

A review of technology choice for teaching language skills and areas in the CALL literature

GLENN STOCKWELL

*Waseda University, 1-6-1 Nishi-waseda Shinjuku-ku, Tokyo, Japan
(email: gstock@waseda.jp)*

Abstract

The use of technology in language teaching and learning has been the focus of a number of recent research review studies, including developments in technology and CALL research (Zhao, 2003), CALL as an academic discipline (Debski, 2003), ICT effectiveness (Felix, 2005), and subject characteristics in CALL research (Hubbard, 2005), to name a few. Such studies have contributed to clarifying how language learning technologies have been investigated, but questions remain regarding how these technologies have been used in achieving learning objectives. In other words, what technologies do CALL practitioners select for the teaching of a certain language skill or area such as listening, grammar or pronunciation? Are the decisions to use these technologies made on pedagogical grounds, or alternatively, are there other aspects that are more instrumental in influencing what is used in the language classroom? The purpose of this study is to review the literature to examine what technologies are used in the teaching of the language skills and areas. All empirical research articles appearing in four major English-language journals in the field of CALL (CALICO Journal, CALL, Language Learning & Technology, and ReCALL) from 2001 to 2005 were examined and the results collated to determine (1) what types of technologies are being used in the teaching of specific language skills and areas, (2) whether researchers had a clear idea in mind regarding their choice of technology or technologies in relation to their learning objectives, and (3) whether the researchers attempted to capitalise upon the features inherent in the technology or technologies as opposed to traditional, non-CALL means. The paper concludes with a discussion of the relationship between technology and pedagogical goals.

Keywords: CALL, Language Skills, Language Areas, Pedagogy

1 CALL as a research field

CALL as a research field has received considerable attention over the past few years, and a number of studies have attempted to identify the characteristics and limitations of research taking place in the field. These meta-analyses have contributed much to our

understanding of CALL research, and are invaluable in highlighting problems and shaping future work in the field. They have varied considerably in their objectives and their scope. Levy (2000), for example, analysed 47 CALL research articles in books and journals published in 1999, aiming to define a framework for the description and analysis of CALL research in terms of identifying the goals of CALL researchers and clarifying the unique features and problems of CALL research. In another study, Zhao (2003) examined 156 peer-reviewed articles from 1997 to 2001 located through ERIC using *FirstSearch* with the keywords “Computer Assisted Language Learning” and “second language”, and found that the number of well-designed experimental studies was very limited, that the majority of studies were about college students, that the languages studied were almost exclusively French, Spanish, English, German and Arabic, and that most studies looked at single applications rather than integrated systems. In the same year, Debski (2003) investigated the state of CALL as an academic discipline, specifically looking at changes in CALL research output and its characteristics such as theoretical foundation, method of evidence gathering, and reporting standards. Based on a numerical analysis of 91 research articles published in 1980–2000 in seven English language journals, he found that although data-gathering methods have become more diverse, the increased confidence in research shown by generalisation of findings was not matched by proper attention to research credibility issues.

Other studies have sought to investigate individual characteristics of research into CALL. For example, based on a review of 78 articles from four CALL-oriented journals from 2000 to 2003 on the details of subject characteristics in CALL, Hubbard (2005) concluded that researchers commonly leave out or fail to gather relevant data about subjects, and that most of what we know about CALL is likely to be based on studies of untrained, novice users. In an analysis of papers from 2000 to 2004, Felix (2005) found that some common problems in CALL effectiveness research include misleading titles, poor description of the research designs, failure to investigate previous research, poor choice of variables to be investigated, and over-ambitious reporting of results.

These studies of CALL research have greatly furthered our understanding of CALL as a research field, but what do we know about CALL as a technological field? This leads us to ask questions such as, “How important is technology in CALL?”, and “How dependent are we on developments in technology in our design and implementation of language learning activities?” In order to answer these questions, we need to consider the nature of the technologies that are used in CALL and how decisions are reached regarding the use of these technologies, which is the primary focus of this paper.

2 CALL as a technological field

A brief inspection of the types of technologies that are appearing in CALL research reveals that it is indeed a highly technical field. Some such technologies¹ and related concepts include the following:

- Interface design and authoring technologies

1. Technologies in the context of this article refers to both hardware and software

- Data management, access and portability
- Artificial intelligence and tutoring systems
- Automatic speech recognition technologies
- Natural language processing technologies
- Speech synthesis technologies
- Learner profiling systems
- Cognitive agent systems, etc.

To this list, we might also add mobile technologies and new communication technologies, and the range and applications of these new technologies continue to grow rapidly. It is easy to lose track of developments in technology in CALL, and how these technologies fit into the CALL classroom. People new to the field may find it very daunting when confronted with the ever-growing list of technologies available to them, and decisions regarding appropriate technology choice are complex.

The reasons for choosing a particular technology are probably as varied as the range of technologies themselves, but some of the main reasons may include the following:

- Pedagogical objectives
- Institutional decisions
- Personal curiosity
- Trends and fashions

Choosing technology on the grounds of pedagogical objectives means that a particular technology is selected due to specific enabling features of the technology. For example, existing technologies such as MP3 players might be considered as being more suited to listening, and hence the decision to choose MP3 players may be made on the grounds that the technology has the ability to facilitate acquisition or improvement of listening skills. Alternatively, through experience in the classroom, teachers may identify a need to develop a particular application for use in a given environment to achieve specific pedagogical goals, and develop this either by themselves or as part of a development team. Often, however, decisions about the technologies that are used are beyond the control of the teachers in the classroom, who are required to keep in line with institutional decisions. Institutions make decisions about implementing technology in general or a particular technology, such as a decision to bring in a course management system such as *WebCT* or *Blackboard*, and expect teaching staff to incorporate these technologies into their courses (see Levy & Stockwell, 2006, for a discussion).

Other reasons for using technology may be more personal. Firstly, CALL practitioners and CALL developers may be motivated to use or develop a particular technology out of curiosity, such as “I wonder if I can...” They may have (or be learning) skills in programming scripts or languages such as JavaScript, PHP, C++, XML and so forth, and begin developing CALL applications initially as a means of testing these programming skills, although this is unlikely to be done without at least some consideration of pedagogical objectives. Secondly, teachers may be influenced by current trends and fashions in technologies from what they see being used by colleagues around them, at conferences or other gatherings, or from what they read about in academic journals and other publications. It is not unknown for CALL practitioners (and non-CALL users who

would like to start to use technology) to see technologies used and not want to get left behind the technological bandwagon, and thus embark on using these technologies without fully considering the implications of such a decision. On the one hand, both of these courses of action have the potential to lead to innovative and effective uses of technology, but on the other hand they may also result in ill-conceived integration of semi-functional technologies that may ultimately interfere with the learning process rather than facilitate it.

In the midst of this growing range of technological options, what do we know about the relationship between the technologies used and the “language learning” side of CALL? After all, we would expect that the objective of teaching our students how to read, write, listen and/or speak in the target language would be at the core of design, development and implementation of these technologies. Thus, the purpose of the current study is to shed light on the relationship between technologies used in CALL and language learning skills. The following research questions were posed in order to achieve this:

1. What types of technologies are being used in the teaching of specific language skills and areas?
2. Do CALL researchers appear to have a clear idea in mind regarding their choice of technology or technologies in relation to students’ learning objectives?
3. Do CALL researchers capitalise upon the features inherent in the technology or technologies as opposed to traditional, non-CALL means?

The methodology adopted for the study is described forthwith.

3 Method

All articles from 2001 through to 2005 from four of the major English language journals in the field of CALL were examined, including the *CALICO Journal*, the *CALL Journal*, *Language Learning & Technology*, and *ReCALL*. The analysis included all empirical articles and forums, but commentaries and software reviews were excluded. For the purpose of this study, the word “empirical” was used only to refer to studies where data were collected pertaining to learners, learning outcomes or the learning process. Empirical studies were selected as examples of technologies that had actually been used and tested with students, as shown in the literature. Although there were a number of empirical studies that described teacher education or projects, these were not included in the analysis. There were several very interesting and informative articles about technologies that were being developed, or where a model was given for technologies that would be ideal to develop, but this study was limited to investigating technologies as they currently exist in language courses, rather than future possibilities. This does not in any way preclude the quality of the development or the significance of the non-empirical studies.

As shown in Table 1, the number of empirical articles comprised approximately half of the total number of articles, which is consistent with earlier studies such as Zhao (2003). The analysis of the current study was carried out on the 206 articles which were identified as being empirical according to the definition above, and took three main parts, which are outlined below.

Table 1 *Number of empirical articles in all four journals according to year*

	2001	2002	2003	2004	2005	Total
Empirical articles	38	35	41	50	42	206
Total articles	79	85	75	89	76	404
Percentage of total	48.1	41.1	54.6	56.1	55.2	51.0

3.1 Selection of technologies for language skills

All articles were categorised according to what technologies were used, and the language skills (reading, writing, listening and speaking) and language areas (pronunciation, vocabulary and grammar) on which the technology focussed were identified. The study did not include areas such as culture or learning strategies in an attempt to reduce the scope. This information was then tabulated according to which technologies were used in teaching which language skill(s) or area(s). There were several cases where a technology was used in the teaching of more than one skill or area, in which case the same technology was listed in each skill or area indicated in the study.

3.2 Choice of technology for learning objectives

The articles were examined to determine whether the reason the technology was selected/developed for specific learning objectives was clearly stated. If there was a clear rationale, or if it was clear from the article as to why the technology was adopted, it was categorised as “yes”, but if it was not clear from the article, it was categorised as “no”.

3.3 Features of the technology used in achieving learning objectives

Articles were examined to see whether it was clear that the features of the technology were used in attempting to achieve the learning objectives, as opposed to maintaining a peripheral role. As above, if the article indicated that the technology was used in a way that capitalised on the features specific to the technology, it was categorised as “yes”, but if the technology appeared to be used in a way that merely emulated non-technological means without using the added functionality of the technology, it was categorised as “no”.

Ratings were based on what was written within the articles themselves, and although the authors' reasons for choosing a particular technology and how this was used may have been clear to them, there were cases where this was not made clear in the article. Due to the subjective nature of many of the judgments, ten per cent of articles were rated independently to confirm reliability of the study. The results were compared using Pearson product-moment correlation coefficient measures of reliability, yielding a reliability figure of $r = .88$. The results are described in the following section.

4 Results and discussion

There was significant variation in the attention given to the various language skills and areas in the literature examined in the current study. As shown in Figure 1, grammar was the most commonly investigated, followed by vocabulary, and then pronunciation, reading, writing (each of which had the same number of articles), listening, and finally, speaking. Empirical studies into grammar and vocabulary alone outnumbered the total of the remaining categories, indicating a tendency to focus on these two language areas. The next section describes the technologies which were used in teaching these language skills and areas, and are ordered according to the rankings in Figure 1. Examples of how the technologies were used in teaching the specific language skills or areas are included.

4.1 Grammar

Studies focussing on grammar generally consisted of the teaching of new grammatical expressions or on the improvement of syntactic accuracy or complexity, and were varied in their range and scope. A number of studies incorporated online activities, using authoring software such as *Hot Potatoes* (e.g., Allum, 2002), and normally consisted of simple grammatical explanations and manipulation activities. Other studies investigated the use of open source (free) or commercial courseware applications, such as a study by Jamieson, Chapelle and Preiss (2004) who investigated the use of *Longman English Online* with adult ESL learners. Many researchers chose to develop their own courseware applications, and these were also varied in their form and functionality. Shaalan (2005), for example, created an Intelligent Language Tutoring System (ILTS) for learners of Arabic which was designed to provide feedback on grammatical errors using Natural Language Processing (NLP). Similarly, Chen and Tokuda (2003) developed a system entitled *Azalea* for use with Japanese learners in an ESL composition course. Concordancing was also used in teaching grammar, such as a study of Taiwanese learners of English by Sun and Wang (2001), who used a concordancer to assist in learning collocations. Finally, there were also studies that investigated the use of CMC technologies in the teaching of grammar, such as that by Van Deusen-Scholl, Frei and Dixon (2005) who used chat as a means of improving grammatical accuracy in learners of German.

4.2 Vocabulary

Vocabulary learning attracted a wide range of studies, with a large variation in their approaches and methods. There was a particularly large number of studies concerned with self-developed courseware, which included presentation of vocabulary with different annotation styles (links for textual meaning, audio, graphics, etc) (e.g., Yeh & Wang, 2003), intelligent language tutoring systems that included sophisticated feedback systems (e.g., Heift, 2001), or hypermedia-enhanced learning environments (e.g., Coll, 2002). Online activities were used widely in vocabulary learning as well, such as Lister and Smith (2001) who used, among other tools, an online vocabulary tester program for learners of Latin. Electronic dictionaries also featured in the literature on vocabulary learning and took various forms, such as portable electronic dictionaries, software-based

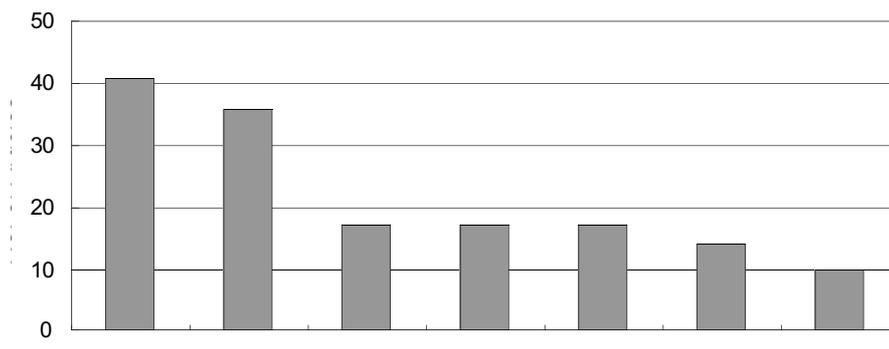


Fig. 1. Language skills and areas focused on in empirical articles 2001–2005.
(The total number of articles does not total 206 due to the fact that empirical studies that covered culture and other areas are not included in this figure.)

dictionaries, online dictionary websites (see Loucky, 2002, for a discussion).

Some researchers, for example Horst, Cobb and Nicolae (2005) used existing free tools such as the suite of tools available from *www.lexutor.ca* including a concordancer, a dictionary, cloze-builder and a database with an interactive self-quizzing feature in order to foster retention by engaging learners in deep processing for vocabulary learning. Others used commercial software such as *Compleat Lexical Tutor* (e.g., Dodigovic, 2005), a free website with tools for English and French such as a concordancer, vocabulary profiler, exercise maker and interactive exercises. Some researchers described how Computer Mediated Communication (CMC) technologies provided conditions amenable to vocabulary, such as Toyoda and Harrison (2002), who claimed that learners of Japanese engaged in chat with native speakers through a graphic MOO exhibited instances of negotiation of meaning of vocabulary during the interactions. Mobile phones also featured as a means of learning vocabulary, for example, a study by Kiernan and Aizawa (2004) who showed that learners acquired vocabulary both through speaking on mobile phones and by using mobile phone email.

4.3 Pronunciation

Courseware² was the most commonly used technology in the teaching of pronunciation, and this predominantly consisted of self-developed applications. Menzel, Herron, Morton, Pezzotta, Bonaventura and Howarth (2001) developed a system using visual representations and feedback for learners of English in Italy and Germany. Hew and Ohki (2004) created a system providing animated graphic annotations for learners of Japanese, while Machovikov, Stolyarov, Chernov, Sinclair and Machovikova (2002) designed a system for learners of Russian using Automatic Speech Recognition (ASR). Online activities also featured in the literature into pronunciation such as a study by Weinberg and Knoerr (2003), who compared audiocassettes and multimedia for learning French pronunciation. Other studies included CMC-based activities, such as a project by

2. Please refer to the definition of courseware given in section 4.9

Volle (2005), where students of Spanish in an online course created voiced audio emails of read-aloud passages and grammar-drill completions each week during the semester, and a study into videos and multimedia-based vocabulary tasks that were used to also promote improvement of pronunciation (Sun & Dong, 2004).

4.4 Reading

A number of studies into reading also focussed on courseware, both self-developed and commercial. Ercetin (2003), for example, developed a system for learners of English using *Macromedia Director* with both textual and contextual annotations, while Pujolà (2001) designed a system called *ImPRESSions* for Spanish learners of English which incorporated a complex feedback system. Commercial courseware examined consisted of *NetLearn* (Chun, 2001), an online reading program for English learners (www.netlearn.us), and *Antidote* (see Burston, 2001), which was developed by *Druide Informatique* for learning French and includes a grammar checker, a dictionary, synonyms, and a conjugator. Other examples of technologies used for reading included Gruber-Miller and Benton's (2001) study of MOOs with learners of Latin, and Chenoweth and Murday's (2003) study of online activities for learning French.

4.5 Writing

Writing was another skill that attracted a wide range of technologies, ranging from online activities (e.g., Lee, 2005), corpora and concordancing (e.g., Chambers & O'Sullivan, 2004; Kaur & Hegelheimer, 2005), word processors (e.g., Biesenbach-Lucas & Weasenforth, 2001), online dictionaries (e.g., Kaur & Hegelheimer, 2005), and screen capture software (e.g., Glendinning & Howard, 2003). There were also examples of self-developed courseware applications such as the package created by Goodfellow, Lamy and Jones (2002), which provided automatic feedback for learners of French, and the translation commentary helper for Chinese learners of English, designed by Shei (2005). CMC technologies also featured in the literature for writing, such as Greenfield's (2003) study of ESL learners in Hong Kong exchanging emails with native speakers in the United States.

4.6 Listening

The majority of studies in listening were of self-developed courseware, and these took a number of different forms, such as a system by Weinberg (2002) for learners of French that included sound, video, pictures, glossaries, dictionaries and a record keeping system, Gorsuch's (2004) computer adaptive testing system for ESL learners, and Jones's (2003) system developed in *Authorware* which provided both visual and verbal annotations. Another technology that was used for listening was videotext by Gruba (2004), who described a study of learners of Japanese providing a series of immediately retrospective verbal reports on authentic Japanese news broadcasts as they attended to a front-to-back viewing of videotexts.

Table 2 *Language skills and areas focused on in empirical articles*

Skill	Technologies Used
Grammar	<ol style="list-style-type: none"> 1. Online Activities 2. Courseware (Commercial/Freeware) 3. Courseware (Self- Developed) 4. Corpora & Concordancing 5. CMC Technologies – Chat, MOO, Email, Audioconferencing
Vocabulary	<ol style="list-style-type: none"> 1. Courseware (Self- Developed) 2. Online Activities 3. Dictionaries 4. Courseware (Commercial/Freeware) 5. Corpora & Concordancing 6. CMC Technologies – Chat, MOO, Email, Conferencing
Pronunciation	<ol style="list-style-type: none"> 1. Courseware (Commercial/Freeware) 2. Courseware (Self- Developed) 3. Online Activities 4. CMC Technologies – Chat, Audioconferencing 5. Videos & Multimedia
Reading	<ol style="list-style-type: none"> 1. Courseware (Self- Developed) 2. Online Activities 3. Courseware (Commercial/Freeware) 4. CMC Technologies – Chat, MOO, Email
Writing	<ol style="list-style-type: none"> 1. Online Activities 2. Corpora & Concordancing 3. Courseware (Self- Developed) 4. CMC Technologies – Chat, MOO, Email, BBS 5. Word Processors 6. Dictionaries
Listening	<ol style="list-style-type: none"> 1. Courseware (Self- Developed) 2. Videotext
Speaking	<ol style="list-style-type: none"> 1. CMC Technologies – Chat (Text & Voice), Audioconferencing 2. Corpora & Concordancing 3. Courseware (Commercial/Freeware)

4.7 Speaking

The most commonly used technologies for speaking were CMC technologies, although these took a number of different forms, such as text chat (e.g., Payne & Whitney, 2002), voice chat (e.g., Jepson, 2005), and audio-conferencing (e.g., Lamy, 2004; Volle, 2005) technologies. Voice chat varies from audio-conferencing in that in voice chat, it is possible to record a message and check it first before sending it, whereas with audio-conferencing, the audio is recorded and sent in real time. Other technologies included corpora, which were used by Curado Fuentes (2004), for example, in the teaching of speaking for Business English through learners comparing their output in oral presentations with corpus frequency data, and the software package *Tell Me More* by

Barr, Leakey and Ranchoux (2005), which is a speech recognition software package for language learning developed by *Aurolog*, available in English, Spanish, French, German, Italian and Chinese. Another example of use of technology for speaking was the creation of a website by learners of French (Jeon-Ellis, Debski & Wigglesworth, 2005) who communicated with each other at the computer during the project.

4.8 Technologies used

From the descriptions above, it is very clear that the range of technologies used in the teaching of the language skills and areas is very broad. Table 2 provides a list of the technologies used for each skill and area, ranked according to frequency of use, from the highest at the top to the lowest at the bottom.

Distinctions were made between the term “online activities” and “courseware” in that “online activities” was used when the activities were smaller-scale independent activities rather than part of a larger package, such as those created through *Hot Potatoes* or similar. In contrast, “courseware” was used to describe packages that were more complex involving several stages or components. Courseware also included systems that are available online. The term “self-developed” refers to technology that has been developed as part of a team, sometimes cross-institutionally, and is intended for use by a specified group of students, such as those studying at the institution(s) at which the technology was developed.

Although grouped together here, corpora and concordancing are quite different technologies. A corpus is a database of instances of usage of a language, while a concordancer is a means of viewing the contents of the database in different formats such as Key Word In Context (KWIC). Corpora have several other uses such as providing data for intelligent systems, but as they are very frequently used together, they have been combined for logistical reasons.

Online activities have featured highly in all language skills and areas with the exception of listening and speaking. CMC was used widely in all categories apart from listening, and it is perhaps paradoxical that CMC has been investigated as a tool for speaking yet has not been included in the literature for listening. Self-developed courseware has been used widely in all skills and areas apart from speaking, and such widespread development seems indicative of a desire for CALL practitioners to create language learning tools which are suited to their own environments in the absence of appropriate existing ones.

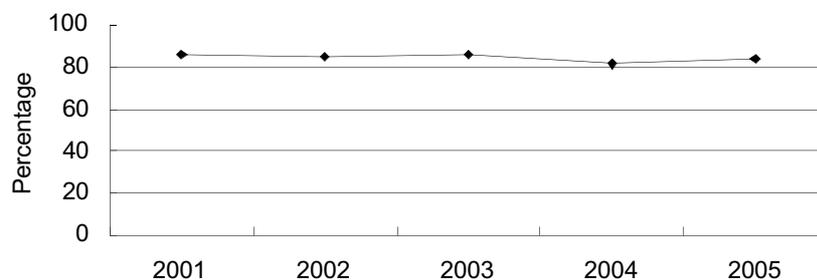


Fig. 2. Percentage of articles where the purpose for using the technology for learning purposes was clear

Table 3 *Language skills and areas focused on in empirical articles*

	2001	2002	2003	2004	2005
Grammar	9	4	10	7	2
Vocabulary	7	7	6	10	6
Pronunciation	2	1	2	7	5
Reading	6	3	3	3	2
Writing	3	1	4	4	5
Listening	2	4	4	4	0
Speaking	1	1	1	2	5

4.9 *Choice of technology for learning objectives*

Figure 2 shows the percentage of articles where the reason for deciding to use the technology or technologies specified in the study was clear. The figure shows that the percentage hovers throughout the 80%-90% range over the five years investigated, with a minor drop in 2004.

While the percentage shown in the figure is quite high, it indicates that there still remains an element of failure to stipulate why a given technology was used in achieving learning objectives. Failure to include this information could be attributed to a lack of clear objectives on the part of the authors, or to the fact that this information was simply not outlined within the paper itself. In light of observations by Levy (2000), Hubbard (2005) and Felix (2005) regarding omission of important information about the research design, one would expect that the latter is more likely, but this is an area of concern for future research in the field.

4.10 *Features of technology used in achieving learning objectives*

This part of the study was aimed at determining whether or not the features inherent in the particular technology used were capitalised on in achieving learning outcomes. That is to say, to see whether the technology was used in a way that could only be done by technology, rather than simply replicating tasks that could be done in essentially the same manner without any loss of functionality through other means. The results are shown in Figure 3.

As with the previous figure, this also showed a very high percentage, sitting a little under the 90% mark across the period investigated. This is a point which deserves some reflection. There have been calls to ensure that we do not simply replicate through technological means what can be done without technology, such as Felix's reminder of the dangers of falling into the trap of replacing "pedagogically sound teaching with inferior online materials" (2003:147). In some learning environments, it may be unavoidable to use certain technologies in place of more conventional means, such as using a computer rather than a DVD player to play a DVD, due to lack of facilities. In saying this, whether mere replacement of simpler technologies with more sophisticated ones without any additional functionality may be considered as CALL, is another matter entirely.

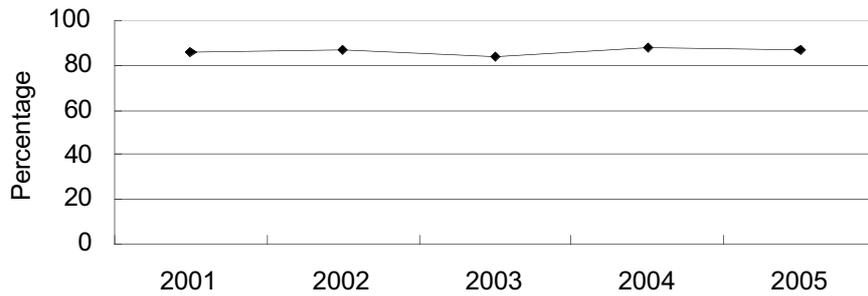


Fig. 3. Percentage of articles where features specific to the technology were used in the learning process

4.11 Skills and technologies

In order to determine trends in the focus on language skills across the five year period investigated, the number of articles focussing on each skill and area per year were counted, and are presented in Table 3. The results show that grammar has received generally consistent attention from 2001 through to 2004, but with a sharp drop in 2005. Vocabulary has also remained relatively constant, but with a peak in 2004. Pronunciation, speaking and writing (to a degree) have shown increases over time, in contrast with reading, which has shown a consistent decrease, and listening, for which there were no empirical articles at all in 2005.

Though speculative, when looking at these changes in focus, it is possible to conjecture that developments in technology may have an effect on the language skills and areas that have appeared in the CALL research. This becomes apparent when investigating which technologies have been used in teaching these skills in the literature. The increase in writing and pronunciation, for example, is possibly a result of an increased accessibility to AI technologies such as language parsing and automatic speech recognition (ASR) technologies, some of which are now available without charge. Similarly, the increase in speaking is likely in part due to development of SCMC technologies such as chat and audioconferencing, and of ASR technologies. Vocabulary, which has remained relatively stable throughout the period investigated, has, however, undergone an evolution in methods, moving from simpler client-side interactive (e.g., *Hot Potatoes*) to more complex AI-based systems. The reasons for the decreases in grammar, listening and reading are not clear, but it is feasible that there is some influence from the development of good quality commercial products (at least as far as grammar and reading are concerned), and by the shift towards speaking. It is also possible that special issues of journals might account for a single high year (such as the special issue in the *CALICO Journal* on CMC in 2005), but there were no special issues during the period studied that looked specifically at one of the language skills or areas described in this study.

5 Conclusions and final comments

This study is not without limitation. Two main points that initially arise are that only English language journals were examined, which excludes work in other languages, and

that there is also a body of very good work in the field which appears in other publications. The study is intended as a cross-section of the work done in CALL and of course cannot include everything that has been done. This problem is compounded when considering that only a small proportion of activity in the classroom actually appears in academic journals. Nonetheless, the study does aim to provide some indication of the issues associated with technology use in the field of CALL, and to that end such a cross-section such as this can be useful.

The results show that there is great variety in the technologies that are used in learning each of the language skills and areas in the sample of studies examined. As described above, there are changes over time in the skills focussed on, and changes in the technologies used. There is a small proportion of studies where the reasons for using the specified technology are not evident, as well as a small number of studies where the features specific to the technology do not appear to be used, both of which are issues of some concern. As Levy (2000:190) argues, "...for the CALL researcher, the technology always makes a difference..." and as such it is essential to have a clear idea in mind as to why a particular technology is used, and then to ensure that it is used in a way that justifies its adoption. The study does give rise to a number of other issues regarding technology use in the language classroom which deserve comment; these issues are outlined below.

5.1 Sharing content and sharing applications

With the wide spread of self-developed courseware developed across a range of language skills and areas, one cannot help but wonder how much more efficient we might be if we started to pool our efforts together. Evidence has been seen of this with regard to content (e.g., Cushion, 2004; Ward, 2002), and the possibilities are certainly there for sharing applications as well. This is seen to a degree in the open source Course Management System *Moodle*, but there is very little evidence of such collaboration occurring in more specialised dedicated courseware for specific language learning objectives. While of course academics who are involved in development possess to some degree a sense of ownership over materials and applications that they develop, CALL as a field would benefit greatly from collaboration at both the content and the application level. This is not to say that sharing applications is without logistical difficulties. Many languages have features that are specific to them which would mean that completely generic shared applications would be difficult to create, and care would need to be taken to ensure that enough flexibility was included to allow for add-ons to deal with problems this might cause.

5.2 CALL as a technology-centred discipline?

The relationship between technology and pedagogy is complex, and has been the topic of much discussion, really since the inception of CALL. There has been argument advocating the importance of a pedagogical focus, as is echoed by those who hold to the view that good pedagogy is not dependent upon technology (Felix, 2003), and that technology choice is a natural outcome from solid pedagogical design (Colpaert, 2006). While pedagogy is of course an essential element in CALL, the importance of the role

of the technology cannot be discounted. The relationship between pedagogy and technology may be seen as “the chicken or the egg?” where the emergence of new technologies gives rise to new possibilities in pedagogy, and pedagogical ideas give rise to new developments in technology. Internet-based communication technologies, for example, have given rise to new pedagogies utilising CMC that were not conceivable prior to these technologies, in that learners have instant access to a text-based “script” of the chat conversation they conducted with native speakers on the other side of the world for review or correction. It was obviously not a pedagogical need which resulted in the development of technologies such as chat, but rather, the technology may be thought to have contributed to the development of new pedagogies. Many pedagogies exist as a result of technology, and many technologies exist as a result of pedagogies. It is perhaps, then, accurate to describe the relationship between technology and pedagogy as a *symbiotic* one, where they are mutually dependent upon each other, potentially to their benefit, but also potentially to their detriment. Complicating the situation further is the fact that it is also natural for technologies to evolve, and such evolution brings with it changes in expectations of teachers and learners alike. Many technologies that were once seen as new and exciting, are now often seen as boring and outdated, and thus it is not surprising that learners who are aware of technological developments look for these developments to be reflected in the technology used in the language classroom.

In conclusion, it could be said that one of the most important responsibilities for those teachers who make the decision to use technology as a part of their language learning environments is to ensure that they are familiar with the technological options available and their suitability to particular learning goals, and to then implement these technologies capitalising on their specific features. This is a necessary balance, but one that is difficult to achieve, in that on the one hand it requires teachers to keep aware of and abreast of new technological developments, while on the other hand keeping a focus on learning goals, and how the technologies relate to them.

References

- Allum, P. (2002) CALL and the classroom: The case for comparative research. *ReCALL*, **14**(1): 146–166.
- Ariew, R. and Ercetin, G. (2004) Exploring the potential of hypermedia annotations for second language reading. *Computer Assisted Language Learning*, **17**(2): 237–259.
- Barr, D., Leakey, J. and Ranchoux, A. (2005) Told like it is! An evaluation of an integrated oral development pilot project. *Language Learning & Technology*, **9**(3): 55–78.
- Biesenbach-Lucas, S. and Weasenforth, D. (2001) E-mail and word processing in the ESL classroom: How the medium affects the message. *Language Learning & Technology*, **5**(1): 135–165.
- Brett, D. (2004) Computer generated feedback on vowel production by learners of English as a second language. *ReCALL*, **16**(1): 103–113.
- Burston, J. (2003) Exploiting the potential of a computer-based grammar checker in conjunction with self-monitoring strategies with advanced level students of French. *CALICO Journal*, **18**(3): 499–515.
- Chambers, A. and O'Sullivan, I. (2004) Corpus consultation and advanced learners' writing skills in French. *ReCALL*, **16**(1): 158–172.
- Chen, L. and Tokuda, N. (2003) A new template-enhanced ICALL system for a second language composition course. *CALICO Journal*, **20**(3): 561–578.
- Chenoweth, N. A. and Murday, K. (2003) Measuring student learning in an online French course. *CALICO Journal*, **20**(2): 285–314.
- Chun, D. (2001) L2 reading on the web: Strategies for accessing information in hypermedia.

- Computer Assisted Language Learning*, **14**(5): 367–403.
- Coll, J. F. (2002) Richness of semantic encoding in a hypermedia-assisted instructional environment for ESP: Effects on incidental vocabulary retention among learners with low ability in the target language. *ReCALL*, **14**(2): 263–282.
- Colpaert, J. (2006) Pedagogy-driven design for online language teaching and learning. *CALICO Journal*, **23**(3): 477–497.
- Curado Fuentes, A. (2004) The use of corpora and IT in evaluating oral task competence for tourism English. *CALICO Journal*, **22**(1): 5–24.
- Cushion, S. (2004) Increasing accessibility by pooling digital resources. *ReCALL*, **16**(1): 41–50.
- Debski, R. (2003) Analysis of research in CALL (1980-2000) with a reflection on CALL as an academic discipline. *ReCALL*, **15**(2): 177–188.
- Dodigovic, M. (2005) Vocabulary profiling with electronic corpora: A case study in computer assisted needs analysis. *Computer Assisted Language Learning*, **18**(5): 443–455.
- Ercetin, G. (2003) Exploring ESL learners' use of hypermedia reading glosses. *CALICO Journal*, **20**(2): 261–283
- Felix, U. (2003) Pedagogy on the line: Identifying and closing the missing links. In: Felix, U. (ed.), *Language learning online: Towards best practice*. Lisse: Swets & Zeitlinger, 147–170.
- Felix, U. (2005) Analysing recent CALL effectiveness research? Towards a common agenda. *Computer Assisted Language Learning*, **18**(1–2): 1–32.
- Glendinning, E. and Howard, R. (2003) Lotus ScreenCam as an aid to investigating student writing. *Computer Assisted Language Learning*, **16**(1): 31–46.
- Goodfellow, R., Lamy, M.-N. and Jones, G. (2002) Assessing learners' writing using lexical frequency. *ReCALL*, **14**(1): 133–145.
- Gorsuch, G. (2004) Test takers' experiences with computer-administered listening comprehension tests: Interviewing for qualitative explorations of test validity. *CALICO Journal*, **21**(2): 339–371.
- Greenfield, R. (2003) Collaborative e-mail exchange for teaching secondary ESL: A case study in Hong Kong. *Language Learning & Technology*, **7**(1): 46–70.
- Gruba, P. (2004) Understanding digitized second language videotext. *Computer Assisted Language Learning*, **17**(1): 51–82.
- Gruber-Miller, J. and Benton, C. (2001) How do you say "MOO" in Latin? Assessing student learning and motivation in beginning Latin. *CALICO Journal*, **18**(2): 305–338.
- Heift, T. (2001) Error-specific and individualised feedback in a Web-based language tutoring system: Do they read it? *ReCALL*, **13**(1): 99–109.
- Hew, S.-H. and Ohki, M. (2004) Effect of animated graphic annotations and immediate visual feedback in aiding Japanese pronunciation learning: A comparative study. *CALICO Journal*, **21**(2): 397–420.
- Horst, M., Cobb, T. and Nicolae, I. (2005) Expanding academic vocabulary with an interactive on-line database. *Language Learning & Technology*, **9**(2): 90–110.
- Hubbard, P. (2005) A review of subject characteristics in CALL research. *Computer Assisted Language Learning*, **18**(5): 351–368.
- Jamieson, J., Chapelle, C. A. and Preiss, S. (2005) CALL evaluation by developers, a teacher and students. *CALICO Journal*, **23**(1): 93–138.
- Jeon-Ellis, G., Debski, R. and Wigglesworth, G. (2005) Oral interaction around computers in the project-oriented call classroom. *Language Learning & Technology*, **9**(3): 121–145.
- Jepson, K. (2005) Conversations - and negotiated interaction - in text and voice chat rooms. *Language Learning & Technology*, **9**(3): 79–98.
- Jones, L. (2003) Supporting listening and vocabulary acquisition with multimedia annotations: The students' voice. *CALICO Journal*, **21**(1): 41–66.
- Kaur, J. and Hegelheimer, V. (2005) ESL students' use of concordance in the transfer of academic word knowledge: An exploratory study. *Computer Assisted Language Learning*, **18**(4): 287–310.
- Kiernan, P. and Aizawa, K. (2004) Cell phones in task based learning: Are cell phones useful

- language learning tools? *ReCALL*, **16**(1): 71–84.
- Lamy, M.-N. (2004). Oral conversations online: redefining oral competence in synchronous environments. *ReCALL*, **16**(2): 520–538.
- Lee, L. (2005) Using web-based instruction to promote active learning: Learners' perspectives. *CALICO Journal*, **23**(1): 139–156.
- Levy, M. (2000) Scope, goals and methods in CALL research: Questions of coherence and autonomy. *ReCALL*, **12**(2): 170–195.
- Levy, M. and Stockwell, G. (2006) *CALL dimensions: Options and issues in computer-assisted language learning*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Lister, B. and Smith, T. (2001) Learning Latin by electronic media: Edging into the future. *CALICO Journal*, **18**(2): 235–248.
- Loucky, J. P. (2002) Improving areas to target vocabulary using computerized bilingual dictionaries. *ReCALL*, **14**(2): 293–312.
- Machovikov, A., Stolyarov, K., Chernov, M., Sinclair, I. and Machovikova, I. (2002) Computer-based training system for Russian word pronunciation. *Computer Assisted Language Learning*, **15**(2): 201–214.
- Menzel, W., Herron, D., Morton, R., Pezzotta, D., Bonaventura, P. and Howarth, P. (2001) Interactive pronunciation training. *ReCALL*, **13**(1): 67–78.
- Payne, J. S. and Whitney, P. J. (2002) Developing L2 oral proficiency through synchronous CMC: Output, working memory, and interlanguage development. *CALICO Journal*, **20**(1): 7–32.
- Pujolà, J.-T. (2001) Did CALL feedback feed back? Researching learners' use of feedback. *ReCALL*, **13**(1): 79–98.
- Shalan, K. F. (2005) An intelligent computer assisted language learning system for Arabic learners. *Computer Assisted Language Learning*, **18**(1–2): 81–108.
- Shei, C.-C. (2005) Integrating content learning and ESL writing in a translation commentary writing aid. *Computer Assisted Language Learning*, **18**(1–2): 33–48.
- Sun, Y. and Dong, Q. (2004) An experiment on supporting children's English vocabulary learning in multimedia context. *Computer Assisted Language Learning*, **17**(2): 131–147.
- Sun, Y.-C. and Wang, L.-Y. (2003) Concordancers in the EFL classroom: Cognitive approaches and collocation difficulty. *Computer Assisted Language Learning*, **16**(1): 83–94.
- Toyoda, E. and Harrison, R. (2002) Categorisation of text chat communication between learners and native speakers of Japanese. *Language Learning & Technology*, **6**(1): 82–91.
- Van Deusen-Scholl, N., Frei, C. and Dixon, E. (2005) Constructing learning: The dynamic nature of foreign language pedagogy in a CMC environment. *CALICO Journal*, **22**(3): 657–678.
- Volle, L. M. (2005) Analyzing oral skills in voice e-mail and online interviews. *Language Learning & Technology*, **9**(3): 146–163.
- Ward, M. (2002) Reusable XML technologies and the development of language learning materials. *ReCALL*, **14**(2): 285–294.
- Weinberg, A. (2002) Virtual misadventures: Technical problems and student satisfaction when implementing multimedia in an advanced French listening course. *CALICO Journal*, **19**(2): 331–357.
- Weinberg, A. and Knoerr, H. (2003) Learning French pronunciation: Audiocassettes or multimedia? *CALICO Journal*, **20**(2): 315–336.
- Yeh, Y. and Wang, C.-W. (2003) Effects of multimedia vocabulary annotations and learning styles on vocabulary learning. *CALICO Journal*, **21**(1): 131–144.
- Zhao, Y. (2003) Recent developments in technology and language learning: A literature review and meta-analysis. *CALICO Journal*, **21**(1): 7–28.