

UC Santa Barbara

UC Santa Barbara Previously Published Works

Title

Research methods for investigating technology for language and culture learning

Permalink

<https://escholarship.org/uc/item/1m1905vw>

Author

Chun, DM

Publication Date

2023-12-11

Peer reviewed

To appear in Chapelle, C., & Sauro, S. (Eds.). 2016. *The handbook of technology in second language teaching and learning*. John Wiley & Sons.

## RESEARCH METHODS FOR INVESTIGATING TECHNOLOGY FOR LANGUAGE AND CULTURE LEARNING

Dorothy M. Chun

### **Abstract**

Based on selected research studies that are among the most highly-cited or considered seminal or influential, this chapter provides an overview of the various qualitative, quantitative, and mixed-methods approaches that have been used to date in CALL research. CALL is used to refer to “Computer-Assisted **Languaculture** Learning,” which encompasses not just second language learning but also learning about the cultures associated with these languages. Areas of investigation have included learning of grammar, vocabulary, reading/writing, listening/speaking, pragmatics and intercultural competence, as well as overall communicative and intercultural competence. Technologies investigated in these areas range from tutorial lessons to collaborative Internet-based projects. Potential future methodologies and directions for future research are discussed for Computer-Assisted Languaculture Learning.

### Keywords

research methods, quantitative, qualitative, mixed methods, language learning, culture learning, languaculture

## <A> Introduction

Although it is difficult to pinpoint exactly when the field of computer-assisted language learning (CALL) began producing a body of research, the oldest journal exclusively devoted to CALL, the *CALICO Journal*, published its first article in 1983 and celebrated its 25<sup>th</sup> anniversary in 2008. The homepage of its website contains lists of “seminal” and “highly-cited and influential” articles. In 2009, Hubbard published a four-volume collection of seminal CALL studies published between 1988-2007, and in 2016, the journal *Language Learning & Technology* will reach the 20-year mark and in a special issue will feature commentaries from the authors of the most highly-cited articles. In addition, meta-analyses and meta-syntheses of particular aspects of CALL research (e.g., multimedia vocabulary annotations, computer-mediated communication (CMC), telecollaboration, gaming) are increasing in number. On the basis of the aforementioned lists and collections of excellent research, the methodologies of selected studies will be used to highlight how appropriately chosen methods can contribute to our knowledge of the extent to which technology-based pedagogies are effective for language and culture learning, or *languaculture* learning, to adopt Agar’s (1994) term. I use the term *languaculture* in part to retain the same acronym *CALL* and in part because many teachers and applied linguists recognize language and culture as inseparable constructs (e.g., Byrnes 2009; Kramsch 1993).

There are various ways that this chapter could be organized. One could categorize studies into quantitative, qualitative, or mixed methods and discuss how these different methods have been used in the seminal studies. One could examine the different aspects of languaculture (e.g., speaking, reading, grammar, vocabulary, culture, identity), how they have been taught, learned,

and researched using technology, and the methods used to conduct the research. One could use the underlying theory of second language acquisition or learning in general (e.g., interactionist, cognitive/psycholinguistic, sociocultural, ecological) as the starting point for organizing a discussion of methodology. Or one could begin with the technologies themselves, investigating how they have been employed for teaching a particular facet of language (e.g., speech recognition, CMC, blogs, mobile apps, video chat), or how they actually facilitate research (e.g., tracking user behavior, screen capture, eye tracking), and review the different methodologies that have been used in the research. Finally, one could take a historical perspective and attempt to trace the trends in the type of methodologies used over the years.

I have chosen the perhaps ambitious path of integrating the components above to reflect the complexity of the research endeavor. By focusing on seminal studies, I hope to show how all of the variables come into play in selecting an appropriate methodology, and how the reporting of the results of a given study will depend on the methodology chosen. However, I will generally follow the topics presented in this volume, beginning with the more “traditional” aspects of vocabulary and grammar, reading and writing, listening and speaking, and pragmatics and intercultural competence. Then I turn to learning language and culture in “newer” technological environments, e.g., mobile assisted language learning, telecollaboration, digital gaming, and virtual environments, and to emerging goals for the 21<sup>st</sup> century, e.g., development of learner identity and digital literacies.

### <A> **Brief overview of research methods**

In early research on technology for learning in general, it was common to conduct controlled studies of whether using technology resulted in similar (or better) learning outcomes as compared to not using technology, e.g., a control group would be taught in a traditional manner without technology and an experimental group would receive instruction/treatment using technology. But the field of educational technology in general and CALL in particular have moved away from this type of research and instead are investigating the affordances that particular technologies provide to learn particular aspects of language and culture, with particular types or groups of learners.

One of the leading figures in the field of CALL, Chapelle (1997), stressed early on the need for empirical research methods for CALL, suggesting applying research on instructed SLA to CALL. She favored interactionist theories of SLA but also acknowledged that other effective research methods from cognitive psychology, constructivism, psycholinguistics and discourse analyses could be used. In particular, Chapelle (1998) suggested that research methods for evaluation of CALL learning outcomes include process-oriented observations of learners working on L2 tasks and introspective methods to gain evidence about learners' strategies while working on L2 tasks. In an update to her 1997 article, Chapelle (2010) stated "The need was clear at that time, as it is now, for research designs to move beyond quantitative, outcomes-oriented studies comparing learning through technology to learning in a classroom—a paradigm inherited from education" (27).

In line with the social turn in second language acquisition (SLA) (Block 2003), other CALL pioneers Warschauer and Kern (2000) viewed network-based language teaching from socio-cognitive perspectives, and suggested a shift from primarily quantitative research methods to principally qualitative methods that considered classroom cultures as well as language use. A few years later, Kern, Ware, and Warschauer (2004) wrote of a second wave of papers about online language learning research, proposing that early research on networked language learning focused on linguistic interaction and development, followed by intercultural awareness and learning, and was moving in the direction of new multiliteracies and their relation to learner identity.

Levy (2000) reported on a corpus of 177 journal articles and book chapters on CALL, noting a multiplicity of methods and techniques and that “many studies show a mixture of quantitative and qualitative approaches to answer a wide variety of research questions” (180). Similarly, Felix (2008) in an overview of two decades of CALL effectiveness studies, discussed successful research design models, finding almost equal numbers of experimental and non-experimental studies. Important observations she made were the emerging trend toward investigating both learning *outcomes* and learning *processes*, and that a combination of various data collection methods within a single study would help to strengthen confidence levels about the results. “Because there is such a large scope for research in this area, there cannot be a single best design model” (148); researchers need to match their design to their research questions.

In a retrospective on “Twenty-Five Years of Theory in the *CALICO Journal*,” Hubbard (2008) reported that there is no single “theory of CALL” (387), noting that the most commonly cited theories were either general learning theories or SLA theories but there was nothing akin to

“native CALL” theories (394). This would imply that there are also not research methodologies based on CALL theories. In introducing his 4-volume series, Hubbard (2009) reiterated that most of the research and development in CALL has been driven by external theories, and he cited two of the more influential views as those of Chapelle (2001), who links the design and evaluation of CALL tasks to principles derived from interactionist SLA research studies, and Bax (2003), who views “normalization” as the defining direction for the field (3). Normalization refers to a state where technology is fully integrated into language teaching and is no longer special or unusual, in the way that books, pencils and blackboards were in traditional classrooms. Interestingly, Bax called for more in-depth ethnographic studies of individual environments and action research methods for investigating CALL. Bax (2011) revisits the issue of the normalization of technology in language education, adopting a neo-Vygotskian conceptual framework and reiterates the call for qualitative, ethnographic approaches to study the social, cultural, and contextual factors of technology use in educational settings. He suggests an action research mode, “in which the change agent seeks to implement a new technology by one mechanism, using one approach, and then carefully observes the impact of the change, inviting contributions from the stakeholders, and then attempting a further step in response” (12). This is typical of the reiterative nature of much action research, which can be defined broadly as a method that seeks first to understand the causes of a certain (pedagogical) situation and then to produce change in it. In the case of SLA, language teachers would start with their own classroom practice, develop some kind of action or intervention, make a change, and analyze and reflect on the results.

I conclude this overview with a discussion of two meta-analyses of CALL research, each reviewing a different body of research. Grgurović, Chapelle, and Shelley (2013) compiled

empirical research on language outcomes and included studies which (1) measured performance on language tests, (2) used an experimental or quasi-experimental design, (3) employed a pre-test/post-test design or post-test design only. One of their concluding recommendations was that future quantitative research designs that use control-treatment comparisons should employ random placement of subjects into conditions, and when that is not possible as is often the case, to verify the comparability of groups with a pre-test at the outset of the study (192).

Sauro's (2011) meta-synthesis of the role of synchronous computer-mediated communication (SCMC) for SLA operationalized SLA as the development of Canale and Swain's (1980) framework for communicative language teaching based on Hymes' (1972) notion of communicative competence. Her qualitative research synthesis revealed that almost half of the 97 studies explored grammatical competence, using cognitive or cognitive-interactionist approaches. Thirty-one (31) studies explored strategic competence (e.g., negotiating breakdowns taking cognitive-interactionist approaches or facilitating communicative effectiveness as analyzed with sociocultural approaches and discourse analysis). An additional 22 studies investigated sociocultural competence (again from sociocultural and discourse analytic perspectives), and 11 studies focused on discourse competence. The studies incorporated and built on research in face-to-face contexts and also utilized technological tools and strategies unique to CMC contexts. A wide variety of methods were used, depending on the learning outcomes that were targeted.

In summary, the work discussed in this section, in particular, the two meta-analyses/syntheses, can be seen as a sign that CALL is a maturing area of research. The fact that CALL research has extensively investigated through the lens of different SLA theories using



different methodologies, e.g., quantitative methods to study aspects of language ranging from grammatical competence to strategic competence, or qualitative methods to explore questions ranging from linguistic interaction to intercultural competence, reflects the reality that such a complex set of languaculture learning outcomes requires an equally nuanced understanding of appropriate methodologies to study them.

### **<A> Research methods for teaching and learning different aspects of languaculture**

This section discusses representative studies for the different aspects of second language and culture learning, with the caveat that it is not possible in this chapter to include every type of study in each of the categories that has been investigated.

### **<B> L2 grammar and vocabulary**

Many early studies of L2 grammar learning investigated the role of computer feedback, e.g., Brandl (1995), who investigated learners' behavior and preferences for different kinds of feedback in a German CALL program. He performed quantitative analyses of learners' selection of four kinds of feedback and qualitative analyses of interviews with the learners. Heift (2002) studied the impact of learner control on the students' error correction process in an Intelligent Language Tutoring System, which provided detailed error-specific and individualized feedback. The system recorded all of the students' interactions with the program, and percentages of the different types of interactions were calculated. Based on 4,456 server requests, she ascertained that students tended overwhelmingly to correct their errors, and that they showed distinct interaction patterns depending on their language skill. A similar type of quantitative investigation of learner behavior was also employed by Heift (2010) in a longitudinal study of learner uptake.

Program logs of learner behavior were compiled over the course of three semesters, and results showed significant differences in learner uptake at the advanced level depending on the degree of specificity of the feedback.

For the investigation of L2 vocabulary acquisition with CALL, a number of studies compared the effects of different types of multimedia annotations on learning. For example, Chun and Plass (1996) reported on a classroom learning situation, using a within-subjects design (but not an experimental study with random assignment of learners to different treatment groups). A key component of the study was the lookup behavior recorded by the multimedia program that was compared to the students' vocabulary learning with text, picture, and video annotations. Similarly, in the study by Plass et al. (1998), learners had the freedom to look up whichever types of annotations they wished, and results of questionnaires about their learning preferences divided them into visualizers and verbalizers. Al-Seghayer (2001) also used a within-subject design, three conditions (different types of multimedia annotations), and two types of tests (recognition and production vocabulary tests). He supplemented the quantitative data with qualitative data from interviews and questionnaires. The above studies found that different multimedia annotations were effective for vocabulary learning (picture glosses were most effective in Chun and Plass 1996 and video glosses were most effective in Al-Seghayer 2001). In addition, the behavior logs analyzed by Chun and Plass showed that when learners looked up both text and picture annotations, they performed better on the vocabulary tests, and Al-Seghayer' interviews with learners confirmed that the students believed that the video annotations showed the meaning of the word more clearly than the text or picture annotations.

In contrast, Laufer and Hill (2000) used an experimental methodology to study what kind of information L2 learners select when using a CALL dictionary. Their study included a pre-test, a tutorial showing students the variety of lookup options at their disposal, and a retention post-test. Log files in their program tracked user behavior. They found that different students exhibited different lookup preferences and that the use of multiple types of dictionary information seemed to reinforce retention.

The meta-analysis by Yun (2011) on the effect of hypertext glosses on L2 vocabulary acquisition during the period 1990-2009 identified approximately 200 articles, reports and papers. However, based on a set of criteria, including that the study had to have either an experimental or a quasi-experimental design, i.e., had to have a control group and a treatment group (with or without random assignment) as well as a pre- and post-test of vocabulary, only 10 studies were eligible for the meta-analysis. This is one indication that a great majority of CALL studies on hypertext glosses have not used quantitative experimental (or quasi-experimental) designs. Among the eligible studies, text glosses in combination with visual glosses were found to be moderately effective for L2 vocabulary acquisition, and studies with large samples provided a bigger effect size.

### **<B> L2 reading and writing**

Similar to the research on L2 vocabulary learning, studies of L2 reading also explored the effect of multimedia and hypertext glosses on overall reading comprehension. In suggesting a research agenda for studying text comprehension in multimedia environments, Chun and Plass (1997) combined interactive theories of reading comprehension with theories of multimedia

learning and suggested that research methodologies of empirical studies should seek to strike a balance between authentic learning situations and rigorous experimental conditions. They suggested using a combination of methods to assess specific elements of the reading process, e.g., tests, grades, written essays, observations of learner behavior, self reports and think-aloud protocols, eye movement, and for affective factors, questionnaires and interviews.

Contrary to the above suggestion, Abraham's (2008) meta analysis of the effect of computer-mediated glosses for reading comprehension (and incidental vocabulary learning) restricted the included studies to only those employing an experimental design, i.e., those with a treatment group vs. a control group. Out of 125 books, articles, book chapters and refereed conference papers published up to 2007, only 11 fulfilled the criterion of using an experimental design. He found an overall medium effect for learners who had access to glosses performing consistently better on measures of reading comprehension and vocabulary learning than those without access.

Yanguas (2009) investigated the effects that different types of multimedia glosses have on text comprehension (and vocabulary acquisition) when the goal is exclusively comprehension of a computerized text. Using both quantitative and qualitative analyses, his experimental method utilized a pre-post test design and also a treatment and a control group, which was supplemented by think-aloud protocols that were analyzed qualitatively. The results of both types of analyses showed that with regard to reading comprehension, the combination gloss group (those who saw both textual and pictorial glosses) significantly outperformed all other groups. The combination of quantitative and qualitative analyses lent greater confidence to his conclusions.

Seminal research on L2 writing using CALL tools often investigated different forms of CMC. For example, Sotillo (2000) compared the types of discourse functions and syntactic complexity produced by learners in two modes of CMC, namely SCMC and asynchronous (ACMC). Syntactic complexity was measured using T-unit analyses, e.g., the total number of units, the error-free T-units, and the number of subordinate clauses were counted and reported quantitatively. Discourse functions were categorized qualitatively, and the research method used was not experimental, i.e., there was no random assignment of learners to a control or experimental group. Stockwell and Harrington (2003) also investigated syntactic development in native-speaker nonnative-speaker email interactions by quantitatively recording the number of linguistic text features (T-units) and calculating lexical mastery (type/token ratios). They measured overall language proficiency based on proficiency ratings, basing their work theoretically on the Interaction Hypothesis and on the psycholinguistic conditions that facilitate language learning.

A study by Strobl (2014) on computer-supported collaborative writing was based on constructivist learning principles and investigated the effect of online collaboration on academic writing in a foreign language. Individual and collaborative writing processes were compared by applying a mixed-methods approach: quantitative instruments measured quantity, complexity, accuracy, fluency, and coherence/cohesion, while qualitative analyses were employed for content selection, organization, and planning discussions. Results indicated that although no statistically relevant difference was found between the individual and collaborative writing tasks in terms of complexity, accuracy, and fluency, raters scored collaboratively constructed texts significantly higher on appropriate content selection and organization.

### <B> The relationship between L2 writing and speaking

CMC, both asynchronous and synchronous, has been studied by CALL researchers as a possible bridge between writing and speaking. Indeed, online “chatting” often displays characteristics closer to oral conversation than to traditional written genres. Early research compared text-based electronic discussion with oral face-to-face discussion, e.g., Kern (1995) and Warschauer (1995). Warschauer (1995) performed a controlled experiment comparing face-to-face and electronic discussion in an L2 classroom. Using a counter-balanced, repeated measures study of the amount and equality of participation, he quantified student participation as well as lexical and syntactic complexity. An added qualitative component analyzed differences in turn-taking and formality and students’ attitudes. Kern’s (1995) seminal work likewise compared transcripts of classroom interaction with networked computers with face-to-face interactions, quantitatively reporting on turns, T-units, and morphosyntactic features, while qualitatively analyzing characteristics of discourse, specifically discourse functions, and questionnaire results of learners’ impressions.

Using a psycholinguistic model of speech production and work memory theory, Payne and Whitney (2002) used a quasi-experimental design with pre- and posttests and an experimental and a control group (but no random assignment to groups). Their results showed that SCMC can directly improve L2 oral proficiency. Similarly, Abrams (2003) also used an experimental design employing a control group to study the effect of SCMC and APMC on oral performance. She measured lexical richness and diversity, syntactic complexity, and the number of idea units and words produced by L2 learners.

By using the methodology of analyzing both chat transcripts and video-enhanced chatscripts, Sauro (2012) examined L2 performance in text-chat and spoken discourse and found no significant differences in either lexical or syntactic complexity of the narratives in the two modalities. Her study was not experimental in that she did not employ pre- and posttests or control and experimental groups, but rather the two conditions were “controlled” by the use of a single consistent interlocutor for both modalities and the same narrative tasks.

In a meta analysis of text-based SCMC and its effect on SLA, Lin, Huang, and Liou (2013) investigated how SCMC contributes to oral skills. Their methodological criterion for whether to include studies reported on between 1990-2012 was that an experimental or quasi-experimental design had been employed. Only 10 studies matched their criteria, and most of the studies took an interactionist perspective. They concluded that both data collection and analysis needed to be expanded, e.g., by new methodologies such as screen capture and recording nonverbal behaviors. Their findings included a small but positive overall effect of text-based SCMC tasks on SLA than other means of communication and suggested that intermediate learners may benefit more from SCMC tasks if they are grouped into pairs or small groups.

### **<B > L2 listening and speaking**

Studies using technology for L2 listening comprehension include those that controlled the rate of speech and the effect of multimedia annotations to support listening. Zhao (1997) conducted his experiment on an individual basis whereby each subject was able to try four different listening conditions with varying degrees of learner control on the speech rate. McBride’s (2011) experiment, on the other hand, had a pre-test–treatment–post-test design and

subjects were assigned in a semi-random fashion to one of the four experimental groups. The results of Zhao's study were that students' listening comprehension improved when they were given control over the speech rate in their listening tasks. McBride concluded that the group that was trained on slow materials fared the best in comprehension, apparently because their bottom-up processing improved.

Jones (2003) grounded her study in a generative theory of multimedia learning and conducted a study of vocabulary acquisition with multimedia annotations during a listening activity. She used an experimental between-subject design, with learners randomly assigned to one of four groups (a control group and three experimental groups) and pre- and post-tests. Her quantitative results showing that students learned vocabulary best when they selected both verbal and visual annotations while listening were complemented with qualitative interview data indicating that learners believed that the availability and choice of multimedia annotations were helpful for vocabulary learning.

Due to research (e.g., by Anderson-Hsieh, Johnson and Koehler 1992) suggesting that suprasegmentals (prosody, intonation) have a greater impact on global pronunciation ratings than segmentals (vowels and consonants), CALL studies have investigated the effect of prosody training on L2 speaking. Hardison (2004) conducted two experiments, the first using a pretest-posttest design to determine whether computer-based training that permits visual displays of pitch contours in real time would help in the acquisition of French prosody by American speakers. The quantitative results were supplemented by qualitative results of anonymous learner questionnaires, with both indicating the usefulness of computer-assisted speech training.



Levis and Pickering (2004) also used speech visualizations to develop materials for teaching discourse-level uses of intonation. And Chun et al. (2015) reported on a study of L2 learners of Mandarin Chinese who created their own visualizations of the four Mandarin tones (and the neutral tone) and were able to improve their pronunciation, as measured both auditorily and acoustically. They studied an authentic learning environment in which learners received training during their normal class hours, deciding against an experimental design with random assignment to a control and a treatment group. Native speaker ratings of the learners' tones revealed an improvement between pretest and posttest, and acoustic analyses indicated that the students' pronunciation of some tones improved in the posttest.

### **<B> How CMC promotes SLA in general**

Depending on the underlying theoretical approach taken to study SLA, different learning goals are targeted. The sub-sections above discussed the traditional aspects and skills in second language learning, namely vocabulary and grammar, reading and writing, and speaking and listening, with the observation that digital media have changed communication and have blurred the lines between writing and speaking. This sub-section presents studies that do not fit into the traditional categories. For example, if SLA is operationalized as the development of Canale and Swain's (1980) four types of communicative competence (see discussion of Sauro's 2011 research synthesis in Section 2 above), then different aspects of SLA are studied.

An early longitudinal study of computer-assisted classroom discussion examined an intra-class networked discussion and found that second-semester L2 German learners developed interactive competence over the course of two semesters (Chun, 1994). Transcripts of the

discussions were analyzed with regard to the number and length of turns, syntactic complexity, and different discourse structures. Blake (2000) in a highly cited study of CMC based on the Interaction Hypothesis analyzed the chatscripts from dyads who had carried out online tasks. He sought to determine what promotes negotiations, based on Varonis and Gass' (1985) schema (trigger, indicator, response, reaction). His quantitative data on the number of negotiations and the statistical analyses comparing tasks and types of negotiations was complemented by qualitative data on student attitudes and reflections.

Like Blake (2000), Smith (2003) also saw negotiation patterns in his CMC study that were similar to those observed in face-to-face communication (the Varonis and Gass 1985 model). But he proposed that the model be expanded in order to be able to allow for a delay, sometimes a long delay, between the initial trigger and the indicator. This is due to the nature of CMC, that turns are not always adjacent to each other as they are in face-to-face conversation. Analyses of chatscripts included calculations of total turns for each dyad as well as ratios of negotiated turns to total turns.

Two studies that were both concerned with interactional features of synchronous CMC chat used different underlying theories and thus reported on different types of learning outcomes. Fernández-García and Martínez-Arbeláiz (2002) took an interactionist perspective in analyzing chat data of native speakers of English learning Spanish and found that instances of negotiation, critical for SLA, did occur in the online conversations. By comparison, although Darhower (2002) also studied CMC data from English-speaking learners of Spanish, in applying a sociocultural lens to his analyses, he described the most salient features of the interactions, attributing learning to the social interaction between learners and more knowledgeable partners.

While both studies used discourse analysis as their methodology for data analysis and both concluded that online chat can support language learning, each delineated specific areas of competence that are improved by CMC by working from different theoretical perspectives.

In a meta-analysis of CMC and SLA studies between 2000-2012, Lin (2014, 2015) restricted the studies to those that were experimental or quasi-experimental. Her aim was to determine whether there was a link between the use of CMC and SLA, operationalizing SLA as “the acquisition of tools language learners need to rely on in order to successfully carry out communication with target language users” (2014, 123) and the tools included speaking, reading, writing, listening, as well as grammar, vocabulary, and pronunciation. With such a broad scope, 59 studies were identified and drew on interactionist and sociocultural theories of SLA, and they were highly diverse with respect to a number of features, including research design. Findings discussed in the 2014 article showed a positive and medium effect of CMC interventions, but that communication taking place asynchronously or synchronously did not seem to have a differential effect on SLA. The 2015 article delineated how among the four language skills which CMC was intended to facilitate, writing skills produced the largest effect size, and that studies using smaller groups produced a larger effect size than those using larger groups or no grouping.

### **<B> Research methodologies for teaching and learning L2 pragmatics and intercultural competence**

Pioneering work in using technology for teaching culture was reported in Furstenberg et al. (2001). Their groundbreaking *Cultura* model has been used for two decades with great

pedagogical success and has been researched extensively (e.g., Chun, 2014). Research on online intercultural exchanges or telecollaboration began with more quantitative analyses of email, forum discussions and text chats, and has moved to more qualitative, contextualized, discourse-based analyses of the processes of such exchanges and how cultural understandings are expressed by participants over time (Chun, 2015).

Seminal studies on telecollaboration include those of Belz (2002, 2003), O'Dowd (2003), Thorne (2003), Thorne and Payne (2005), which employed a variety of research methods. Belz (2002) investigated the socio-institutional dimensions of telecollaborative foreign language study within the theoretical framework of social realism using an exploratory multi-strategy approach. In contrast, Belz (2003) employed a case study approach to study linguistic perspectives on the development of intercultural competence in telecollaboration. Like many others, she based her analyses on Byram's (1997) model of intercultural communicative competence (ICC), examining the key moments in a seven-week email correspondence between German and American learners. She also employed appraisal theory, an extension and refinement of systemic functional linguistics, and provided quantitative analyses of different types of modalities and linguistic features of the learners' language, as well as of attitudinal appraisal. Her data revealed the German speakers' tendency toward negative appraisal and categorical assertions in contrast to the American student's communication patterns of indirectness and implicitness.

Thorne (2003) also used a case study approach to investigate Internet tools and their mediational affordances as cultural tools for intercultural communication and language learning. Taking a cultural-historical approach, he reported on three different case studies, providing

excerpts from emails and synchronous chats, demonstrating that Internet communication tools are not neutral media.

In reporting on a year-long email exchange between Spanish and English university language learners, O'Dowd (2003) used qualitative methods to identify key characteristics of the exchanges which helped to develop learners' ICC. A variety of ethnographic techniques were used, e.g., participant observation, reviewing the actual email data as well as emails from students containing feedback on the exchange, questionnaires and interviews with students, a researcher's reflexive journal, and feedback from a partner teacher. In addition, he suggested action research as a method for this type of research, a recommendation echoed by Müller-Hartmann (2012) and Chun (2015).

Edited volumes and special issues on intercultural competence include Thorne and Payne (2005), O'Dowd (2007), and Dooly and O'Dowd (2012). Thorne and Payne (2005) suggested that a substantial strand of CMC research prior to 2005 investigated negotiation of meaning with an interactionist approach, but that using CMC tools for intercultural communication was emerging as critical for teaching L2 pragmatics and that language and culture are inseparable. Based on the individual articles in all of these collections, it is evident that when the focus is intercultural communication qualitative methods of analysis are often employed. A reasonable alternative to choosing either a quantitative or qualitative method is to use multiple methods, as all research methods have inherent strengths and limitations, and triangulation of different methods can compensate to some extent for the weaknesses. The current trend of having ICC as one of the primary goals of telecollaboration and of second language/languaculture learning in general has motivated many researchers to take sociocultural approaches and utilize multiple

methodologies, including action research, which is intended to inform teaching practices in the immediate context.

### **<B>Research methodologies for teaching and learning languaculture in other contexts**

Some of the emerging areas of interest in technology-based learning include digital literacies/ multiliteracies/ 21<sup>st</sup> century literacies, development of learner autonomy and learner identity, games and virtual worlds. Guikema and Williams's (2014) volume *Digital Literacies in Foreign and Second Language Education* includes a wide range of topics and research methods, from conceptual pieces to survey studies to classroom-based studies using digital storytelling and digital games. Primarily qualitative methods, including case studies, were used. One study by Jiménez-Caicedo, Lozano, and Gómez (2014) on learner agency and the use of blogs for developing L2 literacy employed Q Methodology, which provides a framework for the study of human subjectivity and according to Brown (1993) allows researchers to investigate viewpoints (e.g., perspectives, attitudes, beliefs, and motivations) in a systematic way. It is based on the premises that subjectivity is communicable and that when asked to rank statements about a particular topic, participants will always do so from their own (subjective) point of view. Jiménez-Caicedo and his colleagues (2014) used QM to analyze their students' subjectivities about the use of blogs for developing their Spanish academic literacy and cultural awareness, concluding that students' agency played an important role in the three different ways they used blogs: one group saw blogs as primarily a tool for practicing grammar and vocabulary, while another believed that blogs were an important tool for motivating real language use, and a third group felt that blogs were a space where they could explore and experiment with the L2 rather than a space where instructors would make grammatical corrections.

A study by Zheng et al. (2009) explored affective factors in learning English as a Foreign language in a 3D game-like virtual world. Using mixed methods, a posttest only quasi-experimental design was employed to study patterns of language and media use and to determine self-efficacy toward advanced use of English, attitude toward English, and self-efficacy toward e-communication. Exploratory factor analysis was performed on questionnaire items, producing a solution in which the three factors were empirically identified, and multivariate analyses were conducted to determine the differences in self-efficacy and attitude between the experimental and control groups.

A highly-cited paper by Lam (2000) on L2 literacy and development of learner identity presented a case study of a teenager writing on the Internet, using ethnographic and discourse analytic methods. The examination of the Chinese immigrant teenager's written correspondence in English with a transnational group of peers on the Internet showed how the correspondence related to his developing identity in the use of English and how texts were composed and used to represent identity online.

The use of games and simulations is a growing sub-field of CALL. Although technically not a meta-analysis in the quantitative sense, Peterson (2010) described seven studies of computerized games and simulations for language learning that appeared between 2001-2008. These were based on psycholinguistic or sociocultural theories of SLA and were generally qualitative, descriptive studies (e.g., case studies) that analyzed transcripts of learners' interactions in multiuser object-oriented (MOO) domains, in three-dimensional web-based simulated virtual worlds, in commercial simulation games, in massively multiplayer online role-playing games (MMORPGs), and in a game- and simulation-based training system. Discourse

analysis of the transcripts was frequently used to determine the types of negotiation of meaning, interactions, and collaborations used by the players. Observations by the researchers revealed the presence of autonomous and exploratory learning. One study used mixed methods to investigate the use of a stand-alone commercial simulation game combined with supplementary web-based materials for vocabulary learning. Pre- and post-vocabulary tests revealed significant gains in vocabulary knowledge, and pre- and post-project surveys were conducted to assess the students' perceptions of the game and their vocabulary learning.

In their overview of research in games and social networking, Sykes and Holden (2011) reported similar methodologies, including ethnographic observations of language learners playing MMORPGs and analyses of the attendant discourses (discussion forums, machinima groups, and modding communities), along with interviews with the learners.

In Reinhardt and Sykes's (2014) special issue of *Language Learning & Technology* on game-informed L2 teaching and learning, all of the articles report on non-linguistic gains: autonomy and community, willingness to communicate, daily self-reports of engagement, motivation, attitudes, and perceptions of performance. One was a qualitative case study of the use of language play while microblogging (with Twitter). Discourse analysis of the students' tweets and retrospective interviews indicated that they took ownership of the task and engaged in ludic language play.

### **<B> Methods for triangulating data collection**

In the field of CALL, a very influential and innovative study that introduced a new methodology for studying CMC was reported by Smith (2008), who showed convincingly that



by simply using the finished “product” of chat log files, much information on the “process” of chatting is being neglected or ignored. In his particular study of self-repair in task-based activities, he first evaluated the chat data by using only the chat log file; he then examined the video file of the screen capture of the entire interaction. His results are persuasive that fundamental differences in interpretation and conclusions are reached about the chat interaction, depending on the type of data that is collected and the evaluation methods that are employed.

Related or follow-up studies to Smith (2008) include ones by Smith and Sauro (2009), Sauro and Smith (2010), and Sauro (2012). These articles provided details of how to code the additional information provided by the screen capture and utilize quantitative methods for comparing the different learner actions, e.g., preemptive or self-initiated deletions as opposed to reactive deletions, as well as the more traditional measures of syntactic complexity, grammar, and lexical diversity. Sauro (2012) used controlled conditions and screen capture software to compare the complexity of adult ESL learners’ output in text-chat as compared to spoken discourse. She suggested that additional methods, such as stimulated recall sessions in which learners can view the videos of their text-chat sessions might prompt participants to articulate what they were thinking as they composed and edited their chat turns.

Another novel methodology being used in SLA and CMC research is the use of eye-tracking technology. Smith (2012) attempted to study the construct of noticing, which is key in cognitively-oriented approaches to SLA, by recording participants’ eye gaze while they were engaged in a short chat interaction task. Specifically, the question was whether eye-tracking could be employed as a measure of noticing of corrective feedback when nonnative learners performed a task with a native speaker in a synchronous CMC setting. Noticing events, i.e.,

increased visual attention as shown in “heat maps” of the eye gaze, to the recasts provided by the native speaker, were tracked by the software. The heat map data was compared with the data from stimulated recall and both were highly and positively correlated with one another. Smith concluded that the two methodological techniques used in conjunction with each other may help SLA researchers better understanding the construct of noticing.

### **<A> Summary and conclusions**

The foregoing discussions of the multiplicity of both areas for CALL research and methodologies to study them suggest that the choice of a research methodology for CALL studies depends primarily on four considerations: (1) which aspect of language or culture is being taught/learned; (2) which theory of learning is considered most appropriate for teaching/learning that aspect of language or culture; (3) which technologies are being employed for teaching that particular facet of language or culture; (4) which technologies are available for conducting and analyzing the study.

The general trend in terms of research methods seems to be continuing to employ quantitative and/or qualitative methods as appropriate to the theoretical perspective taken. Traditional quantitative studies that use experimental and quasi-experimental methods are still needed to continue to research the effects of various applications or integrations of technology with languaculture learning. But it is also common for studies to be conducted in authentic learning situations, e.g., as part of regularly scheduled language courses, and increasingly, the lines between in-class or course-related learning and learning outside of the classroom or non-course-related learning are becoming blurred. Qualitative studies using ethnographic methods

and action research, often described as cyclical and participatory, can be used appropriately in real-world learning environments. This also aligns with sociocultural and ecological theories of language and culture learning. Developing ICC, for example, cannot be measured with the same types of quantitative instruments as mastery of linguistic elements.

The foregoing sections illustrate how the underlying learning theories in combination with the chosen methodology not only influence the research questions posed but can also result in very different conclusions. Ideally, mixed or multiple methods employed in a given study will yield the most comprehensive and persuasive results. That is, in addition to assessing particular components or skills of languaculture learning, querying learners' attitudes and perceptions about their learning can also contribute to our understanding of the ecology of the learning environment.

For the future, as technology and learning become increasingly integrated and we approach Bax's (2003, 2011) concept of "normalization," and as the goal of developing digital and multiliteracies transcends language and culture learning, we must be open to whatever new technologies emerge. As with using video-enhanced screen capture and eye-tracking technologies to research SLA, CALL researchers have access to new technologies for teaching and for research: Web 2.0 blogs, wikis, and social networks; games, virtual worlds; mobile apps that can be used untethered and ubiquitously; Web 3.0 tools to connected intelligence and augmented reality; Web 4.0 tools that are predicted to be ultra intelligent electronic agents for personalized learning, e.g., learner analytics tools that not only track learner behavior but adapt to the learner's proficiency level. These technologies, when used with pedagogical approaches that focus, for example, on task-based teaching and learning, on the 5 Cs, or on recording and

analyzing non-verbal learner behavior, open new possibilities for teaching and research. It will be up to us to think of new ways to use technology to aid and inform our research endeavors.

## References

- Abraham, Lee B. 2008. "Computer-Mediated Glosses in Second Language Reading Comprehension and Vocabulary Learning: A Meta-Analysis." *Computer Assisted Language Learning*, 21, no. 3: 199–226. Doi:10.1080/09588220802090246.
- Abrams, Zsuzsanna Ittzes. 2003. "The Effect of Synchronous and Asynchronous CMC on Oral Performance in German." *The Modern Language Journal*, 87, no. 2: 157–67.
- Agar, Michael. 1994. *Language Shock: Understanding the Culture of Conversation*. New York: William Morrow and Company.
- Al-Seghayer, Khalid. 2001. "The Effect of Multimedia Annotation Modes on L2 Vocabulary Acquisition: A Comparative Study." *Language Learning & Technology* 5, no. 1: 202–32.
- Anderson-Hsieh, Janet, Ruth Johnson, and Kenneth Koehler. 1992. "The Relationship between Native Speaker Judgments of Nonnative Pronunciation and Deviance in Segmentals, Prosody, and Syllable Structure." *Language Learning*, 42, no. 4: 529–55.
- Bax, Stephen. 2003. "CALL—Past, Present and Future." *System*, 31, no. 1: 13–28.
- Bax, S. (2011). Normalisation revisited: The effective use of technology in language education. *International Journal of Computer-Assisted Language Learning and Teaching*, 1(2), 1–15.
- Belz, Julie A. 2002. "Social Dimensions of Telecollaborative Foreign Language Study." *Language Learning & Technology*, 6, no. 1: 60–81.
- . 2003. "Linguistic Perspectives on the Development of Intercultural Competence in Telecollaboration." *Language Learning & Technology*, 7, no. 2: 68–117.
- Blake, Robert. 2000. "Computer Mediated Communication: A Window on L2 Spanish Interlanguage." *Language Learning & Technology*, 4, no. 1: 120–36.
- Block, David. 2003. *The Social Turn in Second Language Acquisition*. Edinburgh: Edinburgh University Press.
- Brandl, Klaus K. 1995. "Strong and Weak Students' Preferences for Error Feedback Options and Responses." *The Modern Language Journal*, 79, no. 2: 194–211.
- Brown, Steven R. (1993). "A primer on Q-methodology." *Operant Subjectivity*, 16: 91–138.
- Byram, Michael. 1997. *Teaching and Assessing Intercultural Communicative Competence*. Clevedon: Multilingual Matters.
- Byrnes, Heidi. 2009. "Revisiting the Role of Culture in the Foreign Language Curriculum." *The Modern Language Journal*, 94, no. 2: 315–17. Doi:10.1111/j.1540-4781.2010.01023.x.

- Canale, Michael, and Merrill Swain. 1980. "Theoretical Bases of Communicative Approaches to Second Language Teaching and Testing." *Applied Linguistics*, 1, no. 1: 1–47.
- Chapelle, Carol A. 1997. "CALL in the Year 2000: Still in Search of Research Paradigms?" *Language Learning & Technology*, 1, no. 1: 19–43.
- . 1998. "Multimedia CALL: Lessons to Be Learned from Research on Instructed SLA." *Language Learning & Technology*, 2, no. 1: 22–34.
- . 2001. *Computer Applications in Second Language Acquisition*. Cambridge: Cambridge University Press.
- . 2010. "Research for Practice: A Look at Issues in Technology for Second Language Learning." *Language Learning & Technology*, 14, no. 3: 27–30.
- Chun, Dorothy M. 1994. "Using Computer Networking to Facilitate the Acquisition of Interactive Competence." *System* 22, no. 1: 17–31.
- . 1997. "Research on Text Comprehension in Multimedia Environments." *Language Learning & Technology*, 1, no.1: 60–81.
- , ed. 2014. *Cultura-Inspired Intercultural Exchanges: Focus on Asian and Pacific Languages*. Honolulu, HI: National Foreign Language Resource Center.
- . 2015. "Language and Culture Learning in Higher Education via Telecollaboration." *Pedagogies: An International Journal*, 10, no. 1: 1–17.  
Doi:10.1080/1554480X.2014.999775.
- Chun, Dorothy M., and Jan L. Plass. 1996. "Effects of Multimedia Annotations on Vocabulary Acquisition." *The Modern Language Journal*, 80, no. 2: 183–198. Doi:10.2307/328635.
- . 1997. "Research on Text Comprehension in Multimedia Environments." *Language Learning & Technology*, 1, no. 1: 60–81.
- Chun, Dorothy M., Yan Jiang, Justine Meyr, and Rong Yang. 2015. "Acquisition of L2 Mandarin Chinese Tones with Learner-Created Tone Visualizations." *Journal of Second Language Pronunciation*, 1, no. 1: 86–114.
- Darhower, Mark. 2002. "Interactional Features of Synchronous Computer-Mediated Communication in the Intermediate L2 Class: A Sociocultural Case Study." *CALICO Journal*, 19, no. 2: 249–77.
- Dooly, Melinda, and Robert O'Dowd, eds. 2012. *Researching Online Foreign Language Interaction and Exchange: Theories, Methods and Challenges*, Vol. 3. Telecollaboration in Education. New York: Peter Lang.
- Felix, Uschi. 2008. "The Unreasonable Effectiveness of CALL: What Have We Learned in Two Decades of Research?" *ReCALL*, 20, no. 2: 141–61.

- Fernández-García, Marisol, and Asunción Martínez-Arbelaiz. 2002. "Negotiation of Meaning in Nonnative Speaker-Nonnative Speaker Synchronous Discussions." *CALICO Journal*, 19, no. 2: 279–94.
- Furstenberg, Gilberte, Sabine Levet, Kathryn English, and Katherine Maillet. 2001. "Giving a Virtual Voice to the Silent Language of Culture: The Cultura Project." *Language Learning & Technology*, 5, no. 1: 55–102.
- Grgurović, Maja, Carol A. Chappelle, and Mack C. Shelley. 2013. "A Meta-Analysis of Effectiveness Studies on Computer Technology-Supported Language Learning." *ReCALL* 25, no. 2: 165–98. Doi:10.1017/S0958344013000013.
- Guikema, Janel P., and Lawrence Williams, eds. 2014. *Digital Literacies in Foreign and Second Language Education*. Vol. 12. CALICO Monograph Series. San Marcos, TX: CALICO.
- Hardison, Debra M. 2004. "Generalization of Computer-Assisted Prosody Training: Quantitative and Qualitative Findings." *Language Learning & Technology* 8, no. 1: 34–52.
- Heift, Trude. 2002. "Learner Control and Error Correction in ICALL: Browsers, Peekers and Adamants." *CALICO Journal* 19, no. 3: 295–313.
- . 2010. "Prompting in CALL: A Longitudinal Study of Learner Uptake." *The Modern Language Journal*, 94, no. 2: 198–216.
- Hubbard, Philip. 2008. "Twenty-Five Years of Theory in the CALICO Journal." *CALICO Journal*, 25, no. 3: 387–99.
- , ed. 2009. *Computer Assisted Language Learning: Critical Concepts in Linguistics*. Vol. 1–4. London and New York: Routledge.
- Hymes, Dell. 1972. "On Communicative Competence." In *Sociolinguistics*, edited by J. B. Pride and J. Holmes, 269–93. London: Penguin.
- Jiménez-Cañedo, Juan Pablo, María E. Lozano, and Ricardo L. Gómez. 2014. "Agency and Web 2.0 in Language Learning: A Systematic Analysis of Elementary Spanish Learners' Attitudes, Beliefs, and Motivations about the Use of Blogs for the Development of L2 Literacy and Language Ability." In *Digital Literacies in Foreign and Second Language Education*, edited by Janel P. Guikema and Lawrence Williams. Vol. 12. CALICO Monograph Series. San Marcos, TX: CALICO.
- Jones, Linda C. 2003. "Supporting Listening Comprehension and Vocabulary Acquisition with Multimedia Annotations: The Students' Voice." *CALICO Journal*, 21, no. 1: 41–65.
- Kern, Richard G. 1995. "Restructuring Classroom Interaction with Networked Computers: Effects on Quantity and Characteristics of Language Production." *The Modern Language Journal*, 79, no. 4: 457–76.

- Kern, Richard, Paige Ware, and Mark Warschauer. 2004. "Crossing Frontiers: New Directions in Online Pedagogy and Research." *Annual Review of Applied Linguistics*, 24: 243–60. Doi:10.1017/S0267190504000091.
- Kramsch, Claire. 1993. *Context and Culture in Language Teaching*. Oxford: Oxford University Press.
- Lam, Wan Shun Eva. 2000. "L2 Literacy and the Design of the Self: A Case Study of a Teenager Writing on the Internet." *TESOL Quarterly*, 34, no. 3: 457–82. Doi:10.2307/3587739.
- Laufer, Batia, and Hill, Monica. 2000. "What Lexical Information Do L2 Learners Select in a Call Dictionary and How Does It Affect Word Retention." *Language Learning & Technology*, 3, no. 2: 58–76.
- Levis, John, and Lucy Pickering. 2004. "Teaching Intonation in Discourse Using Speech Visualization Technology." *System* 32, no. 4: 505–24.
- Levy, Mike. 2000. "Scope, Goals and Methods in CALL Research: Questions of Coherence and Autonomy." *ReCALL*, 12, no. 2: 170–95.
- Lin, Huifen. 2014. "Establishing an Empirical Link between Computer-Mediated Communication (CMC) and SLA: A Meta-Analysis of the Research." *Language Learning & Technology*, 18, no. 3: 120–47.
- . 2015. "A Meta-Synthesis of Empirical Research on the Effectiveness of Computer-Mediated Communication (CMC) in SLA." *Language Learning & Technology*, 19, no. 2: 85–117.
- Lin, Wei-Chen, Hung-Tzu Huang, and Hsien-Chin Liou. 2013. "The Effects of Text-Based SCMC on SLA: A Meta Analysis." *Language Learning & Technology*, 17, no. 2: 123–142.
- McBride, Kara. 2011. "The Effect of Rate of Speech and Distributed Practice on the Development of Listening Comprehension." *Computer Assisted Language Learning*, 24, no. 2: 131–54. Doi:10.1080/09588221.2010.528777.
- Müller-Hartmann, Andreas. 2012. "The Classroom-Based Action Research Paradigm in Telecollaboration." In *Researching Online Foreign Language Interaction and Exchange: Theories, Methods, and Challenges*, edited by Melinda Dooly and Robert O'Dowd, 163–94. Bern: Peter Lang.
- O'Dowd, Robert. 2003. "Understanding the 'Other Side': Intercultural Learning in a Spanish-English E-Mail Exchange." *Language Learning & Technology*, 7, no. 2: 118–44.
- , ed. 2007. *Online Intercultural Exchange: An Introduction for Foreign Language Teachers*. Vol. 15. Clevedon: Multilingual Matters.



- Payne, Scott J., and Paul J. Whitney. 2013. "Developing L2 Oral Proficiency through Synchronous CMC: Output, Working Memory, and Interlanguage Development." *CALICO Journal*, 20, no. 1: 7–32.
- Reinhardt, Jonathon, and Julie M. Sykes. 2014. "Digital Game and Play Activity in L2 Teaching and Learning." *Language Learning & Technology*, 18, no. 2: 2–8.
- Peterson, M. 2010. "Computerized Games and Simulations in Computer-Assisted Language Learning: A Meta-Analysis of Research." *Simulation & Gaming* 41, no. 1: 72–93. Doi:10.1177/1046878109355684.
- Plass, Jan L., Dorothy M. Chun, Richard E. Mayer, and Detlev Leutner. 1998. "Supporting Visual and Verbal Learning Preferences in a Second-Language Multimedia Learning Environment." *Journal of Educational Psychology*, 90, no. 1: 25–36.
- Sauro, Shannon. 2011. "SCMC for SLA: A Research Synthesis." *CALICO Journal*, 28, no. 2: 369–91.
- . 2012. "L2 Performance in Text-Chat and Spoken Discourse." *System*, 40, no. 3: 335–48. Doi:10.1016/j.system.2012.08.001.
- Sauro, Shannon, and Bryan Smith. 2010. "Investigating L2 Performance in Text Chat." *Applied Linguistics*, 31, no. 4: 554–77. Doi:10.1093/applin/amq007.
- Smith, Bryan. 2003. "Computer-mediated Negotiated Interaction: An Expanded Model." *The Modern Language Journal*, 87, no. 1: 38–57.
- . 2008. "Methodological Hurdles in Capturing CMC Data: The Case of the Missing Self-Repair." *Language Learning & Technology*, 12, no. 1: 85–103.
- . 2012. "Eye Tracking as a Measure of Noticing: A Study of Explicit Recasts in SCMC." *Language Learning & Technology*, 16, no. 3: 53–81.
- Smith, Bryan, and Shannon Sauro. 2009. "Interruptions in Chat." *Computer Assisted Language Learning*, 22, no. 3: 229–47. Doi:10.1080/09588220902920219.
- Sotillo, Susana M. 2000. "Discourse Functions and Syntactic Complexity in Synchronous and Asynchronous Communication." *Language Learning & Technology*, 4, no. 1: 82–119.
- Stockwell, Glenn, and Michael Harrington. 2013. "The Incidental Development of L2 Proficiency in NS-NNS Email Interactions." *CALICO Journal*, 20, no. 2: 337–59.
- Strobl, Carola. 2014. "Affordances of Web 2.0 Technologies for Collaborative Advanced Writing in a Foreign Language." *CALICO Journal*, 31, no. 1: 1–18. Doi:10.11139/cj.31.1.1-18.
- Sykes, Julie M., and Christopher L. Holden. 2011. "Communities: Exploring Digital Games and Social Networking." In *Present and Future Promises of CALL: From Theory and*

- Research to New Directions in Language Teaching*, edited by Nike Arnold and Lara Ducate, 311–36. San Marcos, TX: CALICO.
- Thorne, Steven L. 2003. “Artifacts and Cultures-of-Use in Intercultural Communication.” *Language Learning & Technology*, 7, no. 2: 38–67.
- Thorne, Steven L., and Scott J. Payne. 2005. “Evolutionary Trajectories, Internet-Mediated Expression, and Language Education.” *CALICO Journal*, 22, no. 3: 371–97.
- Varonis, Evangeline M., and Susan M. Gass. 1985. “Non-Native/non-Native Conversations: A Model for Negotiation of Meaning.” *Applied Linguistics*, 6: 71–90.
- Warschauer, Mark. 1995. “Comparing Face-to-Face and Electronic Discussion in the Second Language Classroom.” *CALICO Journal* 13, no. 2/3: 7–26.
- Warschauer, Mark, and Richard Kern G., eds. 2000. *Network-Based Language Teaching: Concepts and Practice*. Cambridge: Cambridge University Press.
- Yanguas, Iñigo. 2009. “Multimedia Glosses and Their Effect on L2 Text Comprehension and Vocabulary Learning.” *Language Learning & Technology*, 13, no. 2: 48–67.
- Yun, Jeehwan. 2011. “The Effects of Hypertext Glosses on L2 Vocabulary Acquisition: A Meta-Analysis.” *Computer Assisted Language Learning*, 24, no. 1: 39–58.  
Doi:10.1080/09588221.2010.523285.
- Zhao, Yong. 1997. “The Effects of Listeners’ Control of Speech Rate on Second Language Comprehension.” *Applied Linguistics*, 18, no. 1: 49–68.
- Zheng, Dongping, Michael F. Young, Robert A. Brewer, and Manuela Wagner. 2009. “Attitude and Self-Efficacy Change: English Language Learning in Virtual Worlds.” *CALICO Journal*, 27, no. 1: 205–31.

**Biographical Note**

Dorothy M. Chun is Professor of Applied Linguistics at the University of California, Santa Barbara. Her research areas include: L2 phonology and intonation, L2 reading and vocabulary acquisition, computer-assisted language learning (CALL) and telecollaboration for intercultural learning. She has conducted studies on cognitive process in learning with multimedia, has authored courseware for language and culture acquisition, and recently edited a volume on intercultural learning via telecollaboration. She edits the journal *Language Learning & Technology*.