALL.

critical thinking, creativity, and analytical skills rather than merely the achievement of a correct answer or the passive comprehension of meaning. A related learning model was the use of the computer as a tool providing the means for students to become active learners (Levy, 1997; Taylor, 1980). Software in this category, such as word processors, spelling and grammar checkers, desktop publishing programs, and concordancers, did not supply language-learning activities but facilitated the students' understanding' and manipulation of the target language (Warschauer, 1996a).

The present stage of CALL, integrative CALL, arose in the mid 1990s and has been made possible by the development of powerful desktop computers that support rapid use of the Internet, local area networks (LANs), multimedia, and linked resources known as hypermedia (Warschauer, 1996a). Currently, a typical multimedia language program might allow students to do a reading assignment in the target language, use a dictionary, study grammar and pronunciation related to the reading, perhaps access support materials and translations in the students' first language (L1), view a movie of the reading, and take a comprehension test on the reading content, receiving immediate feedback, all within the same program. This is a highly interactive and individualized approach, with the main focus on content supported by modules instructing learners on specific skills (Kern & Warschauer, 2000).

Much of the theory underlying integrative CALL is derived from the Vygotskyan sociocultural model of language learning (Wertsch, 1985) in which interaction is regarded as essential for the creation of meaning. Thus, person-to-person interaction is a conspicuous feature of many current CALL activities. The rise of LANs to teach writing interactively and e-mail exchange programs among students, classes, and institutions are examples of interactive language learning activities, as are multiplayer role-playing games and interactive online real-time learning situations such as MOOs (multiple user-domain object oriented) and simulation games played by different users. The rise of the Internet has promoted the use of CALL for information retrieval, creating the concept of computer literacy, a term referring to the development of skills for data retrieval, critical interpretation, and participation in online discourse communities (see Felix, 1999, 2002; Hawisher & Self, 2000; Murray, 2000; Warschauer, 1999). Learner autonomy-the influential concept from general education suggesting that students learn better when they discover things through their own efforts rather than when they receive knowledge passively through instruction-is an important goal of the current view of CALL (Healy, 1999).

A second feature of integrative CALL is the movement away from language-learning software and CD-ROMs to Web-based activities that allow learners flexible, self-paced access to information (Felix, 1998, 1999, 2000; Lin & Hsieh, 2001; Schcolnik, 2002; Warschauer, 1999). Thus, both teachers and students increasingly view computers and CALL as means to an Fend-the end being authentic, Web-based communication for meaningful purpose-rather than merely as a tool for language learning.

Regarding the future of CALL and the direction of educational technology in general, the point has been made repeatedly that no one knew what ;a powerful communication tool the telephone would eventually become, ,how the car would transform transportation, or how important television 'would become as a global medium. In the same way, from our current vantage point at the start of the computer era, it is impossible to visualize the changes that will occur as a result of its future development. Some researchers caution against the destruction of human relationships and the fragmentation of human society as a result of computer-mediated communication (CMC) preempting face-to-face interaction, warning that "improved tools are still projecting an unimproved and thoroughly unrevolutionary agenda" (Brown, 1997, p. 245). Other researchers (e.g., Ogden, 1995; Warschauer,1999) predict that we are heading toward a world without borders, with the rise of knowledge brokers and information literates as the new aristocracy and power elite. However, still others caution that the expensive technology and infrastructure required for online activities tend to privilege the culture and educational pedagogies of the advanced nations, creating a hegemonic "digital divide" between technological haves and have-nots (e.g. Crystal, 2001; Hawisher & Self, 2000; Hoffman & Novak, 2001; Murray, 2000; Warschauer, 2003). However, Murray (2000) observed that the new communication technologies such as video conferencing and e-mail have not yet replaced the old forms such phone calls and letters, but rather complement them, so the direction of the relationship between language learning and technology is still unclear.

Nonetheless, most researchers agree that a major shift is taking place (see discussions in Crystal, 2001; Murray, 2000; Warschauer, 2003)-a shift in the use of general technology and a shift in education away from the teacher-centered classroom toward a learner-centered system where the learner is in control of the lesson content and the learning process. CALL has historically been rooted in educational technology, and findings from the general field of education will continue to be influential in determining its future directions. The general differences between education in the pre-computer industrial society and education in the computer-based information society are summarized in Table 1.1. The most effective uses of CALL support this new model of education, and language teachers need to be able to respond by creating CALL-based activities for their particular instructional situation. A quote that has made the rounds of language teaching e-mail lists and online journals during the past several years states the situation clearly: "Technology will not replace teachers; teachers who use technology will replace those who don't!" Teachers must therefore find opportunities to gain CALL skills by taking courses in computer technology,

TABLE 1.1
Education in the Pre-Computer Society Versus
Education in the Information Society[a]

	Education in the Pre-Computer Society	*Education in the Information Society*
School	Isolated from society	Integrated in society
	Information on school functioning is confidential	Information on school functioning is openly available
Teacher	Initiates and controls instruction	Empowers students to find appropriate instruction for their particular learning styles and strategy preferences
	Teacher-fronted instruction of the whole class	Teacher as facilitator guides the students' independent learning; students often work in groups or pails or singly
		Helps students evaluate their own progress
	Evaluates students	High emphasis on communication skills
	Low emphasis on communication skills	
Student	Mostly passive learning	Actively in charge of own learning
	Learning mostly at school	Learning at school and outside of school
	Little teamwork	Much teamwork
	Answers questions from text-books or teacher	Asks questions; learns to find answers to questions
	Low: interest in learning	High interest in learning

[a]Adapted from Pelgrum (2001, p. 164).

teaching themselves, and using' their colleagues and the World Wide Web as resources, this last option suggested to be especially significant in skills development (Egbert, Paulus, & Nakamichi, 2002)[4]

EFFECTIVENESS OF CALL

An important question at this point concerns the effectiveness of CALL: Does its use really promote language learning and student development? A large number of books describing and evaluating CALL, summarizing research

to promote language learning have been published recently, including Boswood (1997), Chapelle (2001), Crystal (2001), Debski and Levy (1999), Egbert and Hanson-Smith (1999), Felix (1998, 2002), Hanson-Smith (2000), Levy (1997), Warschauer and Kern (2000), and Warschauer, Shetzer, and Meloni (2000). These works strongly emphasize the significant role of

[4]See Levy's (1997, chap. 5) survey of language teachers' use of CALL.

CALL in developing linguistic proficiency and communicative competence
in L2 learners as well as promoting increased levels of learner autonomy,
motivation, satisfaction, and self-confidence. For example, mid-1990s sum of
CALL research noted positive results from its use, indicating that
CALL permitted students to control the pace of their learning and their
interaction with others, and encouraged them to become better writers because
they had an authentic audience and a purpose for writing (Pennington, 1996;
Pennington & Stevens, 1992; Warschauer, 1995; Yates, 1996).
The use of CALL and distance learning activities was found to create classroom
discourse communities and encouraged shy students to participate more fully
(Palloff & Pratt, 1999; Warschauer, 1996b). Students also reported that CALL
activities helped them develop their ideas and promoted steaming from their
classmates. In addition, developing expertise in using computers gave students
feelings of pride and achievement and greatly en'couraged their autonomy as
learners (see summaries in Warschauer, l996b, 1999; Shetzer & Warschauer,
2000). Thus, CALL has been shown to produce a number of favorable learning
outcomes.

CALL ACTIVITIES

CALL has been divided into seven general types of activity (Warschauer
1996a). One of the most important is writing (see Pennington, chap. 5,
this volume). This includes word processing, text analysis, and desktop
publishing, often combined with communication over a LAN. Though
student use of spell checkers and grammar checkers is common in these
types of activities, much more sophisticated and interactive approaches
are also possible. Many L2 teachers, for example, now request their students to
use computers to write essays then to e-mail each other what they
have written or to post their essays on a LAN. The students then discuss
and correct each other's writing (in this volume, see Braine, chap. 6; Pennington,
chap. 5), engaging in meaningful discourse and creating knowledge through
interaction.
    A second type of CALL is communicating. This includes e-mail exchanges
(see Fotos, chap. 7, this volume), student discussions with each other or with
their teacher on LANs (see Braine, chap. 6, this volume), MOOs (sites on the
Internet where student do role-playing games and talk with each other), and
real-time chat. These activities are particularly useful for foreign language
teaching where students share the same LI because they create the need to
use the foreign language for authentic communication.
    Another CALL activity is use of multimedia. This includes courseware
presented on CD-ROM or online for study of specific skills such as pronunciation
or grammar, and integrated skills-based or communicative practice

where hyperlinks allow students to access a range of supplementary material for learning support (in this volume, see Hubbard, chap. 4; OppBeckman & Kieffer, chap. 12; Reeder et al., chap. 13; Taylor & Gitsaki, chap. 8). Often teacher-created programs are course-specific and are designed to quiz students over material covered in class (in this volume, see O'Connor & Gatton, chap. 11; Iwabuchi & Fotos, chap. 9).

Other CALL activities involve the Internet, such as Web searches for information and student construction of home pages. Related to this is the field of information literacy, a concept similar to computer literacy and referring to the ability to obtain information from the Internet and process it selectively and critically (in this volume, see Taylor & Gitsaki, chap. 8; Susser & Robb, chap. 14; Warschauer, chap. 2). The tremendous amount of online resources means that teacher evaluation of Web sites and L2 learn ing materials has now become an important aspect of Internet based activides (in this volume, see Chapelle & Hegeiheimer, chap. 15; Reeder et al., chap. 13; Susser & Robb, chap. 14).

An additional use of CALL is concordancing and referencing, or using a corpus to examine the range of usages for grammar and vocabulary items, and using online dictionaries for definitions and usage information.

Yet another significant use of CALL is distance learning. In the United States, United Kingdom, and Europe, many college professors now teach some or all of their courses online.[5] Research on distance learning and courses with online components suggests that online students make the same gains as those achieved by students receiving a regular "brick-and-mortar" lecture (McIntyre & Wolff,.1998). Although it began only recently, distance learning via the Internet has already developed into an important field, with a rapidly increasing number of publications on its implementation and evaluation (e.g., Abbey, 2000; Belanger & Jordan, 2000; Lau, 2000; Palloff & Pratt, 1999; White & Weight, 2000). In fact, an article in the *Chronicle of Higher Education* (November 16, 2001) titled "The Deserted Library" suggests that U.S. college students are doing most of their research online as well.

An additional aspect of distance learning is the teacher creation of Web pages to disseminate their lesson plans, course material, research papers, and other material. Many teachers now routinely take attendance online and post course outlines, specific activities, tests, drills, and so on, on their home pages. Veteran teachers may recall when there was often a filing cabinet

[5]Many university review committees now consider the development of electronic teaching materials as a legitimate pan of a candidate's tenure or promotion portfolio, and increasingly, university hiring search committees search for candidates who have experience teaching with technology. A discussion of this issue is found in the spring 2002 issue of *TEXT Technology* (11:1), especially the opening paper by Siemens (2002) on the credibility of electronic publishing.

of time-tested activities, lessons, and tests in the teachers' office for instructors to browse through and copy.

Now this "filing cabinet" has moved online to hundreds of sites, including listening laboratories, Test of English as a Second Language (TOEFL) practice, reading and writing activities and ;exercises, tests, holiday-related and other types of cultural activities, Web page design, and so forth (see the Appendix for a list of links). Again, teachers are required to be able to evaluate sites and online materials (in this volume, see Chapelle & Hegelheimer, chap. 15; Reeder et al., chap. 13; Susser & Robb, chap. 14; Taylor & Gitsaki, chap. 8).[6]

Another important use of CALL is test taking. There is extensive research on computer-assisted language testing (CALT), suggesting that computer-based tests, particularly those that respond to learners' choices by   presenting subsequent items at varying levels of difficulty, are effective in building language skills because they provide immediate feedback and multimedia support by access to dictionaries, grammatical explanations, and audio and video material for study of test items (see Chalhoub-Devilile, 1999; Chapelle, 2001).

Because the TOEFL is now administered by computer, students routinely use CD-ROM TOEFL practice tests and other selftests.

Furthermore, many teachers have developed their own tests, checked them for reliability and validity, and posted them on home pages for others to use, or have developed freeware for course-specific test creation (see the Appendix for links to test sites).

Thus, CALL is now an integral part of L2 classrooms and is likely to assume increasing importance as technology improves (see Chapelle & Hegelheimer, chap. 15, this volume).

This book serves as a practical handbook for those who would like to develop an understanding of the wide range of issues, research, and applications of CALL to the 21stcentury L2 classroom.

In the near future it is likely that many L2 teachers will need to be prepared to: (a) use classroom CALL and perhaps put part or all of their courses online, (b) evaluate CALL materials and Web sites (in this volume, see Reeder et al., chap. 13; Susser & Robb, chap. 14), (c) participate in institution-wide CALL projects (see O'Conner & Gatton, chap. 11, this volume) as well as interinstitutional partnerships (see Opp-Beckman & Kieffer, chap. 12, this volume), and (d) use or administer multimedia language laboratories (in this volume, see Liddell & Garrett, chap. 3; Browne & Gerrity, chap. 10).

These issues are addressed in the chapters that follow. In chapter 15, Chapelle and Hegelheimer observe, "The need has never been greater for teachers with basic technological skills who understand the capabilities and limitations of technology in teaching and who accept responsibility for critically examining the options and their implications" (p. 313). Teachers must therefore meet

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[6]Many L2 textbooks now have a Web-based component for students to perform activities on the book Web site, submit tests for scoring, and participate in chat sessions or post messages to bulletin boards.

the challenge of this continually evolving technology and embrace CALL as a powerful instructional partner.

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