Chapter XXXIII
Portable Handheld Language Learning:
From CALL, MALL to PALL

Chaka Chaka
Walter Sisulu University, South Africa

ABSTRACT

This chapter explores aspects of portable handheld language learning that are likely to benefit many mobile assisted language learning (MALL) practitioners. Portable handheld language learning refers to mobile, virtual, and ubiquitous language learning mediated through mobile handheld devices. Currently, both computer assisted language learning (CALL) and MALL seem to dominate the act of language learning. Against this background the chapter first provides a brief review of CALL, highlighting CALL technologies helping mediate language learning. Second, it delineates features typifying e-Learning and contends that CALL is more closely linked to traditional e-Learning than MALL. Third, it provides empirical instances of MALL and argues that the future of language learning lies more with MALL and especially with pen assisted language learning (PALL) than with CALL. Finally, it maintains that an all-encompassing and multidimensional definition of mobile learning is necessary if MALL is to evolve into a mainstream virtual learning enterprise.

CALL: WHAT IT IS AND ITS BRIEF HISTORY

In one sense, CALL is an approach to language learning and teaching that uses the computer as an aid to presenting, reinforcing, and assessing the material to be learned. In another sense, it is a catch-all term referring to the use and study of computer applications in language learning and teaching. It is an expression that was coined at the 1983 TESOL convention. However, as an enterprise, it dates back to the 1960s, even though

it gained currency in the 1980s, supplanting the then much-vaunted approach, computer assisted language instruction (CALI). In the late 1980s, an alternative term, technology enhanced language learning (TELL), which was thought to precisely embody the activities that mostly fall within the scope of CALL, emerged. However, its usage was short-lived, and to date, CALL is still a vogue term as it appears to have gained an upper hand over TELL (Davies & Walker, 1999-2007; Warschauer, 1996).

CALL TECHNOLOGIES AND LANGUAGE LEARNING

CALL technologies (programs, applications, and platforms) are central to how language learning is mediated in CALL environments. Most of these technologies are determined largely by language learning approaches and methods and their attendant pedagogical and theoretical philosophies. That is, they tend to reflect the prevailing philosophies and the dominant pedagogical and learning paradigms determining how language learning ought to be mediated. However, these technologies also tend to shape and influence pedagogical and learning paradigms (Kern & Warschauer, 2000). Against this backdrop, this section of the chapter outlines some of the CALL technologies and the way in which they facilitate language learning. Modeled on the typology of CALL programs, applications, and platforms delineated by Warschauer (1996) and Kern & Warschauer (2000), these technologies are categorized into three divisions: mainframe computer technologies; PC technologies; and multimedia networked computer technologies.

Mainframe Computer Technologies

These are the first-generation CALL technologies related to the mainframe computer informed by the behaviorist approach to CALL—the view that

language learning and acquisition entailed repetitive habit formation patterns. Most of them (e.g., the audio language laboratory and the PLATO system) viewed the computer as a tutor/taskmaster mediating language learning between the learner and materials. Some of the software programs they used included drill and practice programs, grammar and tutorial programs, and language testing instruments. One prominent feature of these programs was the provision of immediate positive and negative feedback to learners on the structural accuracy of their responses (Davies & Walker, 1999-2007; Kern & Warschauer, 2000; Warschauer, 1996).

According to these mainframe computer technologies, language learning is mediated through:

- Repetitive drilling of the same material (e.g., grammar, vocabulary, spelling)
- Pronunciation and reading activities
- Constant error analysis
- Listening to audio recordings of the target speech
- Reading, speaking, and writing

Some of the drill programs included, among other things, the following: *Advanced Grammar Series*; *Accelerated English*; *Firsthand Access*; *Reading Adventure 1 – ESL*; *Gapmaster*; *English Vocabulary*; *Typing Tutor*; and *Testmaster* (Davies & Walker, 1999-2007; Warschauer, 1996; Warschauer & Healy, 1998).

PC Technologies

These constitute the second-generation CALL technologies. Driven primarily by cognitivist/constructivist approach to language learning and teaching, these CALL technologies view the computer from a blended perspective as both a tutor and a pupil on the one hand; and as both stimulus and toolkit on the other hand. Fundamental to these technologies are three principles: learners

are social constructors of new knowledge; usage of structures (language use and context) should take precedence over mechanical knowledge of structures; and computers serve as resources for language learning and acquisition. Most of the software programs in this category focus on the following types of communicative activities: skill practices in a nondrill format; oral and written activities; and simulations and role-playing (Kern & Warschauer, 2000). Consequently, language learning is mediated by:

- Communicative and contextual activities (oral and written)
- Language games, reading, and text reconstruction
- Simulations and role-plays
- Language exploration activities
- Critical thinking, problem-solving, and hypothesis-testing activities (Kern & Warschauer, 2000; Warschauer, 1996; Warschauer & Healy, 1998).

Some of the applications learners can employ for learning and acquiring language include tools such as word processors, spelling and grammar checkers, and desktop publishers (Kern & Warschauer, 2000). Other software programs that are part of the resources for PC technologies are *Wordsmith, Vocabulary Game*s, *Clozewrite, Mc-Collaborator,* and *Multitester* (Davies & Walker, 1999-2007; Warschauer, 1996).

Multimedia Networked Computer Technologies

These are the third-generation CALL technologies based on multimedia computers, the Internet, and the Web. These technologies are underpinned by two intertwined frameworks: a sociocognitive view that emphasizes meaningful interactions as embedded in authentic discourse communities and a technological move about computer networking in which computers function as primary vehicles of interactive human communication. Thus, one of the basic tenets of this category of technologies is that learners learn best in interaction with other human beings via computers (Kern & Warschauer, 2000). In this regard, some of the features characteristic of these technologies are the integration of the four basic language skills (listening, speaking, reading, and writing) into one common activity; the integration of text, graphics, sound, animation, and video; the use of the multimedia applications such as CD-ROMs and DVDs; the hypermedia platform that integrates the aforementioned resources into the latter applications and the Internet; and hybrid approaches that integrate CD-ROMs/DVDs and audio- and videoconferencing with Web activities (Davies & Walker, 1999-2007; Kern & Warschauer, 2000).

Accordingly, in respect to these CALL technologies, language learning is mediated through:

- The use of multimedia CD-ROMs and DVDs
- Synchronous and asynchronous communication (e.g., MOOs [Multi-User Domains])
- Object Oriented, Internet Relay Chats (IRCs), chat rooms, and e-mail
- Newsgroups and bulletin boards
- The use of the Internet and the Web
- Interactive pair and group work
- Audio- and videoconferencing
- Content- and task-based activities (Kern & Warschauer, 2000; Warschauer & Healy, 1998)

The Internet, the Web, e-mail, MOOs, Multi User Dungeons (MUDs), IRCs, chat rooms, CD-ROMs, and DVDs are among the applications and tools associated with multimedia networked computer technologies. In this instance, some of the software packages linked to these technologies are encyclopaedias (e.g., *Encarta* and *Britannica*), dictionaries (e.g., *American Heritage Dictionary* and *Collins Online Dictionary*), and glossaries (Davies & Walker, 1999-2007; Warschauer & Healy, 1998).

E-Learning and Some of its Distinctive Features

In its traditional sense. e-Learning simply refers to learning facilitated by personal computers, multimedia resources (e.g., CD-ROMs and DVDs), and Internet-based tools (e.g., e-mail and discussion forums—synchronous or asynchronous), and online or Internet learning meant for distance learning (Davies & Walker, 1999-2007). However, in its broader sense (with which this chapter aligns itself), e-Learning is an overarching term broadly referring to the use of technology to design, select, deliver, administer, support, and facilitate learning. This encompasses and transcends the traditional sense to refer to other Internet- and Web-based learning technologies and resources such as blogs, wikis, podcasts, Really Simple Syndication (RSS) feeds (collectively known as Web 2.0 applications), simulations, games, webinars, and instant messages.

On the basis of this definition, the following constitute some of the distinctive features of e-Learning:

- Mass and standardized learning and content
- Learner-centricity (learner-centered approach that sometimes can be undercut by prepackaged tutoring modules)
- Interactivity (interactive learning and learning materials)
- Global and wide access to resources by learners
- Streaming technologies
- Problem-solving oriented and simulation-based learning and teaching
- Benchmark-based grading (testing and assessment)
- Formal and supportive expert instruction
- Monitoring of learner progress
- Blended learning (use of a variety of content delivery forms and employing of various modes of learning)

Given both the traditional concept of e-Learning portrayed here and the brief representation of CALL made earlier on, it can be argued that CALL embodies more of the traditional concept of e-Learning. Thus, of the evolutionary trajectory of the technology-enhanced learning continuum characterized here, CALL seems to occupy the first phase of this continuum, while MALL tends to occupy the last phase of this continuum.

THE FUTURE OF LANGUAGE LEARNING: FROM CALL TO MALL

This section argues that the future of language learning lies more with MALL than with CALL. This argument is framed within a broader view that both CALL and MALL are subsets of e-Learning only if in this case they can be seen to be part of the electronically driven technologies. The rationale for maintaining that the future of language learning lies more with MALL is informed by the following factors characteristic of MALL: mobility, ubiquity, and connectivity; portability and handheldability; convergence, multifunctionality, cross-platform blending, optionality, and convenience; access, accessibility, availability, and affordability; and context-awareness, personalization, and flexibility. The chapter maintains that these factors tend to give MALL a competitive and utilitarian edge over CALL.

LANGUAGE LEARNING IN THE MALL

There is currently a number of mobile devices facilitating language learning. Seven of such devices that are the focal point in this chapter are pocket personal computers (Pocket PCs), mobile phones, personal digital assistants (PDAs), iPods, two game consoles (Nintendo DS and PlayStation Portable [PSP]), and a *Java 2 Platform*, *Micro Edition* (J2ME) application. Needless to say, as

much as these mobile devices can enhance any language learning endeavor, they do not on their own guarantee a successful learning of language structures. Rather, it is their thoughtful and purposive leveraging by the target users that is critical. So, in this case, they are just enablers of language learning in the same way as the PC and other related tools are with respect to CALL.

Pocket PCs

Projects related to language learning mediated through Pocket PCs have been reported in the past few years. Two such projects are the Network for English Acquisition and Reading Star Schools (NEARStar) program that started in September 1999 in the United States (US) and the Crescent Girls' School (CGS) project developed in late 2003 in Singapore. The NEARStar project is a program intended for learners (of Hispanic, Asian, Pacific Island, and other ethnic minority groups from high-poverty and non-English language backgrounds) who are in the beginning stages of their oral and reading English language development. Having started as a purely interactive Web-based multimedia, this project is now offered to learners on Pocket PCs as part of their mobile learning (m-Learning). It combines both reading and speaking. It does this by having English language learners (ELLs) learn featured vocabulary words and phonemic skills from engaging activities, animated songs and chants, and interactive online books that provide repeated exposure and focused practice (Brauer & Tung, 2005). Driven by, among other things, situated learning, learning by doing, practice and feedback, and learning from mistakes, the project's content for reading comprises five domains: phonemic awareness, word recognition, fluency, vocabulary, and comprehension.

Furthermore, the project espouses the following principles: reading skills are acquired much better when the rate of introducing new words is reduced and when the pace at which new words are repeated is increased; successful English language acquisition is better facilitated by high meaning words with images, phonetically regular words, and high frequency words; and chants, songs, and poems immensely enhance phonetic awareness. Two of the most valuable results emanating from the evaluation of the learners who were on the NEARStar program (experimental group) vs. those who were not (control group) were as follows: ELLs employing the NEARStar approach significantly increased their sight word recognition by more than twice the control group; and texts with critical word factor (CWF) had a significant positive impact on reading speed, accuracy, and comprehension (Brauer & Tung, 2005).

The CGS project is an m-Learning (the m-Learning@Crescent) initiative in which more than 400 Tablet PCs and a pervasive local area network (LAN) were deployed to 355 students to enable them to leverage these devices as an integral part of their education. Although the project targeted subjects ranging from English, Humanities, and History to Home Economics, Geography, and Science, it is English whose results matter most here. According to the project, which employed a constructivist approach, students showed improvement in language exercises and in their English language writing practice. In fact, the project reports that for students, writing on the touch screens of Tablet PCs was as natural as reading (Gilgen, 2005; Intel Centrino Mobile Technology, 2006).

In an unrelated but relevant instance, a study conducted during 2003-2004 between two schools (four elementary and two seventh-grade science classes) in Northeast Ohio had a positive spin-off for language learning. Its results showed that the use of handheld computers in the form of portable AlphaSmart's Danas improved learners' spelling and writing as a result of the time learners spent writing and editing their science tasks (Swan, van't Hooft, Kratcoski & Unger, 2005).

Mobile Phones

While the use of telephones in language learning and teaching is not exclusive to mobile phones, the multifunctionalities (e.g., short messaging service [SMS], voice messaging, Internet access, camera, and videorecording capabilities) built into most new generation mobile phones are unique to the latter. All these features leverage interactivity, communicative practice, and access to authentic material in language learning (Chinnery, 2006). Studies on the uses of mobile phones in language learning do abound. Their foci range from vocabulary words and phrases (Brown, 2001; Houser, Thornton & Kluge, 2002; Thornton & Houser, 2003, 2005) to idioms, example sentences (Levy & Kennedy, 2005), and task-based language activities (Kiernan & Aizawa, 2004).

One of the earliest mobile phone projects on language learning is the one undertaken by the Stanford Learning Laboratory at Stanford University. The project involved a Spanish study program that employed e-mail and voice with mobile phones and focused on vocabulary exercises, quizzes, and access to live talking tutors. The results of this project showed that mobile phones were effective for quiz delivery if vocabulary quizzes were sent in small bites. In addition, the automated voice vocabulary quizzes and lessons were found to have a great impact on learning and acquiring vocabulary words. Similarly, live tutoring turned out to be effective in enhancing listening and speaking, even though it was judged to affect comprehension to some degree (Brown, 2001; Chinnery, 2006; Gilgen, 2005).

There are also some innovative projects mounted by Thornton and Houser (2003, 2005) that have explored the use of mobile phones in teaching English to a group of Japanese university students. One such project focused on three aspects. First, 333 Japanese university students were polled regarding their use of mobile phones. Second, 100-word English vocabulary lessons were sent via SMS at timed intervals to the mo-bile phones of 44 Japanese university students with a view to promoting regular study. Lessons defined five words per week, recycled previous vocabulary, and used the words in a variety of contexts, including episodic stories. Students were tested biweekly and compared to a control group that received the same lessons on paper and via the Web. Third, a Web site explaining English idioms was created. Concerning the first aspect, a large number of students reported that they used their mobile phones for e-mailing and SMSing purposes more than they did on PCs and PDAs. In the second instance, results indicated that the SMS students learned twice the number of vocabulary words as the control group, and that the scores of the SMS group significantly improved by almost twice as much as those who had received their lessons on paper (Chinnery, 2006; Houser, et al., 2002; Thornton & Houser, 2003, 2005).

In a different but related scenario, Italian learners at Griffith University in Australia were taught Italian Literature and Society in Italian via two to three mobile phone SMS messages a day over a period of seven weeks in 2004. They were provided with vocabulary words, idioms, definitions, and sample sentences in a paced and timed delivery pattern. In each instance, they were required to give feedback in the form of quizzes and follow-up questions. The findings of this study revealed that learners were able to acquire vocabulary items and idioms and write sentences on their own (Chinnery, 2006; Levy & Kennedy, 2005;). In addition, mobile phones have been found to be useful tools for learning grammar (English language grammar), especially in relation to concord and tense (Wong, Sellan & Lee, 2006).

In another project involving mobile phones, Kiernan and Aizawa (2004) set out to investigate the usefulness of mobile phones as second language learning tools and their related use in task-based learning. In this study, lower- and upper-level Japanese university students were

divided into three user groups: PC e-mail users, mobile phone e-mail users, and mobile phone speaking users (with the latter group becoming face-to-face speaking users due to cost). A pretest, three narrative tasks, three invitation tasks, and a posttest were administered. Markedly contrasting results emerged from this study. First, all the face-to-face speaking users completed their tasks in the designated time, while only two pairs and one pair of the PC e-mail and mobile phone e-mail users, respectively, completed their tasks. Second, the face-to-face speaking users had significantly faster performances than the two other groups. Third, the mobile phone users had, overall, employed fewer words in their tasks than the other two groups. Based on these findings, the researchers in this study argue that second language acquisition is best facilitated through utilizing language tasks that force learners to fill in the information gap and focus on meaning (Chinnery, 2006; Kiernan & Aizawa, 2004).

PDAs

PDAs have had many and varied uses in most second and foreign language learning contexts. They serve as translation tools and as devices for learning and acquiring phrases, idioms, location-aware expressions, spelling, and writing skills, and for reading comprehension and intercultural communication (Chinnery, 2006; Ogata & Yano, 2004; Savvas, Sotirou, Malliou & Agogi, 2003). In an instance in which Chinese learners of English who used PDA-enabled translators were shown contextual words according to the lexical approach, the following observations were made: the learners preferred to look up words and phrases from the English translation rather than from the Chinese translation, thereby displaying the inclination to function in a foreign language; they repeatedly attempted to say unfamiliar words typed into the translator; they took written notes of new words and phrases learned from the translator; they typed full words into

the translator and instantly learned to recognize word stems; and their spelling quickly improved (Chinnery, 2006).

In another instance, a faculty-wide survey involving various beginning foreign language courses was conducted at the University of Wisconsin-Madison in 2002. The languages in question ranged from Spanish, French, Danish, Norwegian, and Ojibwe to Japanese and Tagalog (Filipino). Comparative literature courses in some of these languages (e.g., Spanish) were also included in the survey. One of the objectives of the survey was to evaluate the impact and value of mobile technologies (in particular, PDAs and laptops) on the learning of these languages by students. The survey reports that students strongly felt that PDAs and laptops had helped them with their reading and writing activities but not with their listening and speaking activities (Gilgen, 2005).

In a further instance, Thornton and Houser (2003) undertook a study in which a Web site containing English idioms, their definitions, and multiple-choice quizzes, together with accompanying illustrative videos and animations, was developed for use by Japanese students. The students had to access the Web site using either PDAs, video phones, or mobile Web and assess their usability. While scores were positive and similar for both media, PDA users, however, rated their video quality higher than the mobile phone users.

In another further context, an overseas university student eager to learn Japanese and a Japanese student interested in learning English as a second language (and who acted as a language helper to the overseas student) participated in a collaborative-learning support system for ubiquitous environment (CLUE). The latter is a prototype system for embedding a knowledge awareness (KA) map that facilitates collaborative learning and sharing of language knowledge. It is capable of both retrieving past experience and interaction based on the current context and providing learn-

ers with the right expressions at the right place immediately. For instance, if the learner enters a hospital, then the right expressions at that place are instantly provided. Thus, it enables right time and right place learning (RTRPL). Using PDAs, the two students leveraged the prototype system and collaborated with each other in learning their respective target languages. All this entailed context-aware and situated language learning on their part (Ogata & Yano, 2004). In a different but related scenario, Savvas, et al. (2003) report that PDAs can be used as advanced multimedia language learning devices to facilitate intercultural communication with people from diverse cultural and linguistic backgrounds; that is, they can be employed by end users (i.e., language learners, business people, travelers, etc.) to learn and acquire specific language information through communicating with locals in various host countries.

iPODs

Arguably, iPods rank as some of the leading portable handheld media devices for language learning. They are particularly prominent in the areas of listening, reading, oral comprehension, and pronunciation. Coupled with podcasting (iPod + broadcasting) technology, their use becomes even more critical for language learning purposes. One of the large-scale projects ever undertaken regarding the application of iPods to language learning is the 2004 Duke University iPod experiment (the Duke iPod First-Year Experience) in the United States. Prior to this, two small-scale case studies had been carried out in 2002 and 2004 at George College and State University and Osaka Jogakuin College, respectively (Thomas, 2006; Thorne & Payne, 2005).

In the Duke University project (in partnership with Apple), 1,650 freshmen were issued 20GB iPods fitted with voice recorders. The students were required to use the iPods to record academic content and language learning lessons of seven

language courses, two of which were Spanish and Turkish. Students in a Turkish class used the iPods to listen to songs, poems, and news, and to their instructor's vocabulary and translations. On the other hand, students in a Spanish class used them to record audio journals, submit audio assignments, respond to verbal quizzes, and receive oral feedback from their instructor. The evaluation of the project indicated that students managed to listen to the content outside the classroom while moving between activities or traveling on and from campus. It also underlined the significance of iPods as classroom recording, course content dissemination, study support, and field recording tools (Chinnery, 2006; Thomas, 2006; Thorne & Payne, 2005).

A technology that is increasingly leveraging the utility of iPods in the area of second and foreign language learning is podcasting. In this case, it can be used, inter alia, for listening exercises (http://www.eigolistening.com/), listening to idioms (http://www.englishcaster.com/blogs), speech and pronunciation activities, and phonetics exercises (http://phoneticpodcast.com/). In addition, authentic podcasts aimed at and sometimes produced by second and foreign language teachers and learners are now available (Thomas, 2006). All of this, in combination with digital audio and video content, can be in the form of autocasting (automatic generation of podcasts from text-only sources), streaming media, mobcasting (mobile podcasting), MMS podcast (mobile podcasting and viewing through mobile phones using multimedia messaging service), vodcasting (video podcasting), and blogcasting (blogging podcast). As Thorne and Payne (2005) point out, software such as iPodder and blogcasting sites such as http://bylpodcasts.blogspot.com/ and http://mylcpodcasts.blogspot.com/ can be used and accessed by learners for language learning purposes. Thus, coupled with iPod and blogging technologies, podcasting enables language learners to publish their work. Most importantly, it helps language learners learn and master genres

of communication (e.g., readings of literature, dramatic performances, investigative reporting, dialogues/monologues, talk shows, etc.) (Thorne & Payne, 2005) that in turn can be embedded within specific contexts of language use.

Nintendo DS, PSP, and J2ME

There has been some interest in the potential computer and console games have to support learning and teaching. On the other hand, there has been some cynicism in the application of games to learning (Dumbleton, 2007). In this section, the chapter briefly delineates the potential two mobile handheld game consoles (Nintendo DS and PSP) and a J2ME-enabled English-Chinese learning system hold for language learning. One view expressed in the context of games-based learning is that each game has a unique language and some skill to be learned and that the more engaged players are in a given game, the more fluent they become in a given skill. In addition, research has found that computer games lead to subconscious or incidental learning on the part of learners and that they encourage learners to explore, probe, hypothesize, and experiment (Krotoski, Ellis, Heppell, Kirriermuir & McFarlane, 2006).

One of the popular computer and console games played on the Nintendo DS handheld console is Dr Kawashima's *Brain Training: How Old Is Your Brain?* It is based on a book titled *Train Your Brain: 60 Days to a Better Brain*, by Dr. Ryuta Kawashima, and challenges players (young and old) to spend 10 minutes a day performing and learning words and simple arithmetic. It also enhances concentration tasks by using a touch-screen input to scribble, draw, and select available options (Dumbleton, 2007; Krotoski et al., 2006).

In addition, in one instance, Nintendo DS game consoles focusing on English lessons are reported to have been introduced to junior high schools in Yawata, Japan, following tests indicating that the devices helped improve students' English vocabulary. The consoles were made available to third-year junior high school students as part of an experiment employing English vocabulary training software (*Chuugaku Eitango Target 1800 DS* or *Middle School English Vocabulary Target 1800 DS*). During the experiment, the students' vocabulary expanded by an average of 40% over five months. To assess the effectiveness of the software, 49 junior high school students were given the software, were split into two groups, and then were required to play it on Nintendo DS consoles for 10 minutes at the beginning of the lessons. When one group of 25 students used the software, their vocabulary increased from an average of 1,013 words to 1,436 words, an increase of 41.8%. The vocabulary of another group of 24 students moved from an average of 1,025 words to 1,386 words, a 35.2% rise. Moreover, in another scenario, it is reported that Japanese junior and senior high school students are using Nintendo DS consoles (by applying styluses to touch-screens) to practice writing in English and to improve their vocabulary and pronunciation skills through audio playback (Boyer, 2007).

A popular game mounted on Sony's PSP handheld console platform is *Talkman*. This is a voice-activated translation package released in languages such as English, French, German, Spanish, Japanese, and traditional Chinese. Run on a universal serial bus (USB) microphone, the software allows players (young and old) to have direct translation between any of the languages it supports. It blends language learning with entertainment and mini-games that challenge players to replicate pronunciation appropriately or to select words matching foreign language definitions. Included in the *Talkman* software are slang and travel phrases (Krotoski et al., 2006).

Another relevant games-based language learning platform is J2ME mounted on mobile phone applications. One classic prototype is the English-Chinese learning system that uses Java servlets. The application allows users understanding Chinese to simultaneously play games

while learning English on their J2ME-enabled mobile phones anytime anywhere. Features built into the system are an online bilingual dictionary and games such as a word scramble game, a crossword puzzle, a multiplayer word guessing contest, and a hangman game. Vocabulary items and multiple-choice questions are also available for self-testing and fun. For instance, the online dictionary allows users to enter a word and find its meaning in English and Chinese; its categories such as noun, verb, adjective, adverb, and so forth; its pronunciation; and sample sentences. Users are provided with the feature of listening to the audio pronunciation of words. The word scramble and hangman games are played between the player and the computing device, while the multiplayer word guessing contest allows multiple users to guess a word puzzle (Chang & Sunkara, 2006).

The crossword puzzle gives the player hints about the word. In turn, the player is required to provide the past tense of the given word. Three aspects are noteworthy about this prototype system: its online word dictionary, vocabulary games, and crossword puzzles facilitate a user's vocabulary acquisition; its interactive games-based learning gives users a chance to test themselves and widen their knowledge in a language; and its digital learning mode makes language learning both challenging and fun (Chang & Sunkara, 2006). Configured on other language combinations (e.g., English-Spanish, English-French, English-Japanese, etc.), this prototype system could yield the same results as its English-Chinese equivalent.

FROM MALL TO PALL

This part provides a short futuristic scenario for m-Learning within the MALL framework. Much as the chapter contends that the m-Learning trajectory is moving from CALL to MALL; it also maintains that within the MALL landscape, there is likely to be a move toward PALL. PALL refers to a mobile computing learning environment in

which a pen and a human finger play an active and dominant role in the process of language learning. The fundamental contention here is that no learning is likely to take place if the pen and the finger are not involved in the learning process in one way or another. This entails instances of switching a given mobile device on or off, scrolling up and down its small screen, touching and pressing its mini keyboard, or tapping its virtual keyboard with the aid of a stylus. Hence, the proposed notion of PALL with its implication that as more MALL evolves, so will its delivery devices be more pen-driven. Thus, it follows that in a pen-powered learning scenario, learners will be called upon to *sift learning and knowledge through their fingers*.

In this regard, LeapFrog has created a pen-powered device called *LeapPad* that uses interactive audio and phonemic awareness to teach young children subjects and skills ranging from English as a second language and special education to mathematics, science, and social studies, while playing action-packed learning games. The device is equipped with an electronic stylus pen that learners can use to discover more information about the text of the *LeapPad* book they are reading. For instance, when the stylus pen is placed on certain words of the book, it allows the learner to hear the words pronounced or hear an individual letter's pronunciation, a sound effect, a phonemic sound, a word definition, and so forth. Launched in a platform series—*LittleTouch LeapPad*, *My First LeapPad*, *Classic LeapPad*, *LeapPad Plus Writing*, and *Quantum LeapPad*—*LeapPad* is currently available in six languages (English, Spanish, French, German, Japanese, and Chinese) (Reuters, 2007).

LeapFrog's *LeapTrack Reading Pro* is a reading intervention product targeting struggling readers in grades 3 and higher grades. This technology is known as *NearTouch* technology because what one touches is what one gets. In the same breath, a *FLY* pentop is able to translate foreign languages, provide spelling prompts, and do mathematical

calculations for users between the ages of 8 and 13. It also allows users to play card games and get real-time audio feedback as they write with a special FLY paper (Reuters, 2007).

A MULTIDIMENSIONAL DEFINITION OF M-LEARNING

A multidimensional definition of m-Learning is necessary if MALL is to become part of the mainstream virtual learning environment. Currently, however, m-Learning seems to suffer from definitional ambiguity. For instance, some of the definitions characterizing it are restrictive, and thus lack clarity and precision since they focus mainly on the usage and functional value of mobile devices employed in m-Learning. On the other hand, other definitions only foreground the teaching and learning benefits associated with such devices. Consequently, most definitions of m-Learning have three focal axes: a device axis; a learning environment and learning experience axis; and a learning functional parameter axis.

Given the points highlighted previously, this chapter envisions m-Learning as both a hybrid and a multimodal delivery approach to learning and teaching mediated through the deployment of various portable and ubiquitous computing devices, some of which are wirelessly connected while others are not. Serving sometimes as pocketable and context-aware handhelds and wearables, these devices include laptops, Pocket PCs, mobile phones, PDAs, iPods, pentops, and games consoles on the one hand, and media files like blogs, wikis, podcasts, RSS feeds (Web 2.0 applications) on the other hand. At times, its various mobile devices can be deployed in conjunction with the PC, the Internet, the Web, and TV so as to facilitate a cross-device and a cross-platform delivery mode. In addition, it can be deployed as part of a blended learning in distance learning, e-Learning, and CALL. In all this, it focuses primarily on mobile learners (from diverse backgrounds, geographies,

and nationalities) displaying varying knowledges and competences and who share multiple virtual mobile classrooms as part of their learning environments. In this sense, m-Learning is part of the emerging m-Education paradigm of which MALL forms a major component. This, then, constitutes an all-encompassing and multidimensional definition of m-Learning, which, it is believed, will help leverage the latter's mainstreaming into a worldwide virtual learning.

FUTURE MALL TRENDS

MALL has the potential to enhance and transform the language learning landscape. Key future and emerging trends likely to drive this transformation are the following: portable and pervasive language learning, personalized context-aware language learning, blended language learning, personal and social language learning, and language learning through gaming and edutainment (education plus entertainment).

Portable and pervasive language learning is a trend related to learning and acquiring language through wirelessly and ubiquitously connected mobile devices such as Pocket PCs, mobile phones, PDAs, and pentops. It is a 24/7 MALL environment that allows learners (as workers, managers, shoppers, travelers, or tourists) to learn various aspects of language wherever they are. This trend dovetails with another related trend: digitization and miniaturization. The former refers to converting data (e.g., text, pictures, images, etc.) into digital forms and conventional devices into digital devices. Coupled with this is a digital m-Learning, which in this context is about the ever mobile ready digital learners (digital migrants) whose desire is to have multiple literacies (both technocomputer and digital literacies related to working with mobile devices and language related literacies such as listening, reading, speaking, and writing). The latter refers to both portable digital devices that become smaller in design

and size in comparison to their earlier versions, and miniature devices that can be embedded in existing ones so as to enhance their functionality and capabilities.

Personalized context-aware language learning is leveraged by context-aware mobile computing devices that enable language learning to be customized to the specific needs and goals of learners as determined by the environments in which learners are embedded. It offers learners situated and *just-in-time* flexible MALL at the right time and at the right place (Ogata & Yano, 2004). Another emerging MALL trend is blended language learning, which involves learning language through deploying mobile devices in tandem with the PC, the Internet, the Web, Internet protocol television (IPTV), voice-over Internet protocol (VoIP), or Web 2.0 applications such as blogs, wikis, podcasts, and RSS so as to synergize them. Closely related to blending mobile devices with these Web 2.0 applications is personal and social language learning. Personal language learning is about individual learners generating or writing their individual content (e.g., personal language blogs or podcasts) on their own, while social language learning has to do with individual or collective language learners creating and sharing their content with two or more other language learners. This latter instance involves collaborative authoring and production of language content and has the potential for learners to learn and acquire language from one another—a phenomenon regarded as collective intelligence or wisdom. The last MALL trend is the one about learning language through mobile games and entertainment such as mobile movies and simulated role-playing. All this has the element of mobile gaming and edutainment.

CONCLUSION

This chapter has discussed specified instances of portable handheld language learning and designated ubiquitous handheld MALL devices mediating such language learning. Key among such devices are Pocket PCs, mobile phones, PDAs, iPods, Nintendo DS, PSP (the last two being handheld game consoles), and a *Java 2 Platform, Micro Edition* (J2ME) application. The chapter has first characterized CALL in terms of its three evolutionary phases and the specific technologies employed for facilitating language learning in each phase. For instance, it has pointed out that mainframe CALL technologies adopted a behaviorist approach to language learning, while PC and multimedia networked computer technologies were informed by cognitivist/constructivist and integrated approaches to language learning, respectively. In addition, it has outlined some of the distinctive features of e-Learning, thereby arguing that CALL forms part of traditional e-Learning modality. Moreover, it has highlighted and presented several case studies in which MALL devices cited previously are leveraged in varying MALL contexts for second and foreign language learning purposes. For example, such devices can facilitate the learning of languages ranging from English, Spanish, French, Italian, Danish, Norwegian, and Ojibwe to Japanese, Chinese, and Tagalog (Filipino). This language learning process relates to both young and adult learners from elementary school phases to university levels. Included here are other subjects such as literature and science whose learning through some of these MALL devices has positive spin-offs for language learning. Furthermore, in the case of PALL, the chapter has outlined the prospects both LeapPads and FLY pentops have for language learning. Most importantly, the chapter has delineated an encompassing and multidimensional definition of m-Learning intended to help leverage MALL's mainstreaming into a worldwide virtual learning. Finally, it has sketched possible future MALL trends.

REFERENCES

Boyer, B. (2007). *Kyoto introduces DS English training to classrooms.* Retrieved August 22, 2007, from http://www.seriousgamessource.com/item.php?story=14043

Brauer, D.C., & Tung, T. (2005). *Case study and demonstration: NEARStar English as a second language.* Retrieved February 23, 2007, from http://unesdoc.unesco.org/images/0014/001436/143684e.pdf

Brown, E. (Ed.). (2001). Mobile learning explorations at the Stanford Learning Lab. *Speaking of Computers*, *55.* Retrieved November 18, 2006, from http://sll.stanford.edu/projects/tomprof/newtomprof/postings/289.html

Chang, C-C., & Sunkara, S. (2006). *An English-Chinese learning system using J2ME and Java servlets.* Retrieved August 07, 2007, from http://ww1.ucmss.com/books/LFS/CSREA2006/EEE4479.pdf

Chinnery, G.M. (2006). Emerging technologies: Going to the MALL: Mobile assisted language learning. *Language Learning & Technology*, *10*(1), 9–16. Retrieved February 22, 2007, from http://llt.msu.edu/vol10num1/pdf/emerging.pdf

Davies, G., & Walker, R. (1999-2007). *ICT4LT. Module 1.4: Introduction to computer assisted language learning (CALL).* Retrieved February 15, 2007, from http://www.ict4lt.org/en/index.html

Dumbleton, T. (2007). Games to entertain or games to teach? *Emerging Technologies for Learning*, *2*, 55–63. Retrieved August 08, 2007, from http://partners.becta.org.uk/page_documents/research/emerging_technologies07_chapters.pdf

Gilgen, R. (2005). Holding the world in your own hand: Creating a mobile language learning environment. *EDUCAUSE Quarterly*, *3*, 30–39. Retrieved February 22, 2007, from http://www.educause.edu/ir/library/pdf/ELI02B.pdf

Houser, C., Thornton, P., & Kluge, D. (2002). Mobile learning: Cell phones and PDAs for education. *Proceedings of the International Conference on Computers in Education.* Retrieved February 23, 2007, from http://csdl2.computer.org/comp/proceedings/icce/2002/1509/00/15091149

Intel Centrino Mobile Technology. (2006). *Learning goes mobile: Crescent girls' school unwires secondary education with pervasive mobile computing.* Retrieved February 22, 2007, from http://www.intel.com/business/casestudies/crescent.pdf

Kern, R., & Warschauer, M (2000). *Introduction: Theory and practice of network-based language teaching.* Retrieved March 19, 2007, from http://www.gse.uci.edu/faculty/markw/nblt-intro.html

Kiernan, P.J., & Aizawa, K. (2004). Cell phones in task based learning: Are cell phones useful language learning tools? *ReCALL*, *16*(1), 71–84.

Krotoski, A., Ellis, H., Heppell, S., Kirriermuir, J., & McFarlane, A. (2006). *Unlimited learning: Computer and video games in the learning landscape.* Retrieved August 08, 2007, from http://www.elspa.com/assets/files/0/20070308110513566_359.pdf

Levy, M., & Kennedy, C. (2005). Learning Italian via SMS. In A. Kukulska-Hulme, & J. Traxler, (Eds.), *Mobile learning: A handbook for educators and trainers* (pp. 76–83). London: Taylor and Francis.

Ogata, H., & Yano, Y. (2004). Knowledge awareness for a computer-assisted language learning using handhelds. *Intl. J. Cont. Engineering Education and Lifelong Learning*, *14*(4/5), 435–449.

Reuters. (2007). LeapFrog Enterprises Inc LF (NYSE). Retrieved August 24, 2007, from http://stocks.us.reuters.com/stocks/fullDescription.asp?rpc=66&symbol=LF

Savvas, S., Sotirou, S., Malliou, E., & Agogi, E. (2003). Mlearning—Mobile learning applica-

tions in language learning and history education. *Learning Technology*, *5*(2). Retrieved February 23, 2007, from http://lttf.ieee.org/learn_tech/

Swan, K., van't Hooft, M., Kratcoski, A., & Unger, D. (2005). Uses and effects of mobile computing devices in K-8 classrooms. *Journal of Research on Technology in Education*, *38*(1), 99–112. Retrieved March 09, 2007, from http://www.kentoedu/rcet/Publications/upload/jrte-38-1-009-swa.pdf

Thomas, M. (2006). *iPod education: Innovations in the implementation of mobile learning.* Retrieved February 22, 2007, from http://kt.flexiblelearning.net.au/wp-content/uploads/2006/08/thomas.pdf

Thorne, S.L., & Payne, J.S. (2005). Evolutionary trajectories, Internet-mediated expression, and language education. *CALICO Journal*, *22*(3), 371–397. Retrieved March 27, 2007, from http://php.scripts.psu.edu/jsp17/articles/calico2005/Thorn_Payne_2005.pdf

Thornton, P., & Houser, C. (2003). Using mobile Web and video phones in English language teaching: Projects with Japanese college students. In B. Morrison, C. Green, & G. Motteram (Eds.), *Directions in CALL: Experience, experiments, & evaluation* (pp. 207–224). Hong Kong: Hong Kong Polytechnic University.

Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, *21*, 217–228.

Warschauer, M. (1996). Computer-assisted language learning: An introduction. In S. Fotos (Ed.), *Multimedia language teaching* (pp. 3–20). Tokyo: Logos International.

Warschauer, M., & Healy, D. (1998). Computers and language learning: An overview. *Language Teaching, 31*, 57-71. Retrieved March 14, 2007, from http://www.gse.uci.edu/faculty/markw/overview.html

Wong, C.C., Sellan, R., & Lee, L.Y. (2006). *Assessment using mobile phone—An exploratory study.* Retrieved August 10, 2007, from http://www.iaea2006.seab.gov.sg/Conference/download/papers/Assessment%20using%20mobile%20phone%20-%20An%20exploratory%20study.pdf

KEY TERMS

FLY Pentop Computer: A FLY is a pen-driven computer manufactured by LeapFrog Enterprises Inc. It is fitted with a battery, a computer brain, a software cartridge, a loudspeaker, and a headphone, and uses FLY paper.

High-Meaning Words: According to the NEARStar program, high-meaning words are concrete, image-rich, high-interest words such as *mommy*, *daddy*, *cookie*, *juice*, or names of siblings, favorite toys, or familiar concepts. *High-frequency words* are a small number of words (the 100 most frequently used words) in the English language (e.g., *of*/*for*/*from*; *was*/*saw*; *on*/*no*; *there*/*then*/*them*/*their*; and *when*/*where*/*what*/*with*) (http://coe.west.asu.edu/students/wduzan/new_one/hfw1.htm). *Phonetically regular words* are words with one-to-one letter-sound correspondences such as /*bat*/; /*cat*/; /*fat*/; /*pat*/; /*sat*/; and so forth, that mostly display a regular consonant-vowel-consonant (CVC) combination. *Critical word factor* (*CWF*) is an index of the number of new unique words per 100 running words of text falling outside a designated group of high frequency and phonetically regular words.

Java 2 Platform, Micro Edition: A technology using Java tools and programming language to develop programs for use on mobile devices such as mobile phones and PDAs.

LeapPa: LeapFrog's family of platforms (e.g., *LittleTouch LeapPad*, *My First LeapPad*, *Classic LeapPad*, *LeapPad Plus Writing*, and *Quantum LeapPad*) consisting of audio software cartridges and corresponding interactive books.

Multi-User-Domains Object Oriented (MOOs): Virtual worlds designed for language learning.

Multi-User Dungeons (MUDs): Types of real-time Internet conferences enabling users to send e-mails or to manipulate objects in an imaginary world.

Nintendo DS: Nintendo's (Japanese manufacturer) dual-screen handheld game console featuring touch screen and microphone controls.

Personal Digital Assistants (PDAs): Small hybrid devices that combine a variety of computing functions such as a data organizer, a fax transmitter, e-mail, and a Web browser.

PlayStation Portable (PSP): Sony's portable game console.

Really Simple Syndication (RSS): A method for distributing news headlines, alerts, reminders, or other related Web content that are available for *feeding* from an online publisher to Web users.

Wikis: Special Web pages that can be immediately edited by any Web reader. A typical example is *Wikipedia*, a vast, multilingual encyclopaedia written, edited, and updated by any reader.