

Facilitating Language Learning Through Technology

A Literature Review on
Computer-Assisted Language Learning



Canadian Association of Second Language Teachers
Association canadienne des professeurs de langues secondes

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CASLT encourages excellence in second and additional language teaching and learning throughout Canada by creating opportunities for professional development, by encouraging research, and by facilitating the sharing of information and the exchange of ideas among second language educators.

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Facilitating Language Learning Through Technology: A Literature Review on Computer-Assisted Language Learning

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ISBN: 978-1-988198-24-8 (print)

ISBN: 978-1-988198-58-3 (digital)

Également offert en français sous le titre : *Faciliter l'apprentissage des langues grâce aux technologies : Une revue de la littérature sur l'apprentissage des langues assisté par ordinateur*

This literature review was conducted to provide information to guide decisions on the use of technology in second language teaching and learning. Although direction was given to the researchers to establish parameters for the task, the content of this document reflects the writers' perspectives on topics and subjects reviewed and does not necessarily reflect the position of CASLT.

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Acknowledgments

CASLT acknowledges the generous contributions of the following individuals in preparing this publication.

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We acknowledge the financial support of the Government of Canada

Canada

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Introduction



CALL, which stands for computer-assisted language learning, has become a catch-all term to encompass any use of technology for language teaching and learning. The results of nearly 40 years of CALL research indicate that computers, tablets, and smartphones can be effective tools that enable learners to work autonomously, to receive individualized feedback, and to be exposed to real-world language in a range of varieties and voices. Technology can be used as an add-on to enhance classroom language teaching, and it can be used as the sole medium for language teaching and learning. Seemingly endless numbers of software packages, websites, and apps at a range of price points promise effective teaching of a range of languages. Recent developments in mobile-assisted language learning (MALL) mean that learners have access to language learning technologies regardless of where they are.

Deciding on which technology to use and then learning how to use it represent onerous tasks for teachers. Training on the practical details of making a given technology work properly in the classroom setting is far different than using it as an individual. More importantly, teachers need to know that the technology they have chosen offers an effective means of achieving learning goals and is thus appropriate for their group of learners.

CASLT has heard the concerns expressed by language teachers about the effective use of technology. As such, they commissioned researchers from the Language

Research Centre (LRC) at the University of Calgary to review and summarize selected research on the effective implementation of CALL inside and outside of language classrooms. The purpose was to focus on the following aspects: basic principles underlying effective CALL resources; research-informed means of targeting listening, speaking, reading, writing, grammar, vocabulary, and pronunciation skills with CALL; effective techniques for engaging learners with target cultures through technology; and an appraisal of systems for assessing learning and providing feedback in CALL.

This theory-neutral literature review, which provides readers with an overview of research into each of these broad areas, is organized into the following sections:

- Effective integration of CALL resources
- Targeting multiliteracies with CALL
- Production and CALL
- Receptive skills and CALL
- Grammar, vocabulary, and CALL
- Culture and CALL
- Assessing learning and providing feedback in CALL

While it would be impossible to provide a comprehensive review of the research in each of these areas, the review that follows provides summaries of seminal and recent literature published in leading scientific journals in each of these areas. It also highlights the implications of this research for Canadian language classrooms.¹

¹ Throughout this review we use “second language” or L2 as a catch-all term to mean any language learned after the age of three. As such, it also applies to third and fourth languages. It does not apply to home languages, including those acquired simultaneously in childhood. First language (L1) refers to one’s mother tongue.

Executive Summary



Effective Integration of CALL Resources

- In order to determine the effectiveness of a given technology to achieve a learning goal, it is important to determine a causal relationship between the use of the technology and learning outcomes.
- The potential benefits of CALL are many, including providing learners with authentic and enhanced linguistic input, pushed linguistic output, and individualized instruction, as well as enabling learners to work autonomously/at their own pace and engage in collaboration. Moreover, the multimodal nature of CALL appeals to students with a range of learning styles.
- When deciding on which CALL resources to use in their classrooms, teachers should consider the types of tasks and tools required, the objective of a given task, the location in which the objectives are to be achieved, students' levels of digital literacy, and how assessment will be carried out.
- In addition, teachers should consider the following: whether a given technology, app, website, or software is pedagogically sound; whether the target linguistic characteristics are salient; whether the materials are authentic; whether learners have opportunities for production; and whether learners receive feedback on their errors.
- Technologies chosen should provide cultural media (including written and spoken texts, images, and videos) that depict the target language and culture as unique, diverse, and dynamic.

- The development of CALL resources should be a collaboration between classroom teachers, researchers, and technology specialists.
- Teachers require a number of skills to integrate technology effectively into their classroom practice. These include, but are not limited to, basic ICT competence, specific technical competence for the software, knowledge to deal with the constraints and affordances of a particular software, skills to create a sense of community within the class via the technology, and techniques for facilitating communicative competence.

Targeting Multiliteracies with CALL

- The proliferation of digital media has changed our notions of literacy and communication. These now include, for example, texts read primarily on digital devices, interactive hypermedia, computer-mediated communication (CMC), collaborative and multimodal writing, and online affinity spaces in which people from different cultural and linguistic backgrounds who share interests come together.
- Exploiting the range of opportunities for connecting learners with authentic resources and social spaces online may promote a dynamic learning environment and critical thinking, offer authentic L2 learning opportunities, and encourage deeper connections with the target culture(s).
- Language learners require new literacies including computer literacy, information literacy, and L2 media literacies.



- Encouraging learners to interact within online communities requires planning in terms of preparing tasks for learners and mediating potential misunderstandings.

Production and CALL

- CALL can be effective in targeting a range of production skills: speaking (including pronunciation), writing, and interactional competence.
- Providing learners with authentic language models plays an important role in the development of production skills.
- Using CALL for speaking tasks may lead to improved fluency, confidence, and willingness to communicate in face-to-face speaking tasks in the target language.
- Comprehensible pronunciation is an attainable goal for language learners. Tasks including high variability phonetic training, audiovisual training that combines listening instruction with an image of a speaker's face and lips, text-to-speech systems, and shadowing may be especially beneficial for the development of comprehensible pronunciation.
- The nature of writing has changed because of new technologies and collaborative writing platforms like wikis, blogs, and Google Docs, and social networking sites like Twitter.
- Interactional competence, which involves pragmatically correct and comprehensible interaction with one's interlocutor (written or spoken), can be successfully targeted via computer-mediated communication and dialogue-based CALL systems.

Receptive Skills and CALL

- Written and spoken texts chosen to target the receptive skills of reading and listening should do the following:
 - a) be targeted at the appropriate proficiency level;
 - b) contain a relevant topic; and c) have the appropriate types of activities for a given group of students.
- Receptive CALL tasks should focus on developing learners' bottom-up (sounds, vocabulary, grammatical structures) and top-down (background knowledge, context) processing of the language.
- The following should be considered when using and/or developing CALL listening tasks: the goal of the task, the characteristics of the audio, the characteristics of the accompanying visuals, the topic, and the amount of instruction learners require to complete the task.
- Technology offers a number of potential benefits for targeting listening skills: providing learners with a range of voices, the opportunity to listen to a speech sample multiple times, options for slowing down speech, and providing images and videos to accompany the audio tracks.
- Reading a text online is different from reading a print text, and the accompanying tasks that learners carry out should also be different. Technology offers a number of potential benefits for targeting reading skills: highlighting vocabulary or target grammatical forms (e.g., through bolding, italicizing) and providing glosses and embedded multimedia links for vocabulary, grammar, or cultural information.

Grammar, Vocabulary, and CALL

- When choosing CALL resources to target grammar and vocabulary, instructors should consider the difficulty of the grammatical forms and vocabulary items, the extent to which students will be required to produce those forms and items, and the level of explicitness of the grammar explanations and vocabulary tasks.
- Tasks that encourage collaboration and the learning of grammar in context as well as those that integrate a range of multimedia sources may be among the most effective.
- CALL activities for vocabulary that have demonstrated effectiveness include flashcards, SMS, glosses, gaming/virtual environments, and subtitling.
- Learners who spend time learning vocabulary items (i.e., parts of speech, L2 definitions, L1 translations, example sentences, and collocations) — for example by writing them down in a paper notebook, by storing them in their own dictionary, or by learning the words with the help of technology (e.g., by actively exploring their use in authentic contexts or online corpora) — may improve in their knowledge of those words.

Culture and CALL

- CALL offers opportunities to promote cultures as being diverse and complex by providing learners with access to authentic resources in a range of media types.
- Teachers are encouraged to make use of CALL to develop students' intercultural communicative competence. Examples include connecting learners to fellow speakers of the language (e.g., native speakers or second language learners living in the country where the language is spoken, heritage language speakers, fellow language learners) through email, social networking sites, and apps that enable multimodal communication.
- Tasks in which learners and their conversation partners create a product (e.g., a blog, video, or podcast) may enable learners to gain a deeper understanding of the target culture(s) and their own culture(s).
- The ultimate success of tasks that encourage students to engage with and reflect upon culture(s) depends a great deal on appropriate planning and sequencing.

Assessing Learning and Providing Feedback in CALL

- CALL allows for quick and efficient assessment and feedback. Computer-adaptive tests and automated evaluation show great promise for the assessment of L2 learning.
- Although online assessment ensures greater access for students, teachers, and test developers, completing an assessment digitally may present a unique set of challenges to learners (e.g., comfort level with the technology, connectivity issues, and quality of recordings) as well as practical and ethical issues (e.g., plagiarism).
- When creating digital assessments — both summative and formative — teachers should ensure that the assessment aligns with the task and ultimately with learning outcomes.
- Intelligent CALL (ICALL) systems allow for immediate diagnosis of errors and more personalized feedback on a range of adaptive and open-ended tasks.
- Elaborated feedback (i.e., providing learners with insights into their errors including an explanation, the correct answer, and suggestions for remedial actions) may be more effective than feedback that simply indicates “right” or “wrong.”
- Learners may benefit more from immediate — as opposed to delayed — feedback on lower-order tasks (e.g., spelling and capitalization). Both delayed and automatic feedback are beneficial for the development of higher-order learning (e.g., developing an argument).

Effective Integration of CALL Resources



Youngs (2019) reminds us of the importance of making informed decisions about using CALL resources, noting that teachers should consider which technology would be better suited for a given task and when it should be avoided altogether (p. 8). The potential benefits of technology for language teaching are many: its capabilities for **providing learners with authentic and enhanced linguistic input, pushed linguistic output and individualized instruction, and enabling learners to work at their own pace and engage in collaboration** are just a few. Youngs (2019) notes that teachers should consider the following when determining whether or not to use technology in their classrooms: the types of tasks and tools students require, the objective of the task, the location in which the objectives are to be achieved, students' levels of digital literacy, and how assessment will be carried out (pp. 33–34).

Basic Principles Underlying Effective CALL Resources

CALL resources have been gaining in popularity since the 1980s. The growth of the internet and the number of CALL resources available mean that teachers need to take a “critical approach in the selection and analysis of resources” (Guth & Helm, 2019, p. 99). They provide the following questions to assist in the selection process (p. 115):

- Who produced the resource and for what purpose and/or audience was it originally intended?

- How does the resource represent language and its cultures and subcultures — multiple, diverse, dynamic, changing or monolithic and static?
- Does the resource allow learners to make connections between their lives and those represented?
- What opportunities for exploration does the resource afford learners?
- Is the resource appropriate for the intended learners?

Given the recent explosion in mobile technologies, many of the language learning resources currently available enable mobile learning, which Duman, Orhon, and Gedik (2015) define as “teaching and learning with the use of mobile technologies such as mobile phones, media players, PDAs, smartphones, and tablet computers, which are potentially available anytime and anywhere” (p. 198). Mobile-assisted language learning (MALL) is distinguished from CALL by the fact that it relies on portable electronic devices. **Researchers have found that the use of mobile devices may lead to greater learner autonomy and may also encourage collaboration among language learners** (e.g., Pellerin, 2014). Within classroom environments, the use of MALL may be affected by teachers' perceptions that mobile devices distract learners and by teachers' general lack of training in the effective use thereof (Van Praag & Sanchez, 2015). Although researchers once distinguished between CALL and mobile-assisted language learning, given the ubiquity of MALL technology, the review that follows does not distinguish between the two.

It is possible to evaluate a number of aspects of a particular CALL technology. When we talk about “**evaluation**,” we can cite Hémard (2004), who notes

that it **“refers to methods, which are employed for the purpose of assessing how a system behaves and is used to carry out certain tasks within a given environment”** (p. 503). In determining the effectiveness of a particular technology, it is important to define what we mean by “effective.” Felix (2005) notes that we can define **effectiveness as “a strong causal relationship between an intervention, such as the use of a particular item of technology in a learning situation and a discernible change in the learning process, the learning climate or the learning achievement”** (pp. 271–272). When researchers evaluate effectiveness from the user perspective, it is possible to investigate, for example, the extent to which learners have achieved learning goals and their satisfaction with a given technology.

Central to the evaluation of the effectiveness of CALL technologies is reference to relevant theoretical and/or pedagogical models. Reeves (2000) notes that a major problem with much of the research on instructional technology lacks “linkage to theoretical foundations” (p. 4), and Shaughnessy (2003) argues that most commercial software is not based on sound pedagogical principles or research findings. Researchers highlight the importance of collaboration among technology specialists, language experts, pedagogues, and researchers in the development of effective CALL technologies (e.g., Shaughnessy, 2003; O’Brien et al., 2019).

The review that follows is divided into three main areas: general findings on CALL effectiveness, development, and evaluation.

Developing Teachers’ Skills to Work with Technology

The results of a recent review of the literature demonstrate that many language teachers consider CALL to be a “supplemental instructional tool” (Alsuhaibani, 2019). A more careful analysis of the data points to the fact that teachers’ attitudes toward CALL may be rooted in a lack of knowledge, training, and experience. When CALL resources are used in the classroom, it is important to provide training to both teachers and students in the selection and proper use of the technologies (Levy, 2009). In addition, teachers and students who are aware of the potential benefits of technology are more likely to adopt

and use it (Hong, 2010; Levy, 2009; Sydorenko, Hsieh, Ahn, & Arnold, 2017). **Hampel and Stickler (2005) outline the skills that teachers need in order to successfully integrate technology into their teaching practice. They include the following:**

1. Basic ICT competence
2. Specific technical competence for the software
3. Knowledge to deal with constraints and affordances of a particular software
4. Skills to create a sense of community
5. Facilitating communicative competence
6. Creativity and choice
7. Ability to develop one’s personal teaching style

Research has demonstrated that CALL instruction should begin in teacher training programs (Hampel, 2009) and that developing a community of practice — for example, by using common blogs and virtual platforms — may introduce teachers to the pedagogical tools they need to incorporate technology into their language classrooms effectively (Murugaiah, Azman, Ya’acob, & Thang, 2010). Reinders and Benson (2017) point to the important role played by technology-enhanced learning in the teaching and learning of languages beyond the classroom (LBC), and they point to the important role played by teachers in supporting students’ LBC activities.

Literature Review

Basic Principles Underlying Effective CALL Resources

CALL Effectiveness

Burston, J. (2014). **A survey of MALL curriculum integration: What the published research doesn’t tell.** *CALICO Journal*, 31(3), 303–322.

- This paper looks at the uptake of MALL (mobile-assisted language learning) applications, developed through research projects, into curriculum following an initial project. Over the past 20 years, more than 345 experimental MALL projects have been undertaken, but these projects are usually short-lived with little follow-up or broader scale implementation. The study investigated the extent to which MALL has been integrated into curricula as well as the factors that have facilitated or hampered integration. A survey was issued

to MALL practitioners during a 6-week period to gauge the curricular integration of MALL projects. A total of 138 authors of projects between 1994 and 2012 were contacted, and 70 researchers completed the survey. The survey contained five open-ended questions on the author and project and 20 Likert scale questions about facilitation and inhibition of curricular integration of the project. Data collected from the survey reveal that 60% of projects were integrated into the curriculum, with half of integrations occurring at the individual class level. A quarter of integrations were at the course level and a quarter were at the program level. **Influential factors affecting the integration of MALL applications into curricula included pedagogical results/success and reactions of students and instructors. The greatest hinderance to curricular integration was lack of financial support with the second greatest being lack of curricular flexibility.**

Duman, G., Orhon, G., & Gedik, N. (2015). Research trends in mobile assisted language learning from 2000 to 2012. *ReCALL: The Journal of EUROCALL*, 27(2), 197-216.

- This paper provides a summary of research (i.e., a total of 69 papers) into mobile-assisted language learning (MALL) over the 12-year period of 2000 to 2012. The review focuses on a number of aspects of research into MALL including trends, types of technology used, and methodologies. The authors note that much of the research carried out in MALL has focused on vocabulary teaching and that studies investigating usability and learner attitudes toward CALL are also quite common. Although a relatively large number of the reviewed studies ($n = 26$ or 38%) did not rely on a theoretical framework or a specific approach to teaching and learning, the largest number ($n = 33$ or 47%) focused on learning approaches including collaborative learning, interactive learning, ubiquitous learning, informal learning, task-based learning, and peer-assisted learning. The authors note that this lack of connection to theory and/or pedagogy “suggests possible methodological weaknesses” (p. 203). Most of the studies reviewed ($n = 38$ or 55%) made use of a mobile-only learning environment, and other environments included a combination of mobile learning and face-to-face or distance courses. The researchers also noted that many of the studies investigating the effectiveness

of MALL technologies are carried out without control groups. **MALL developers are encouraged to ensure that their technology aligns with theory and relies on best practices in language pedagogy. Researchers investigating the effectiveness of MALL are encouraged to make use of a control group so that learning gains can be attributed to the use of MALL as opposed to normal learning that takes place over time.**

Felix, U. (2005). What do meta-analyses tell us about CALL effectiveness? *ReCALL: The Journal of EUROCALL*, 17(2), 269-288.

- In this paper, the author provides a meta-analysis of several hundred CALL studies published since 1991 with more than 20,000 research participants overall. The ultimate goals of the contribution include demonstrating the benefits and limitations of CALL research and synthesizing findings. The author reports that much of the research into CALL effectiveness is small scale and is experimental, quasi-experimental, or non-experimental and investigates the effectiveness of a single intervention without reporting on the extent to which improvement is made over time. While conclusive results (i.e., statistically significant) point to the positive impact of CALL, the author notes that much research is inconclusive. **Overall, the synthesis of research demonstrates that CALL is generally effective at targeting first language (L1) spelling, L1 writing quality and fluency, and L1 reading. In addition, CALL research generally shows that students who make use of CALL tend to be engaged, that the multimodal nature of CALL appeals to students with a range of learning styles, and that using CALL can have a positive impact on students’ attitudes and willingness to participate.**

Shaughnessy, M. (2003). CALL, commercialism and culture: Inherent software design conflicts and their results. *ReCALL: The Journal of EUROCALL*, 15(2), 251-268.

- The goal of this paper is to investigate the extent to which commercial software design practices align with the results of research. The author argues that **although most CALL software is designed by commercial companies and tends to follow certain uniform design principles and shared components, it ignores the results of research.**

The author looks specifically at the representation of L2 cultures and argues that although the linguistic content of the software is often looked after by an expert in the language, the actual design is handled by technology experts as opposed to experts in language teaching and learning. Linguistic inaccuracies may therefore be introduced that include mistakes made by programmers (e.g., omission of special characters in the written form of the language). Cultural inaccuracies are often introduced as a result of shared content. For example, when decisions are made on which visual elements to include, little attention is given to the cultural authenticity of the images. In addition, software is often cloned, meaning that a single interface is quickly adapted to a range of languages without considering the unique structure of a language or the culture(s) in which it is spoken. The author notes, then, that **learners who make use of commercially developed software are often presented with “unreality,” which he defines as “the misrepresentation of the target culture, either by providing incorrect or incomplete information regarding a subject”** (p. 259). Moreover, the author notes that **software designers often recycle older texts, thus resulting in problems related to diversity (e.g., linguistic bias involving sexist or stereotypical representations of men and women or racist representations of individuals from particular groups)**. As a solution, **the author calls for improved evaluation (both formative and summative) of CALL resources — including both technology and cultural content — throughout the development process.**

Development

Chapelle, C. A. (1998). Multimedia CALL: Lessons to be learned from research on instructed SLA. *Language Learning and Technology*, 2(1), 22–34.

- In this seminal paper, Chapelle presents **seven hypotheses relevant for the development of multimedia CALL**. These include the following (pp. 23–25):
 1. The linguistic characteristics of target language input need to be made salient.
 2. Learners should receive help in comprehending semantic and syntactic aspects of linguistic input.
 3. Learners need to have opportunities to produce target language output.

4. Learners need to notice errors in their own output.
5. Learners need to correct their linguistic output.
6. Learners need to engage in target language interaction whose structure can be modified for negotiation of meaning.
7. Learners should engage in L2 tasks designed to maximize opportunities for good interaction.

When it comes to developing multimedia CALL resources, then, Chapelle notes that “it is useful to view multimedia design from the perspective of the input it can provide learners, the output it allows them to produce, the interactions they are able to engage in, and the L2 tasks it supports” (p. 26). Thus, developers should make use of the following criteria as they develop multimedia CALL resources (pp. 27–28):

1. Making key linguistic characteristics salient, for example, by highlighting them in a different colour.
2. Offering modifications of linguistic input. This can happen through repetition, simplification through restatements, non-verbal cues, decreased speed, reference materials, and change of input mode.
3. Providing opportunities for “comprehensible output.” This means that software should be programmed to understand syntactically well-formed and pragmatically appropriate responses.
4. Providing opportunities for learners to notice their own errors.
5. Providing opportunities for learners to correct their linguistic output.
6. Supporting modified interaction between the learner and the computer.
7. Acting as a participant in L2 tasks.

Evaluators of multimedia CALL resources should make use of these criteria in their evaluation thereof.

Hampel, R. (2006). Rethinking task design for the digital age: A framework for language teaching and learning in a synchronous online environment. *ReCALL: The Journal of EUROCALL*, 18(1), 105–121.

- The goal of this paper is to understand how theory-informed tasks, used for language teaching in a face-to-face classroom setting, can be successfully translated into an online computer-mediated communication (CMC) environment. The paper introduces a framework for the creation of pedagogically informed tasks for an online environment.

Tutorials at The Open University for second language learners of German were facilitated using Lyceum, an online content delivery platform. This platform was piloted in 2001 and was complete with audio, video, picture, and whiteboard sharing capabilities. At The Open University, two levels of German courses, with native English speakers, were studied. Each course is a 9-month long distance education course that combines the study of language and culture. In addition to the regular instruction, students have the option of attending up to 21 hours of tutorials over the course of the semester. The goal of the tutorials was to provide a time for students to practice communicative language use, with a focus on meaning. Data were collected using qualitative measures from tutorial observations and recordings and tutor logbooks, questionnaires, and interviews. All tasks were designed to use the interactive capabilities of Lyceum, like graphic/image exchange, audio exchange, and written text exchange. **Results showed that the tutorial instructors generally had positive experiences using CMC tasks based on those used in face-to-face settings. Most tasks needed to be modified in some way, either due to lack of attendance in the tutorial, time constraints, or changing student interest. Some drawbacks of the environment included “dead silence,” difficulties with turn-taking, and slowed communication with less material covered during the tutorial.**

Son, J. B. (Ed.). (2014). *Computer-assisted language learning: Learners, teachers and tools*. Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

- This study examines attitudes towards MALL (mobile-assisted language learning) and provides a comprehensive resource for the development of MALL tasks and task-based lessons. The goal of the study was to identify tasks for ESL students for MALL and classify the task types into the four skills: reading, writing, speaking, and listening. A total of 35 participants at a large US university completed an online questionnaire and eight of those participants completed a qualitative semi-structured interview. Of the questionnaire participants, 22 were Iranian ESL students, ten were ESL instructors, and three were ESL program administrators. A total of four students and four instructors participated in the interviews. From the interviews, participants cited potential for mobile learning based on mobile device portability,

practicality, and accessibility. Participants cited previous engagement with MALL in the forms of vocabulary learning and watching videos. Four categories of challenges were identified for MALL: a) technological limitations (e.g., small screen size); b) cost factors (e.g., smartphone costs); c) environmental factors (e.g., using a PC versus a mobile phone); and d) psychological factors (e.g., mobile devices are primarily seen as entertainment devices). **Desired reading tasks in MALL included reading text on/offline, looking up vocabulary, and Web browsing. Desired speaking tasks included making informal and formal phone calls, practicing voice recording, and video-chatting/CMC. Desired writing tasks included taking notes, sending SMS, posting on social media, and writing emails. Desired listening tasks included listening to music, podcasts, pronunciation practice, and watching videos. Language learning specific tasks included reading course vocabulary and textbooks, answering listening questions, listening to voice messages, writing emails or diary entries.** These results can inform the development process of CALL or MALL apps, so users are able to engage with the apps in desirable and meaningful ways.

Evaluation

Hémond, D. (2004). Enhancing online CALL design: The case for evaluation. *ReCALL: The Journal of EUROCALL*, 16(2), 502-519.

- The author reports on a study investigating the impact of CALL design on the user. Specifically, she is interested in evaluating a particular web-based interactive interface with the ultimate goal of improving usability by refining the interface design, implementation, and integration. She outlines two main types of evaluation: a) formative (i.e., assessment during the design of a particular technology focusing on its behaviour and functionality); and b) summative (i.e., assessment of system usability, user experience, and the impact of the technology). The author includes a number of examples of evaluation including questionnaires, informal feedback, real-life observations, checklists, user walkthrough, focus groups, tracking, and usability testing. Also included is a case study investigating the notion of usability in the context of student interaction with an online tool focusing on French grammar. While the evaluation of this specific technology is not relevant

for this review, the researcher's demonstration that the various evaluation methods are beneficial to the overall development of CALL technology is relevant.

Employing complementary evaluation methods in the design can lead to the development of more effective CALL resources. Ultimately, multi-faceted user analyses — especially when shared among researchers — may lead to more effective CALL practice and research.

Hubbard, P. (2019). Evaluating CALL software. In N. Arnold & L. Ducate (Eds.), *Engaging language learners through CALL* (pp. 390–430). Sheffield, UK: Equinox.

- This chapter discusses the purposes of CALL software evaluation and some major approaches to evaluation, and proposes a new framework that can be used to evaluate CALL software. **Three stages of the evaluative process include selection, implementation, and assessment.** Selection involves investigating a piece of software for a given setting (i.e., a classroom or program). This phase begins with an analysis of technical aspects of the software, teacher fit, learner fit, implementation in the course, and appropriateness judgments for the context. The implementation stage involves identifying ways in which the software can be used and implemented within the setting. An evaluator must consider usage aspects such as software accessibility, preparatory and follow-up activities, site monitoring, program and setting controls, access to student records, and the ability to upload teacher-authored content. A secondary aspect of the implementation phase is the evaluation of required training of both students and teachers on the use of the software. During the final stage — assessment — the effectiveness of the software implementation is determined, and a decision is made regarding whether or not software use should be continued and if adjustments are required. Several methods can be used to judge the fit and success of the software in a given class. Teachers can perform observations, use tracking systems, ask students to complete surveys, have the students keep journals, and perform pre- and post-tests. **This framework can be used to evaluate existing and future CALL software and to inform pedagogically sound software development.**

Jamieson, J., & Chapelle, C. A. (2010). Evaluating CALL use across multiple contexts. *System*, 38(3), 357–369.

- A goal of this paper is to outline a process to produce stable and reliable evaluation results for CALL application evaluations. The proposed evaluation framework, the Unit Reflection Survey, had questions designed to evaluate the following criteria: **language learning potential, meaning focus, learner fit, authenticity, positive impact, and practicality.** The survey was given to 12 classes at six universities in four countries. Quantitative data were gathered from each class regarding their perceptions of the CALL application in use and statistical analysis was performed to determine the appropriateness of the framework across multiple contexts. A total of 221 EFL learners at universities in the USA, Japan, Thailand, and Chile all used the Longman English Interactive CALL program — a video-based multimedia software. Each student participated in a unit reflection survey after each module in the software. Using a 4-point Likert scale, the software was evaluated on a) language learning potential, b) meaning focus, c) learner fit, d) authenticity, e) positive impact, and f) practicality. **The application of the survey and the consistency of results demonstrates the robustness of the unit reflection surveys.**

McMurry, B. L., West, R. E., Rich, P. J., Williams, D. D., Anderson, N. J., & Hartshorn, K. J. (2016). An evaluation framework for CALL. *TESL-EJ*, 20(2), 1–31.

- The authors of this paper reviewed two main existing frameworks for evaluating CALL resources (i.e., Hubbard, 1987, 1988, 1996, 2006, 2011; and Chapelle, 2001). The authors combined the positive aspects of existing frameworks in the development of a new framework, which includes the following:
 - ↳ **Identify the evaluand** (i.e., the object being evaluated): These may include websites and courseware as noted by Hubbard (2011), complete courses, the technology component of a course, or technology pedagogy as suggested by Chapelle (2001, 2007), or platforms, programs, and pedagogy as suggested by Leakey (2011). The authors also note that it is possible to evaluate technologies and activities that are not components of courses and that

we should not limit our evaluations to the hardware. User experience (e.g., a student, teacher, or class using CALL) is also worthy of study.

- ↗ **Identify stakeholders:** Hubbard (1996) explicitly refers to teachers and learners as the primary stakeholders, and Chapelle (2001) names a range of audiences that may be considered potential stakeholders. The authors note that school administrators, parents, and developers should all be considered in evaluation.
- ↗ **Set evaluative criteria:** Hubbard (2011) includes the following criteria in evaluation: technical considerations, operational description, teacher fit, and learner fit. Chapelle (2001) includes language learning potential, learner fit, meaning focus, authenticity, positive impact, and practicality. The authors note that the criteria will differ according to the evaluators.
- ↗ **Define a purpose:** According to Hubbard's framework, this may include selection for a course, selection for self-access or other instructors' use, reviews, and providing feedback for development. Others may include the appeal of a given technology to learners, credibility and reliability of materials, ability to interest and motivate learners and teachers, learning value, perceived value, and flexibility (Tomlinson, 2003).
- ↗ **Select an evaluation type:** According to Chapelle's (2001) framework, this includes teacher judgments, performance data, and synthesis of judgment and performance data. The authors also summarize a number of other types of evaluation (i.e., responsive, illuminative, utilization-focused, and developmental).
- ↗ **Develop evaluation questions:** The authors highlight that it is essential to work with evaluators in the development of the questions.

In addition, the authors point to the need for collecting and analyzing data, reporting the findings, and evaluating the evaluation. Overall, **this paper provides a solid basis for the issues one needs to consider in the development and evaluation of effective CALL materials.**

Rosell-Aguilar, F. (2017). State of the app: A taxonomy and framework for evaluating language learning mobile applications. *CALICO Journal*, 34(2), 243–258.

- The goal of this paper is to introduce a framework for the evaluation of language learning apps. The

proposed framework enables an evaluation of apps in four areas: **technology, pedagogy, user experience, and language learning.** The proposed framework provides a series of questions that aid in the understanding of the app and guide a needs assessment. To evaluate the **language learning potential of an app, the framework asks if there is opportunity for development of all four language skills (i.e., listening, speaking, reading, and writing), in addition to grammar, vocabulary, pronunciation, and cultural information. In the area of pedagogy, the framework evaluates an app based on the app's teaching model, how it tracks a user's progress, if there is scaffolding, feedback, language level differentiation, and how the app keeps users engaged.** When it comes to **the evaluation of user experience, the framework proposes that the app be judged in terms of its interactivity, content sharing opportunities, opportunities for badges and progress recognition, price, registration, and lack of advertisements.** Finally, **in terms of technology, an app is evaluated based on the interface, the navigation, available instructions, stability across platforms, content gamification, technological support, and offline capabilities.** The framework was evaluated twice by two groups of instructors (a total of 44 instructors). Both groups cited positive views of the framework. **This framework is not only informative for app evaluation, but also app development.**

Villada, E. G. (2009). CALL evaluation for early foreign language learning: A review of the literature and a framework for evaluation. *CALICO Journal*, 26(2), 363–389.

- This paper contains both a review of the literature into CALL evaluation and a framework for CALL evaluation. The author reviews 24 CALL evaluation frameworks put forward between 1983 and 2003. Overall, the **majority of frameworks have been developed for the following purposes:**
 - ↗ To select materials
 - ↗ To establish criteria for designing or selecting materials
 - ↗ To determine the effectiveness of existing materials
 - ↗ To judge the design of materials

The author notes that the previous evaluation models tend to reflect the perspective of the teacher or the

developer. He notes that it is important to consider a number of language-specific aspects when evaluating CALL resources. These include, for example, the context of language learning, language learning theories, and instructional design. He highlights the benefits of models such as Squires and McDougall's (1994) Perspectives Interactions Paradigm and **points to the need for teachers, designers, and students to engage in a three-way conversation about the effectiveness of various tools. The author's proposed interpretivist evaluation for CALL resources ensures that the needs of teachers and students are met through a consistent dialogue with CALL designers.**

Developing Teachers' Skills to Work with Technology

Hampel, R., & Stickler, U. (2005). **New skills for new classrooms: Training tutors to teach languages online. *Computer Assisted Language Learning*, 18(4), 311–326.**

- The paper describes the skills required of language tutors in an online environment. These skills are presented in the form of a pyramid, thus the name "pyramid of skills." This study draws on another study reporting on the practical implementation of online tutor training at The Open University in the UK. **The researchers claim that in order to fulfil their role, online instructors have to not only help students develop their technical skills in using the virtual environment, but also constantly be aware of the benefits and challenges of online learning. In fact, instructors must be familiar with the technology and know about the implications of the medium in the context of teaching language.** They also claim that "the online language teaching skills build on one another in a kind of pyramid, from the most general skills forming a fairly broad base to an apex of individual and personal teaching styles." These seven levels of skills comprise both the technical and pedagogical expertise of using the technology:

1. **Basic ICT competence** (competence in the use of networked computers, including the use of keyboard and mouse, and familiarity with commands and applications, e.g., word processing, internet)
2. **Specific technical competence for the software** (skills necessary to use the specific

software application needed to teach, e.g., Blackboard, Lyceum)

3. **Dealing with constraints and possibilities of the medium** (knowledge to deal with constraints and affordances of a particular software being used in the teaching)
4. **Online socialization** (skills to create a sense of community in the classroom)
5. **Facilitating communicative competence** (can be achieved through task design)
6. **Creativity and choice** (demonstrated in designing online activities with the communicative principles in mind)
7. **A teacher's own style** (ability to develop one's personal teaching style using the media and materials to promote active and communicative language)

The pyramid of skills was revised by Stickler and Hampel (2015). They suggested that a transversal skill (across levels) be added to focus on "negotiating online learning spaces." **The study suggests that online tutors should be prepared to change and adapt their teaching styles according to new developments in the pedagogy of online language teaching.**

Hampel, R. (2009). **Training teachers for the multimedia age: Developing teacher expertise to enhance online learner interaction and collaboration. *Innovation in Language Learning and Teaching*, 3(1), 35–50.**

- This paper reports on two studies undertaken to inform a new generation of blended language courses at The Open University, UK. The first study focused on the skills that teachers need to teach in a complex online environment to foster interaction and collaboration in online language learning. The second study examines the pre-service and in-service teacher-training program that distance education teachers at The Open University receive in the context of teaching languages. The study was based on the premise that teachers need to take various aspects into account (e.g., using affordances of multimodal technologies, encouraging learner autonomy, designing tasks appropriate to the online environment) when using online technologies to support interaction and collaboration. The researcher notes that the skills that online tutors need are those outlined in Hampel and Stickler's (2005) pyramid of

skills (see above), which is based on the idea that online language teachers need a range of skills that build on one another, skills that comprise both technical and pedagogical expertise of using technology. The study found that the new generation of language courses at this university was characterized by a blended approach combining traditional distance learning elements (e.g., printed books with interactive DVDs), and a virtual learning environment (VLE), including various activities and tools ranging from quizzes for self-study and individual Web searches to self-reflective blogs and interactive videoconferencing. The findings reveal that students found it very difficult to collaborate in spite of well-designed tasks. This lack of student collaboration brought about the need for teacher training. To that end, a 6-week tutor-training project was created. The training project involved two institutions: one based in Barcelona, Spain, and the other in the UK. Eight researchers (specialists in online and distance language learning and teaching), 20 teachers of French, German, and Spanish, and 14 English teachers took part in the project. The project aimed to train tutors in online tools, developing a sense of community, collaborative task design, and moderation. Data were collected by means of a post-course questionnaire, interviews with eight teachers, and a record of activities on Moodle and Moodle logs. The findings revealed that the guidelines, the training session, and the hands-on use of the tools helped the teachers to discover more about the possibilities and constraints of the medium. Additionally, the training enabled them to incorporate collaborative tasks (e.g., small group activities, employing particular tools for particular purposes) in the activities that they designed. Furthermore, the findings showed that the teachers attributed importance to the training and highlighted the willingness to apply the new skills and knowledge to their own teaching. **The study points to the importance of tailoring CALL training to address specific institutional needs and pedagogical approaches. Moreover, it demonstrates the need to regulate and monitor tutor workload.**

Murugaiah, P., Azman, H., Ya'acob, A., & Thang, S. M. (2010). Blogging in teacher professional development: Its role in building computer-assisted language teaching skills. *International Journal of Education and Development Using Information and Communication Technology, 6(3), 73–87.*

- This study explores the smart (i.e., technology-based) school English teachers' technical skills and pedagogical knowledge required to teach in a technologically enriched environment. Twenty Malaysian teachers from five smart schools participated in the study by blogging about their experiences. They were divided into three cohorts: English, mathematics, and science. Three blogsites were created, one for each cohort through which teachers collaborated. Teachers collaborated through two online tools: blogs and virtual interactive platform (VIP) that enabled discussion of issues related to their teaching practice. While there were three cohorts in the project, the results presented in this paper are from only the English cohort, which consisted of five female teachers whose teaching experience ranged from five to 18 years. The analysis was based on the blogging activity conducted over a duration of five months. The researchers completed a textual analysis of the blog posts to reveal the teachers' current CALL skills levels as outlined in Hampel and Stickler's (2005) pyramid of skills. They also examined the teachers' interactions to find out how blogging exposed them to the technical and pedagogical skills necessary for teaching in a technologically driven teaching environment. The findings revealed that the blogging activity exposed teachers to the skills proposed by Hampel and Stickler (2005) and helped them to enhance their existing competences. Furthermore, the blogs demonstrated how new ways of using IT in teaching were shared and learned by the participants. **The study suggests that online activities, such as blogging, may help teachers to equip themselves with the relevant ICT skills useful in their daily practice.**

For an additional study that demonstrates the positive impact of blogging on teachers' skill development, see Wang and Hsua (2008).

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Targeting Multiliteracies with CALL

Multiliteracies, which are embedded in digital literacies, are defined by Hafner, Chik, and Jones (2015) as **“the practices of reading, writing and communication made possible by digital media”** (p. 1). These have changed our notions of literacy and communication. Some of the changes include interactive hypermedia, computer-mediated communication (CMC), collaborative writing, and “globalized, online affinity spaces” in which people from different cultural and linguistic backgrounds who share interests are able to come together (Hafner et al., 2015, p. 1). Reinhardt and Thorne (2019) note that we no longer simply consume “read only” texts but that we become participants when texts are “copied remixed, and shared” (p. 211). Literacy has therefore morphed into a social, interactive, participatory practice (Reinhardt & Thorne, 2019, p. 211). As such, **notions of what it means to teach and learn languages have shifted, especially in terms of language learners’ needs and the context of language learning** (Hafner et al., 2015). In her review of the role of technology in L2 research, Chun (2016) predicts a full integration of technology into L2 teaching, learning, and research. She highlights the benefits as follows:

Digital technologies make possible new kinds of texts, allowing writing to be combined with audio, images, music and video in a single document. Language is now just one mode for making meaning among many others, and L2 learners must be able to make culturally encoded connections between forms, contexts, and meaning in a variety of mediums. (pp. 105–106)

Given the ubiquity of a range of media from a plethora of more and less reputable sources, Reinhardt and Thorne (2019) note that it is essential for teachers to design

activities to develop students’ digital literacies. They say that learners require **computer literacy, as they often need to learn how to use a given technology properly** (p. 220). Learners also require **information literacy, or a critical awareness, curiosity, and skepticism about the information they receive** (pp. 220–221). Because many of the tools used in their classrooms come from non-academic contexts, learners might not be willing to treat them critically (e.g., Facebook, games). As such, today’s learners also require **L2 media literacies, or a “critical awareness of media in society and the ideological origins of media discourses”** (p. 222).

Hafner et al. (2015) outline a range of dimensions of digital literacies as well as the affordances of digital tools. They note that **our ways of doing have changed as a result of digital tools**. For example, the ways we share pictures or search for an address are now completely different. This means that language teachers need to consider how to manage this sort of information effectively with digital tools. Other practices that have changed as a result of digital tools include, for example, reading websites online, posting to social networking sites, writing fan fiction, writing and commenting on blog posts, communicating through CMC, being a member of a social networking site, and adopting roles in other online (e.g., fan, gaming) communities. **Our ways of relating have also changed, which has changed our patterns of interaction**. As such, Hamel (2019) suggests that language learners should develop a “social interaction” literacy alongside “multimodal and media” literacies. This means, then, that teachers need to consider the extent to which digital tools can be used to manage relationships,

attract online audiences, and collaborate with peers. **One further example of a changed dimension is our social identity.** Therefore, teachers need to consider the extent to which digital tools can be used to manage impressions and create and maintain online identities in the classroom (Hafner et al., 2015, pp. 2–3).

Literature Review

Blattner, G., & Fiori, M. (2011). Virtual social network communities: An investigation of language learners' development of sociopragmatic awareness and multiliteracy skills. *CALICO Journal*, 29(1), 24–43.

- This study investigates the use of a social networking community (SNC) — Facebook — in the context of a language class to promote sociopragmatic awareness and multiliteracy skills. It looks at the importance of developing sociopragmatic knowledge (the ability to use a language, such as forms of address, in a variety of communication situations) while learning an L2. In addition, the researchers were interested in determining how the integration of Facebook in the classroom provided language teachers with an easily accessible tool that allowed learners to enhance their abilities to interact in a specific electronic environment. The study aimed to a) suggest a means to promote sociopragmatic development through technological applications in a way that encourages interpretation and collaboration and b) address multiliteracy skills development. The participants were 13 undergraduate students (19–24 years) in an intermediate-level Spanish culture course at a private college during the fall term of 2008. The students had to create Facebook accounts, after which they had to join the academic group created by their professor. The task required them to find and post to three different Facebook groups whose content was thematically related to each of the three units covered in the course. They had to identify, examine, reflect upon, and analyze the language posted in the Facebook groups chosen for a specific unit in terms of greetings, leave taking, and the vocabulary used. The data were from the students' written assignments and follow-up discussions in class. The findings revealed that the students used norms in greetings in the context of Facebook discussion forums, which is “the first step in the recognition of this electronic discourse as a genre” (Hanna & de Nooy,

2003). Additionally, the researchers report that students demonstrated multiliteracy development in that they associated particular greetings with the appropriate communicative context. Furthermore, the findings reveal that participating in this kind of SNC activity provides cultural information that stimulates language learners to autonomously explore a target culture and thereby actively engage in the use of authentic source materials. **The study suggests that language teachers may show learners how to exploit social networking sites such as Facebook for academic purposes to create a dynamic learning environment, promote critical thinking, offer authentic L2 learning opportunities, and make deeper connections with the target culture(s).**

Hepple, E., Sockhill, M., Tan, A., & Alford, J. (2014). Multiliteracies pedagogy: Creation of claymations with adolescent, post-beginner English language learners. *Journal of Adolescent and Adult Literacy*, 53(3), 219–229.

- The paper investigates the benefits experienced by three adolescent English language learners who participated in claymation projects as well as the teachers' reflections on using claymation (i.e., the process of stop-action filming of clay figures) as a way of meeting the students' diverse language and literacy needs within the constraints of their teaching context. The project took place in a high school in Australia, and it involved eleven post-beginner students of English from different cultural and linguistic backgrounds. Most of them spoke more than three languages, and had received their schooling in refugee camps. Data analysis is mainly based on three students who represented a range of language proficiency levels within the class. They had noteworthy engagement with the claymation process. The results presented in this paper are from two claymation projects involving adapting the storyline of two movies. The findings revealed that the pedagogy used promoted learner agency, which presupposes “construction of knowledge and understanding in which all members play an active role” (Wallace, 2001). Furthermore, the multimodal approach allowed student ownership of the work, leading to engagement and sustained collaboration. Working collaboratively to produce multimodal texts provided a student-initiated learning environment. In addition, the study demonstrated that **students engaged in a claymation project used a range of linguistic,**

visual, auditory, spatial, tactile, and gestural design modes: creating content for the storyboard, designing and photographing the clay models, constructing the written narrative, and designing the special effects for their film animation. The researchers acknowledge that claymation is just one example of the potential of multiliteracies pedagogy to extend students' language development and literacy capabilities. **The study suggests that multiliteracies pedagogy can help teachers to address the complexity of mainstream literacy classrooms that have culturally and linguistically diverse students.**

Lee, Y., Ardeshiri, M., & Cummins, J. (2016). A computer-assisted multiliteracies programme as an alternative approach to EFL instruction. *Technology, Pedagogy and Education*, 25(5), 595–612.

- The study investigates a computer-assisted multiliteracies program (CaMP), an interactive EFL learning and teaching approach based on the concept of multiliteracies. A 3-week-long CaMP was implemented in an English communication course in a Korean public middle school. Its aim was to connect two EFL classes in different cultural contexts in order to provide students with a series of intercultural opportunities using English. One class was composed of Korean students in Grades 7–9 ($n = 23$) who were mostly beginners in English. The partner class consisted of Iranian students ($n = 22$) attending different schools in the same neighbourhood. The two classes were connected through various CMC tools, and each student was paired with a student from the other class. The CaMP had five learning stages (introduction, individual reading, collective writing, intercultural communication, and reflection) and seven multiliteracies tasks (e-Profile writing, e-Text reading, collaborative media project, class-to-class communication, one-to-one communication, e-Conference, and e-Blogging). The findings indicate that students were able to use personal spaces to practice their writing, brainstorm ideas, and collect resources. The students also reported that the project helped them to change their perspectives on the English language and made them to want to learn more about diverse cultures. However, they also reported limitations to their learning experiences in the CaMP such that their level of English limited their conversation to a rather superficial level, and the heavy workload of the program may be too

taxing during regular school semesters. **The study suggests that effective application of different CMC tools based on a well-developed instructional model may enhance language learners' motivation and language skills.**

Ming, S. T., Sim, Y. L., Mahmud, N., Kee, L. L., Zabidi, A. N., & Ismail, K. (2013). Enhancing 21st century learning skills via digital storytelling: Voices of Malaysian teachers and undergraduates. *Procedia*, 118, 489–494.

- The study explores how digital storytelling (DST) was used to enhance language teaching and learning in a tertiary setting. It specifically investigated the use of DST in the teaching of English for Academic Purposes (EAP) in Malaysia. The project used Photo Story 3 as the software application for the creation of digital stories. A group-based activity approach was used, involving 4–5 students per group. The teacher evaluated the students' digital stories at the end of the semester. The researcher used a questionnaire to identify students' attitudes and benefits of the project and an interview with the teachers of that particular course. The findings reveal an improvement in the students' ICT, language, collaborative learning, and autonomous learning skills. The teachers, on the other hand, observed that DST broadened learners' communication and creative thinking. **The study suggests that teachers should be trained in the use of new technologies and that they should embrace effective technological innovations, as they enable students to build conceptual and multiliteracy skills.**

Pirbhai-Illich, F. (2010). Aboriginal students engaging and struggling with critical multiliteracies. *Journal of Adolescent and Adult Literacy*, 54(4), 257–266.

- The study reports on the teacher participant's and the researcher's attempt to create an engaging learning environment in an alternate school setting by giving access to technology through a critical multiliteracies approach. The research was carried out in a private, non-profit school. Students who had been identified as problematic in mainstream schools were enrolled in this school whose main objective was to teach them educational and social skills to enable them to re-enter mainstream schools. The study was conducted in a split Grade 7/8 classroom. The participants (three females and five males) had literacy levels ranging from Grade 1

to Grade 8. None of them spoke an Indigenous language and all had limited exposure to traditions (e.g., the sweat lodge, smudging, powwows, dance, and music). In addition, the students — all from low-income and single-parent families — had each attended between three to eight schools prior to joining the school under study. This was a classroom action research project involving a teacher participant and her students for a period of three years and two research cycles. Cycle 1 involved ways of scaffolding both traditional print-based literacies and multiliteracies using a genre-based approach, which required students to complete a critical literacy assignment on the theme of Indigenous identity. The results from cycle 1 showed that students displayed signs of disengagement and resistance to traditional pedagogy. They also indicated that there was a need to rethink concepts involved in critical literacy instruction when working with marginalized youth. Cycle 2 of the project involved the use of digital media. It drew on students' cultural knowledge to allow them to use their technological knowledge and interest in computers and the internet to communicate their ideas. The findings from cycle 2 indicated that students' attendance and literacy levels improved. Additionally, students used computer technologies and their knowledge to tell stories and construct meaningful messages that would help others. **The study suggests that engaging diverse students may be enhanced by tapping into their interest in using digital media, accepting their lived experiences, and inviting them to use their funds of knowledge in multiliteracies.**

Yelland, J. N. (2018). A pedagogy of multiliteracies: Young children and multimodal learning with tablets. *British Journal of Educational Technology*, 49(5), 847–858.

- The study explores and documents pedagogical contexts for using tablet technology (iPads, Surface Pro, Asus) in early learning scenarios in Australia. The purpose of the project was to consider the potential for new learning with new technologies and to support teachers to use tablets to reconceptualize their pedagogies and practices in early years. The study was based on the supposition that the essential difference about learning in the 21st century is its multimodal nature, and that multimodality, not digital, should be the focus for early learning ecologies. The project was a 4-year study involving a total of 459 children (2–12 years of age), 17 teachers, and 10 pre-school

teachers. Educators discussed effective pedagogies in using the apps and incorporating them with other play-based pedagogies. The data used in this study were from three sources: daily reflective notes (e.g., descriptions of the children using apps and conversations with them), interviews with the teachers in the school and centres, and conversations with the teachers during the visits. The findings indicated three essential ways that tablets could contribute to the new learning: a) the acquisition of foundational literacy (e.g., letter recognition and phonics, basic vocabulary) and numeracy skills; b) creation of multimodal texts; and c) rethinking pedagogies to incorporate the use of tablets in documenting learning, providing explicit scaffolding, incorporating authentic activities, and communicating ideas with real audiences. The findings also revealed that carefully chosen apps, used alongside other traditional resources (books, cards, crayons), encouraged the development of early literacy concepts in dynamic interactive and multimodal contexts that built on and extended their real-world play experiences. **The study suggests that using new technologies to complement and build on other resources and real-world experiences can benefit new learning and enable educators to provide the most responsive learning ecologies for all children.**

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Production and CALL



Language learners in communicative classrooms are expected to produce the target language from the outset of their language learning journey. These productions are in the form of spoken utterances and written texts produced as the outcome of a (language learning) task that may be individual or collaborative, involving classroom peers and/or the online community at large. Regardless of the motivation for learners to produce language, it is up to teachers to determine the focus of a given production task.

In order to learn how to produce appropriate written or spoken language, L2 learners require good models. For example, if we want learners to write an email complaining about a particular service or produce a how-to YouTube video, they need to determine what each looks like when produced by and for native speakers. When choosing CALL resources that target speaking and writing, teachers should consider both the linguistic level and the appropriateness of the content of examples provided to learners. This includes providing learners with the relevant vocabulary and grammar as well as a set of strategies to determine how to produce language appropriate for a given audience. Moreover, speaking and writing instruction should focus on the importance of learners both as producers (i.e., speakers or writers) and partners in the interactional process. As such, CALL technologies should focus on developing both comprehensible written and spoken output and interactional competence.

Speaking

Beyond using the words and the grammar of the L2 appropriately, speaking requires learners to be in control of the speech sounds, pronunciation features like word stress, intonation, and notions of what it means to interact in appropriate ways. CALL resources that enable learners to practice their speaking skills often require them to listen to a speech model and either repeat after or respond to that model (e.g., Becker, 2017). A goal of this kind of speaking practice is often fluency (i.e., speech fluidity, which corresponds to a spoken language free from pauses, false starts, and self-repetitions [Munro & Derwing, 2015]).

When interacting with others, a learner's willingness to communicate, or "a readiness to enter into discourse at a particular time with a specific person or persons using a L2" (MacIntyre et al., 1988, p. 547), **plays a central role**, in particular in synchronous speech situations where learners participate in live conversations online. Recent research has demonstrated that using CALL resources that require learners to practice speaking the target language may lead to positive developments in learner fluency, confidence, and willingness to communicate in face-to-face tasks in the target language (Buckingham & Alpaslan, 2017; Sydorenko, Daurio, & Thorne, 2018). Speaking tasks in online, telecollaborative exchanges (e.g., Guth & Helm, 2010, 2011; O'Dowd, 2007) in which L2 learners are paired with native speakers may be especially beneficial for pragmatic development (Cunningham,

2016). In addition, CALL speaking tasks that encourage learners to access authentic language (Peyghambarian, Ashraf, & Fatemi, 2014) and those that enable learners to create multimedia stories in the L2 may be beneficial for the development of L2 speaking proficiency (Hwang et al., 2016). Making use of online tasks that require learners to share their speaking tasks on class-specific social networking sites may encourage the development of speaking fluency (Sun et al., 2017).

Pronunciation

An important aspect of effective speaking is **comprehensible pronunciation**, which is defined as **“the ease or difficulty with which a listener understands L2 accented speech”** (Derwing, Munro, & Thomson, 2008, p. 360). Pronunciation researchers tend to agree that anyone who learns a language after about the age of six will speak that language with some degree of foreign accent (Flege et al., 2006), or the pronunciation will differ from an expected native-like norm (Kennedy & Trofimovich, 2008, p. 461). Research in the area of computer-assisted pronunciation teaching (CAPT) has demonstrated that it is possible to target pronunciation effectively via technology in ways that improve learners’ comprehensibility (O’Brien, 2019). CAPT is an ideal use of technology for language learning, as many learners report wanting to focus on pronunciation (e.g., Foote, Holtby, & Derwing, 2011) while their teachers indicate that they either do not have the training or the time to focus on pronunciation in their classrooms (e.g., Hedgcock & Lefkowitz, 2000; Murphy, 2014). Research has demonstrated improved comprehensibility when language learners can focus on improving their perception and production of individual speech sounds as well as prosodic aspects of speech (i.e., word and sentence stress, rhythm, and intonation [O’Brien, 2019]). **Research has demonstrated that the following types of CAPT can improve language learners’ comprehensibility:**

- High variability phonetic training
- Audiovisual training that combines listening instruction with an image of a speaker’s face and lips
- Text-to-speech systems
- Shadowing

An area that deserves attention is the use of speech recognition software, including both speech-to-text conversion (i.e., dictation) software and software

designed especially for language learners. Although some researchers found that some adult language learners appreciate using commercial dictation software (e.g., McCrocklin, 2016), others recommend against using it, primarily because the systems have difficulty understanding accented speech (e.g., Derwing & Munro, 2015).

Writing

Elola and Oskoz (2019) note that **the nature of our writing has changed with the introduction of new technologies** like wikis, blogs, social networking sites, and Twitter. They note that writing is no longer a solitary act, as technologies like wikis and Google Docs have transformed writing into a collaborative task. The notion of audience and the way in which ideas are exchanged have also shifted through the introduction of technologies like Twitter and Facebook. Moreover, digital tools encourage the inclusion of images and sound (p. 241).

Technologies used to focus on writing development can extend from a focus on teaching learners to spell to encouraging them to write much longer, coherent texts. Elola and Oskoz (2019) offer a summary of some of the most commonly used technologies in the language classroom. Their classification includes the following digital tools (p. 245):

- **Asynchronous digital story software**, which allows learners to tell their personal stories while focusing on content, grammar, structure, organization, and incorporating text, pictures, and sound
- **Asynchronous blogs**, which enable learners to write longer written texts while focusing on creativity, content, persuasion, and argumentation, and incorporating both text and images
- **Asynchronous social networking tools** like Facebook allow for fast and immediate responses from users and followers while focusing on vocabulary, grammar, spelling, and incorporating text, images, and sound
- **Asynchronous Twitter**, which encourages immediate responses from followers while encouraging learners to focus on vocabulary and grammar
- **Asynchronous wikis and synchronous Google Docs** enable collaborative writing and encourage learners to focus on organization, coherence, and grammar using text and possibly incorporating images

Research in the field of L2 writing points to the importance of considering one's audience as well as the purpose and genre of writing a given text (Elola & Oskoz, 2019; Xu, Banerjee, Ramirez, Zhu, & Wijekumar, 2019). Whereas language learners' primary audience was once a teacher, new technologies enable writers to share their work with an audience that includes a small group, an entire class, or potentially any user of a given technology around the world (e.g., Andujar, 2016; Dizon, 2016). Xu et al. (2019) demonstrate the importance of providing learners with genre instruction, and Elola and Oskoz (2019) note that when choosing from among the technologies listed above, teachers should carefully consider the genre in which they hope to have students write. Blogs, wikis, and Google Docs allow for the creation of longer texts in a range of genres, whereas digital story software and Twitter are more limited in their application.

Findings of a range of studies point to an improvement in writing when L2 learners use technology as opposed to when they do not (Dizon, 2016; Xu et al., 2019; Zhu, Shum, Tse, & Liu, 2016). Research has demonstrated the benefits of using technology for collaborative writing (e.g., Bikowski & Vithanage, 2016) and peer feedback (Chen, 2016). In addition, research has demonstrated an improvement in writing fluency and accuracy among learners who were encouraged to practice their L2 writing through instant messages (Andujar, 2016) and Facebook posts to their class (Andujar, 2016; Dizon, 2016). Additionally, tools such as podcasts that focus on the development of writing skills (e.g., Bamanger & Alhassan, 2015) and the judicious use of online translation software (e.g., Kol, Schcolnik, & Spector-Cohen, 2018) may encourage more complex, accurate L2 writing. Overall, teachers are encouraged to consider the ultimate goals of a given writing assignment when designing CALL written tasks.

Interactional Competence

Language learners must know not only how to put together grammatically correct utterances, but also how to interact in the target language in the real world (e.g., Ollivier, 2018). It is therefore essential that they learn how to communicate with other language users. **Because conversations involve input, output, the negotiation of meaning, and feedback from conversational partners within a given context, language learners need to develop interactional competence.** Kramersch (1986) notes that **interactional competence involves**

“face-to-face interaction between two or several speakers, or the interaction between a reader and a written text,” and she goes further to indicate that interaction can only be successful when interaction partners share knowledge of the world and a social context (p. 367). Young (2011, p. 440) notes that interactional competence includes the following features:

- Both spoken and non-verbal aspects
- Pragmatics of interaction, which includes the relationship between the language a person uses (e.g., formal vs. informal pronouns) and the social context
- A shared mental context
- The social, institutional, political, and historical context

In order for learners to develop their interactional competence through CALL, they should carry out challenging tasks with clear goals and that require them to negotiate meaning with their conversation partners. When designing tasks that require learners to interact with other language users, it is important that the tasks be carefully designed to align with students' linguistic abilities and interests. One way in which learners can develop interactional competence is through computer-mediated communication (CMC), which includes text-based or spoken technology-mediated synchronous or asynchronous conversations in the target language. Lin (2014) notes that CMC applications “closely approximate authentic communications” (p. 120), and the results of his meta-analysis confirm that electronic discussions for language learning promote interactional competence. Chappelle and Jamieson (2008) note that the written medium of CMC enables learners to reflect on and plan their language. CMC can rely on a range of technologies including social networking sites, virtual reality, and gaming (Goertler, 2009, p. 75).

An alternative to CMC is dialogue-based CALL, autonomous systems in which interaction takes place *with* the computer (i.e., with chatbots, conversational agents, and robots), instead of *through* the computer. In their recent synthesis of the research, Bibauw, François, and Desmet (2019) indicate that this interaction is made possible through technologies including intelligent tutoring systems and automatic speech recognition. The results of a study by Vlugter, Knott, McDonald, and Hall (2009) demonstrates the potential of dialogue-based systems for promoting interactional competence. While the researchers note that dialogue-based CALL encourages interaction and enables learners to work autonomously, there are still a number of technological

and instructional challenges (Bibauw et al., 2019, pp. 2–3). Nonetheless, they report that the results of recent effectiveness studies show increased confidence, motivation, willingness to communicate, and language proficiency among learners who use dialogue-based CALL systems.

Literature Review

Speaking

Buckingham, L., & Alpaslan, R. S. (2017). Promoting speaking proficiency and willingness to communicate in Turkish young learners of English through asynchronous computer-mediated practice. *System*, 65, 25–37.

- This study examines the effects of asynchronous computer-mediated speaking homework practice via audio-visual communicative exercises. The goal was to investigate if the creation of audio-visual recordings improved learner speaking proficiency and willingness to communicate. Forty Grade 3 beginner-level EFL learners (8–9 years old) from an elementary school in Turkey with Turkish as their L1 participated in the study (experimental group — all boys: $n = 19$; control group — all girls: $n = 21$). The participants were assigned four monthly homework activities, each to be completed within three days. The experimental group was assigned audio-visual communicative exercises for which they were prompted to create videos recording their answers to questions asked by the teacher in a video format. The control group was assigned worksheets on the same topic to be completed by hand. Both groups received written feedback. Speaking proficiency was measured using a pre-test/post-test research design through an oral picture description test. Tests were assigned scores by one of the researchers and one of the teachers. Results indicated significant increases in speaking proficiency in the experimental group, but not in the control group. The experimental group also significantly outperformed the control group on the post-test. Results indicate that students spoke with fewer pauses and hesitations, which translates into a greater ease in their speaking fluency. Overall, the results suggest that asynchronous computer-mediated speaking homework practice may lead to greater speaking proficiency learning gains in an EFL context. **Creating audio-visual**

recordings may be particularly beneficial for the development of oral proficiency and willingness to communicate, as they afford opportunities for oral rehearsal and meaningful feedback from the teacher.

Cunningham, J. (2016). Request modification in synchronous computer-mediated communication: The role of focused instruction. *The Modern Language Journal*, 100(2), 483–507.

- This study examines the effects of telecollaboration through synchronous computer-mediated communication (SCMC) via the desktop Web conferencing software Adobe Connect Pro, supplemented by focused instruction on the acquisition of the pragmatic feature of *requests*. The goal of this study was to investigate if SCMC, supplemented by focused instruction, led to changes in the production of requests. Seventeen beginner to advanced learners of German at a university in the US were enrolled in a German business language course. The study was repeated twice over two consecutive semesters (cohort 1: $n = 9$; cohort 2: $n = 8$). Each cohort took part in two experiment sessions with a focused instruction module between the two sessions. The first session consisted of two 1-hour Web conferences where student pairs or groups of three conversed with an expert German speaker. After analyzing the first session for gaps in ability to make requests, a customized 1-week in-class focused instruction module to improve the learners' ability to make appropriate requests was developed and administered. A second session using the same procedure as the first was then held. The requests were coded to determine whether changes occurred between the two sessions. The quantitative analysis revealed no significant difference in the production of requests between the two sessions. However, participants increased their integration of pragmatically appropriate direct requests, as these were suitable for this telecollaboration medium. Moreover, the case studies revealed considerable individual differences. **Overall, the results indicate that SCMC affords opportunities to interact with an expert speaker, which when combined with focused pragmatics instruction, may be beneficial to students, particularly in an environment with limited exposure to expert speakers of the L2.**

Hwang, W.-Y., Shadiev, R., Hsu, J.-L., Huang, Y.-M., Hsu, G.-L., & Lin, Y.-C. (2016). Effects of storytelling to facilitate EFL speaking using Web-based multimedia system. *Computer Assisted Language Learning, 29*(2), 215–241.

- This study examines the effects of digital storytelling on the development of speaking proficiency via a Web-based multimedia storytelling system designed by the researchers. The storytelling system is an interactive platform that allows learners to create, edit and play stories using tools (e.g., text, animation, pictures, voice recordings). The goal of the study was to determine a) the effects of the storytelling system on the learners' speaking proficiency (accent, grammar, vocabulary, fluency, comprehension) and b) the relationship between the animations used within the system and the learners' development in speaking proficiency. Fifty-nine Grade 6 beginner-level EFL learners from an elementary school in China participated in the study (experiment group: $n = 30$; control group: $n = 29$). Over a period of six weeks, both groups were assigned storytelling activities throughout three weekly 1-hour sessions. Learners in both groups created five individual stories during the first three weeks and created four stories in pairs during the second three weeks of the experiment. The learners in the experimental group created the stories using the Web-based multimedia storytelling system. The learners in the control group created the stories using paper and pencil. Speaking proficiency was measured using a pre-test/post-test research design through a multi-task oral test (e.g., short answers, picture description, picture sequencing). Tests were assigned scores by the researchers. The results indicated increases in speaking proficiency for both groups and that the experimental group using the multimedia storytelling system significantly outperformed the control group. The results of surveys and interviews with learners from the experimental group demonstrated that the learners showed positive attitudes toward the use of the storytelling system, and they also reported that they enjoyed the opportunity to incorporate animations into their stories. Overall, the results suggest that storytelling activities using the storytelling system designed by the researchers may encourage higher speaking proficiency. **A Web-based multimedia storytelling system may be particularly beneficial for the development of oral proficiency among young language learners,**

as it affords an engaging environment in which to practice speaking while creating meaningful stories brought to life with animations.

Peyghambarian, F., Ashraf, H., & Fatemi, M. A. (2014). The effect of "GoEnglish.Me" a virtual learning website on lower intermediate Iranian EFL learners speaking ability. *Advances in Language and Literary Studies, 5*(6), 234–238.

- This study examines the effectiveness of the website GoEnglish.Me for the development of speaking proficiency in an EFL context. GoEnglish.Me is an online platform that provides multi-level audio-visual materials and allows learners to interact with other learners and create their own audio-visual recordings. The goal of the study was to determine if there were significant gains in speaking proficiency after using the GoEnglish.Me website. Forty-four lower-intermediate-level adult female learners (experimental group: $n = 22$; control group: $n = 22$) from a language institute in Iran participated in the study. Over the 15-session language course, all participants took part in speaking tasks related to identical topics, but the way in which they completed the tasks varied according to their respective pedagogical approach. Participants in the experimental group practiced speaking through online interactions with other learners and through the creation of audio-visual recordings that allowed the participants to practice pronunciation on GoEnglish.Me. The control group practiced speaking through traditional teaching techniques (e.g., student-teacher interaction, student-student interaction, and repetition) without access to the internet. Learning outcomes were measured using a pre-test/post-test research design through oral questions related to the topics from the speaking tasks. Tests were assigned scores by the researchers. Results indicated learning gains in both groups. The experimental group significantly outperformed the control group on the post-test. Overall, the results suggest that using GoEnglish.Me for the development of speaking proficiency may lead to more learning gains. **Results indicate that speaking tasks that encourage interactions and learner recordings of their own speech may be particularly beneficial for the development of speaking proficiency among language learners, as they afford access to authentic language and exposure to various accents.**

Razagifard, P. (2013). The impact of text-based CMC on improving L2 oral fluency. *Journal of Computer Assisted Learning, 29*, 270–279.

- This study examines the effects of synchronous (via WebCT Chat) and asynchronous (via WebCT bulletin board) text-based computer-mediated communication (CMC) for the development of speaking proficiency in an EFL context. WebCT is a learning management system that offers synchronous and asynchronous CMC platforms. The goal of the study was to determine if there were significant speaking fluency improvements with text-based CMC (synchronous and asynchronous). Sixty-three intermediate-level learners (synchronous CMC experimental group: $n = 21$; asynchronous CMC experimental group: $n = 21$; control group: $n = 21$) were enrolled at a university in Iran. The synchronous CMC experimental group took part in four 45-minute synchronous CMC text sessions with their instructor during which activities were completed. One activity was completed per session (e.g., jigsaw, opinion exchange, problem-solving). The asynchronous CMC experimental group took part in the same activities over the period of four weeks (one activity per week) with the instructor through the asynchronous CMC bulletin board. The control group did not engage in CMC and was not assigned out-of-class activities during the 4-week period of the experiment. Speaking fluency was measured at post-test through a multi-task oral test completed in learner pairs (e.g., picture description, picture sequencing). Tests were assigned scores by the researchers. Results indicated that the synchronous experimental group significantly outperformed both the asynchronous experimental group and the control group in terms of oral fluency (e.g., speech rate, articulation rate). Overall, the results suggest that engaging in synchronous CMC (via WebCT Chat) for the development of speaking proficiency may lead to an improvement in speaking fluency. **Results indicate that synchronous text-based computer-mediated communication may be particularly beneficial for the development of speaking proficiency among language learners, as it affords a real-time text-based communication environment that allows for the transfer of skills from the written environment to oral language.**

Sun, Z., Lin, C.-H., You, J., Shen, H. J., Qi, S., & Luo, L. (2017). Improving the English-speaking skills of young learners through mobile social networking. *Computer-Assisted Language Learning, 30*(3–4), 304–324.

- This study examines the effects of MALL on the development of speaking proficiency via the voice-based social-networking site PaPa. The goal of the study was to determine the speaking proficiency gains (i.e., accuracy, fluency, pronunciation) as well as the learners' attitudes toward the social-networking site. Seventy-two Grade 1 EFL learners (average age: 6.5 years old) from an elementary school in China participated in the study (experimental group: $n = 37$; control group: $n = 35$). Over a period of thirteen weeks, both groups were assigned identical homework. The learners in the experimental group recorded their answers using PaPa and posted a picture, drawing, or photo related to the response on the site. The learners in the control group recorded their answers using any device (without the use of a social networking site) and found a picture or drawing related to the response. Their recordings were not submitted. The teacher provided feedback to random learners in both groups throughout the treatment. Speaking proficiency was measured using a pre-test/post-test research design through a picture-description test. Tests were assigned scores by trained raters. Results indicated significant increases in speaking proficiency in terms of accuracy, fluency, and pronunciation for participants in both groups. The experimental group significantly outperformed the control group in fluency, but accuracy and pronunciation were comparable across the two groups. The results of focus group interviews with learners from the experimental group demonstrate that the learners showed positive attitudes toward the use of PaPa, and they also reported that they enjoyed when their recordings were heard by the teacher. **Results indicate that voice-based social-networking sites may be particularly beneficial for the development of oral proficiency among young language learners, as they afford an encouraging environment to use English in an authentic manner.**

Sydorenko, T., Daurio, P., & Thorne, S. L. (2018). Refining pragmatically-appropriate oral communication via computer-simulated conversations. *Computer Assisted Language Learning*, 31(1-2), 157-180.

- This qualitative case study examines a video-based computer simulation program (SimCon) developed to foster the acquisition of pragmatics. The goal of the current study was to determine the learning outcomes and learner attitudes toward the program. Twelve advanced ESL learners (with first languages of Arabic, Burmese, Pashtu, Spanish, Turkish, and Vietnamese) were enrolled in a 6-week intensive English program at a university in the US to help prepare them for graduate school. The participants took part in six simulations during which they recorded responses to pre-recorded model videos with the goal of requesting a letter of recommendation from a university professor with varying scenarios (time frame of request, academic standing). Learning outcomes were measured using a pre-test (simulations 1-2)/post-test (simulations 5-6) research design. The results of surveys and interviews demonstrate that participants showed positive attitudes toward the use of SimCon, and they also reported an increase in self-confidence. In addition, they indicated a focus on changes of content more than on form. Overall, the results suggest that participants acquired pragmatically appropriate strategies via the video-based computer simulation program. **The results indicate that video-based computer simulation may be particularly beneficial for learners with advanced proficiency levels, as it may help them develop and use pragmatic discourse strategies.**

Pronunciation

Footte, J., & McDonough, K. (2017). Using shadowing with mobile technology to improve L2 pronunciation. *Journal of Second Language Pronunciation*, 3(1), 34-56.

- The researchers sought to determine whether shadowing, “an activity where learners imitate a presented speech stimulus ‘as closely and quickly as possible’” (Luo, Shimomura, Minematsu, Yamauchi, & Hirose, 2008, p. 4), can be used to target L2 pronunciation effectively. The authors note that shadowing, also referred to as “mirroring” or “tracking,” can be completed outside of the classroom, for example as a homework activity, for relatively little cost. Teachers simply need to choose the appropriate sound file and

make it available to learners, and learners need a device on which they can record themselves imitating the speech. Participants in this study were 16 ESL learners who shadowed eight audio dialogues (four times a week for ten minutes at a time) from a popular sitcom using iPods and Multi-Track Song Recorder, a free recording app. They also completed a pre- and post-test semi-spontaneous speaking task that listeners rated for comprehensibility. Overall, participants’ comprehensibility and fluency improved on both the semi-spontaneous task and on a shadowing task. They also reported positive experiences with the shadowing activity. **This research demonstrates that regular shadowing activities may lead to an improvement in speech comprehensibility and fluency, and the benefits may extend to extemporaneous speech.**

Inceoglu, S. (2016). Effects of perceptual training on second language vowel perception and production. *Applied Psycholinguistics*, 37(5), 1175-1199.

- The author was interested in the effect of audiovisual training on the perception and production of French nasal vowels by native speakers of American English. The participants were 60 intermediate-level learners of French at a US university. They were divided into three groups: a) audiovisual training that included auditory stimuli together with videos that focused on a speaker’s face and lips; b) audio-only training; or c) no training. Participants produced 108 words in both the pre-test and the post-test. They were trained on these same words over a series of six perceptual training sessions that took place over the course of 18 days. The results demonstrate that participants in both training groups (i.e., the audiovisual and the audio-only) improved in their perception of the target vowels; however, the production of the nasal vowels by participants in the audiovisual group improved significantly more than that of the participants in the audio-only group. The results indicate that **the addition of facial gestures to pronunciation instruction may lead to an improvement in pronunciation.**

Liakin, D., Cardoso, W., & Liakina, N. (2017). The pedagogical use of mobile speech synthesis (TTS): Focus on French liaison. *Computer Assisted Language Learning*, 30(3-4), 348-365.

- The goal of this study was to determine whether using a free mobile text-to-speech (TTS) synthesis system, NaturalReader, could improve university-level French

language learners' liaison (the production of consonants at the ends of certain words before vowels). The authors note that TTS systems can be good sources of input for language learners, as the output can be adjusted for speed, gender, and language variety (e.g., different accents of French), and the input is chosen by the user and can range from individual words to sentences and entire paragraphs. Participants were divided into three groups: a) a TTS group that engaged in activities with the TTS involving noticing, categorizing, and listen-and-repeat tasks; b) a non-TTS group that did the same pronunciation tasks with a teacher; and c) a control group that worked on conversation skills with a teacher who did not focus on pronunciation. Participants recorded a speech sample that included sentences at three time points: pre-test, post-test, and delayed post-test. Trained raters listened to these productions and indicated whether participants produced liaison when it was required. The results indicate that participants in the TTS group as well as the teacher-led pronunciation group improved over time in their production of liaison. The authors indicate that **TTS may be an effective way to target L2 pronunciation outside of the classroom because it can be used on mobile devices, it provides high quality target language input, it encourages learners to make the association between letters and their sounds, and it can be used to focus on a number of pronunciation features.** In addition, **participants in the study appreciated using the software, found the quality of the speech synthesis to be good, and appreciated its portability and ease of use.**

Mompean, J. A., & Fouz-González, J. (2016). Twitter-based EFL pronunciation instruction. *Language Learning & Technology*, 20(1), 166–190.

- This research looks at the use of Twitter as a tool for explicitly teaching pronunciation. Participants in the study were 16 intermediate (B1) level learners of English from Spain. Every day their teacher sent them a series of tweets that focused on a particular pronunciation feature that caused them difficulty (e.g., difficult correspondences between spelling and pronunciation such as the pronunciation of <ph> in the name *Stephen* as /v/, word stress in cognate words such as English inter'mittent vs. Spanish intermi'tente, or silent letters such as the <s> in *aisle*). The target items were always "embedded in authentic language," and the tweets sent contained excerpts from interviews, video clips,

news, or songs on variety of subjects. Participants received two tweets a day over the course of 27 days. They completed a pre-test and post-test in which they pronounced 100 words in a sentence. Moreover, participants who completed the task ($n = 10$) improved in their pronunciation and reported high levels of engagement throughout the study. The authors note that participants indicated that they would appreciate receiving feedback on their pronunciation. The results of the study indicate that **sending students regular tweets containing "tricky" pronunciation features in context may lead to improved pronunciation.**

Thomson, R. I. (2011). Computer assisted pronunciation training: Targeting second language vowel perception improves pronunciation. *CALICO Journal*, 28(3), 744–765.

- The goal of this study is to determine whether participants who complete high variability phonetic training (HVPT; training of individual speech sounds that includes stimuli produced by multiple speakers and in a range of phonetic contexts) could train their perception of English vowels and improve their pronunciation of those vowels. A total of 22 Mandarin learners of English completed eight HVPT training sessions over the course of three weeks using an early version of English Accent Coach. The training program included ten English vowels as produced by 21 native speakers of Canadian English. Participants recorded words at a pre- and post-test, and these words were assessed for their intelligibility by five native speakers of Canadian English. The results indicate an overall improvement in intelligibility and that **presenting students with variable input (i.e., a range of voices) may be a successful way of improving both their perceptual skills and their pronunciation.**

For a comprehensive review of recent work in the field of CAPT, see O'Brien (2019) and O'Brien et al. (2019).

Writing

Andujar, A. (2016). Benefits of mobile instant messaging to develop ESL writing. *System*, 62, 63–76.

- The purpose of this study was to examine the impact of using mobile instant messaging, with the WhatsApp mobile app, on writing development for intermediate ESL learners. The aspects of writing development focused on were accuracy, lexical complexity, and syntactic complexity. Eighty students taking a third-

year English class at the B1 level (CEFR) at a university in Spain participated in the study. Intact classes were randomly assigned to either the treatment group or the control group. Over six months, all classes met weekly for 4.5 hours. The treatment group also participated in instant messaging over WhatsApp. Participation was not graded, but every day a different participant asked a question, and all participants were expected to provide at least one response daily. A total of 13,937 messages were recorded over the 6-month period. A pre-test/post-test design was used to assess writing development for each group. For the tests, students wrote two short texts, of about 100 words, in 30 minutes. Results showed that there was a significant difference between groups for writing accuracy on the post-test, with the treatment group that had used WhatsApp making fewer grammatical, lexical, and mechanical errors. A significant increase in lexical diversity was also observed in the treatment group over the control group on the post-test. A qualitative analysis of the WhatsApp messages showed that participants negotiated meaning, provided feedback, constructed knowledge, and reflected on previous knowledge. **The results of the study indicate that daily use of instant messaging may have a positive impact on learners' grammar, vocabulary, and mechanics as well as on students' negotiation of meaning and construction of knowledge in the target language.**

Bamanger, E. M., & Alhassan, R. A. (2015). Exploring podcasting in English as a foreign language learners' writing performance. *Journal of Education and Practice, 6(11), 63-74.*

- The purposes of this study were to examine the effects of supplemental podcast instruction focusing on grammar and vocabulary on EFL learner's writing and to investigate student perceptions on podcast instruction. A total of 55 EFL learners at a university in Saudi Arabia participated in the study, with students randomly assigned to the treatment group or the control group. Participants on average had been learning English for approximately six years. All students were enrolled in an English language class that met for 20 hours each week for six weeks. In addition to instruction time, the treatment group also listened to two podcasts outside of class (i.e., Grammar Girl and ESL Podcast). The first podcast focused on grammar tips and the second on vocabulary and phrases. A pre-test/post-test design was used, and both tests required

the students to write a short essay on a general topic. Participants also completed a questionnaire that focused on their perceptions of the podcast instruction. Results showed no significant improvement in writing performance for the control group, but there was a significant improvement observed for the treatment group. Results from the questionnaire indicated an overall positive assessment of the use of podcasts. In particular, participants noted that they felt the podcasts had improved their vocabulary and grammar, and they intended to continue using the podcasts after the study. Participants suggested that access to the transcripts for the podcasts would have been beneficial. **Participants who listened to grammar and vocabulary podcasts outside of class were able to significantly improve their writing performance on short essays.**

Bikowski, D., & Vithanage, R. (2016). Effects of web-based collaborative writing on individual L2 writing development. *Language Learning & Technology, 20(1), 79-99.*

- This study looked at the effects of synchronous collaborative writing on individual writing performance for ESL students at a US university. A total of 59 undergraduate students, divided into two groups, were enrolled in a 15-week English writing course. There were four sections in total, with two intact sections assigned to the treatment group and the others to the control group. The majority of students had Chinese as their L1. All groups took part in four in-class ungraded web-based writing tasks. For the treatment group, the tasks were collaborative in groups of 3-4, and the control group tasks were done individually. Google Docs was used, as it allows for collaborative writing and the ability for teachers to monitor the writing in real time. Each task lasted 45 minutes and topics were related to other content on the syllabus. Corrective feedback was provided to all participants. A survey was also administered to both groups to gather data on their perceptions of the writing tasks. Results showed that both the control group and the treatment group made significant improvement from pre-test to post-test. The participants in the treatment group also made significantly more individual writing gains than the control group participants. The survey results showed that overall the participants in both groups had positive attitudes towards the writing tasks. Nearly half of the participants in both groups indicated they would have liked to have done more work in the

other group (i.e., control group participants would have liked to have done more collaborative writing).

Learners who engage in synchronous collaborative writing may demonstrate improved individual writing performance.

Dizon, G. (2016). A comparative study of Facebook vs. paper-and-pencil writing to improve L2 writing skills. *Computer-Assisted Language Learning, 29(8), 1249–1258.*

- The purpose of this study was to look at how using Facebook, compared with traditional paper and pencil writing, can improve L2 writing. Three areas of L2 writing were focused on: writing fluency, lexical richness, and grammatical accuracy. For the study, 30 Japanese EFL learners in their second year at a university in Japan were randomly assigned to a treatment group that required them to post their writings to a group Facebook page or a control group that engaged in traditional writing activities in individual journals. Each week for 12 weeks, both groups participated in two 10-minute freewriting tasks. The topics of the tasks were related to themes covered in the classes. Both groups received corrective feedback (CF): the control group received CF in their journals and the treatment group had CF posted as a comment under their Facebook post. A pre-test/mid-test/post-test design was used to assess writing development. Results for writing fluency showed that both groups made significant improvements from the pre-test to the mid-test, but only the treatment group showed significant gains in writing fluency from the mid-test to the post-test. The difference in the gains between the groups was also significant. Participants did not improve in lexical richness or grammatical accuracy. **This study demonstrates that the writing fluency of students who post weekly writing assignments and receive feedback via Facebook may improve significantly more than that of those who use paper and pencil for free-writing tasks.**

Kol, S., Schcolnik, M., & Spector-Cohen, E. (2018). Google Translate in academic writing courses? *The EuroCALL Review, 26(2), 50–57.*

- The purpose of this study was to examine possible benefits of using Google Translate to improve students' writing in an English for Academic Purposes (EAP) program. Participants began the study by completing a pre-experiment awareness task in which they were asked to identify mistakes in a machine translation

done by Google Translate from Hebrew to English. A B2 class of 49 students was chosen to participate in the study. The experiment then looked at whether using Google Translate might lead to an improvement in L2 writing. The participants completed two writing tasks, each requiring them to write their opinion on a topic in multiple paragraphs; one task was done without Google Translate, and the other was done with it. The participants also completed a survey asking them about how they used Google Translate for the second task. The writing in each task was assessed on grammar, quantity (word count), readability (complexity), and vocabulary. For grammar, there was no significant difference observed between tasks; however, significant results were observed for the remaining assessment categories. **When learners used Google Translate, the length of their writing increased, along with the complexity and use of less common and academic words.** From the questionnaire, **most students responded that they only used Google Translate to look up words or phrases, with very few participants translating sentences or paragraphs. The results of the study indicate that advanced intermediate students may have the language knowledge required to use Google Translate effectively in their writing.**

Pham, V. P. H., & Usaha, S. (2016). Blog-based peer response for L2 writing revision. *Computer Assisted Language Learning, 29(4), 724–748.*

- This study looked at peer feedback and writing revision behaviour using online blogs. Specifically, it looked at differences in commenting on global versus local areas of a piece of writing and how students incorporated said comments into their revisions. The participants were 32 Vietnamese second-year university students studying English at an intermediate language proficiency. The students were all part of an Academic Writing in English course, and over the course of the semester they wrote three drafts of the paper used for data analysis. The first two drafts of the paper were posted as an online blog, and students were required to give feedback. Students received feedback from the instructor on the third draft. The first round of peer feedback focused on paper content and organization (global feedback) and the second round focused on grammar, word usage, and sentence structure (local feedback). The participants were randomly assigned to four groups of eight, and each participant provided feedback only

to the other students in their group. Participants provided significantly more global comments than local comments on both drafts. In terms of the types of revisions made, revisions at the word level were most common, followed by the sentence level then the phrase level. Finally, the majority of revisions made by students between drafts were done independently of the peer feedback. Only 22% of revisions were entirely based on peer feedback and 17% partially on peer feedback. The results of the study indicate that **students giving peer feedback on paper drafts through online blogs may provide both global and local revision-oriented comments. Nonetheless, student revisions may be made independently of peer feedback.**

Zhu, Y., Shum, S.-K. M., Tse, S.-K. B., & Liu, J. J. (2016). Word-processor or pencil-and-paper? A comparison of students' writing in Chinese as a foreign language. *Computer Assisted Language Learning, 29*(3), 596–617.

- This study compared writing quality and student perceptions of word processors and traditional paper-based methods for Chinese writing tasks. A total of 32 students from overseas studying elementary Chinese as a foreign language in a Chinese university participated in the study. The average participant had been studying Chinese for nearly three years. All participants completed two writing tasks, both with a length of 300 Chinese characters. The first task was completed using Microsoft Word, with the grammar and spelling correction functions disabled. The second task was completed using paper and pencil. Each participant also completed a questionnaire and interview after the tasks to gather data on the perspectives of each writing method. Each writing task was evaluated on ideas and content, linguistic expression, and cohesion and coherence. Overall, the scores for the word processor essays were significantly higher than those produced by hand. Participants who scored highly on the handwritten essays showed no significant improvement on the word processor essay; although some students performed poorly on the handwritten essay, many of them showed significantly better performance on the task completed with the use of Microsoft Word. Interview data revealed that **participants felt they were able to write faster and correctly produce more characters with the word processor than by hand. Students with lower scores on handwritten**

essays were able to write significantly better essays with a word processor. The results indicate that using word processing tools — even those with the grammar and spelling functions disabled — for writing in the target language may lead to higher quality written texts.

Interactional Competence

Chun, D. M. (1994). Using computer networking to facilitate the acquisition of interactive competence. *System, 22*(1), 17–31.

- The objective of this paper is to examine how students used language to express communicative functions in a computer-assisted class discussion (CACD). The primary focus of the paper is on how CACD helps to develop sociolinguistic discourse and strategic competence in language learners as described in both the communicative competence and proficiency movements (Canale & Swain, 1980; Omaggio, 1986). This was a longitudinal study of first year German students, based on the premise that using CACD would provide students with the opportunity to generate and initiate different kinds of discourse structures or speech acts and also take a more active role in discourse management. The data were collected over two semesters from first and second semester German classes. A total of 25 students participated in the study. Five computer networking sessions were conducted in the first semester, each lasting for approximately 15–20 minutes, and nine sessions in the second semester for periods varying between 20 and 45 minutes, averaging approximately 25 minutes each. The participants used the *Interchange* function of the Daedalus Integrated Writing Environment software, which allows for real time, synchronous CACD. The discussions between students consisted of various topics (e.g., weekend activities, travel experiences), which were saved verbatim on the computer, and transcripts were printed out. On the basis of these transcripts, the analysis was done. The findings showed that CACD provided opportunities for language learners to develop discourse skills and interactive competence. Furthermore, CACD enabled learners to enhance their writing proficiency. **The study suggests that the computer can be an effective medium for facilitating written discussion among students, which may promote the acquisition of interactive competence in writing.**

Lee, L. (2014). Digital news stories: Building language learners' content knowledge and speaking skills. *Foreign Language Annals*, 42(2), 338–356.

- The study addresses one form of computer-mediated communication (CMC), digital storytelling, and it seeks to determine whether the creation of digital news stories promotes the development of content knowledge and oral language. The study specifically looks at the effects of peer comments on asynchronous CMC from sociocultural perspectives. A total of 15 advanced Spanish students participated in the study. Four of the students were Spanish majors, two were double majors in Spanish and International affairs, and three were heritage speakers. For the project, they used VoiceThread, an interactive multimedia tool in the creation and exchange of digital news about current events from different Spanish-speaking countries. All the participants were tech-savvy and comfortable using social media and mobile devices, but none had used VoiceThread for L2 learning prior to the project. The researcher used both quantitative and qualitative data collected from digital recordings, blog reflections, surveys, and final interviews. The findings indicated that the inclusion of topics about major current events (e.g., the election in Venezuela or the economic crisis in Spain) gave students the opportunity to learn about different cultural practices and products. Furthermore, creating digital stories on topics of their own choice enabled students to use the target language beyond the classroom and allowed them to build important content knowledge. **The study suggests that sharing digital stories via interactive media tools like VoiceThread may foster a stimulating learning environment where students are actively engaged in sharing and exchanging ideas concerning current events.**

Schenker, T. (2017). Synchronous telecollaboration for novice language learners: Effects on speaking skills and language learning interests. *Alsic*, 20(2), 1–17.

- This paper argues for the integration of telecollaboration in language teaching at all levels, as learners can benefit in different ways from the direct exchange with native speakers of the target language. The study aimed at investigating the effects of participation in a semester-long voice- and text-based synchronous virtual exchange on the speaking proficiency of L2 learners of German and their interest in the study of German and study abroad.

The telecollaborative project took place between first-semester college students learning German at the novice level in the US and high school students in Germany learning English. The participants were divided into two groups: an experimental and a control group. The experimental group consisted of 28 students (15 male and 13 female), aged between 17 and 23. They were from different backgrounds, but most reported English as their native language; three spoke Italian, Czech, or Japanese as their native language. A total of 32 high school students (20 male and 12 female) in Germany, aged between 16 and 18, participated in the project. These students reported German as their native language and all had been learning English since Grade 5. Each US student was assigned one German partner. They completed a total of six text-chats (minimum of 20 minutes) and five voice-chats (minimum of 15 minutes) every week. The students were required to divide their time equally between speaking in English and German to allow participants on both sides to practice their target language. Students were given discussion topics to use as prompts but were also free to talk about other topics. The majority used Skype for the voice-chats and Facebook for the text-based chats. The findings revealed that students' interest in learning the target language and studying abroad was positively impacted by the virtual exchange. Even though the voice-based exchange did not result in noticeable advancement in speaking proficiency as compared to the control group, the participants appreciated the opportunities for getting to know real Germans, learning colloquialisms and conversational language, and enhancing their cultural knowledge. **The study suggests that interacting online with native speakers of the target language in telecollaborative exchanges may motivate students to learn more about another language and culture.**

Tsuei, M. (2011). Development of a peer-assisted learning strategy in computer-supported collaborative learning environments for elementary school students. *British Journal of Educational Technology*, 42(2), 214–232.

- The aim of this study was to develop a synchronous computer-supported collaborative learning (CSCL) tool — named electronic peer-assisted learning for kids (EPK) — to provide structured, peer-assisted learning strategies that would promote learning Chinese through online language arts activities. This study

specifically explored the effects of EPK on the quality and development of reading skills, peer interaction, and self-concept (i.e., an individual's perception of self, which is formed through experiences with the environment, interactions with others, and attributions of their own behaviour [Shavelson, Hubner, & Santon, 1976]) in elementary students. This study also investigated whether the patterns of peer interaction were related to different online tasks. Fifty-six Grade 4 students, aged 10–11 years, participated in the study for eight weeks. They were from two classes at an elementary school in Taipei, Taiwan. These two classes were randomly assigned to either the control or experimental group. The participants had three sessions of 40 minutes each, weekly, of Chinese language arts activities. Students in both groups received two sessions of whole-class instruction. Students in the control group worked face-to-face in pairs using the peer-assisted learning strategy, and those in the experimental group worked in pairs online using the EPK system to practice early Chinese language arts activities once a week. Students engaged in three types of Chinese language arts activities: a) recognition of the component radicals and numbers of strokes in Chinese characters, b) building of words and vocabulary aimed at helping students to achieve fluency, and c) condensation and elongation of sentences. The program had eight lessons in total. The findings revealed that of the three types of Chinese language arts activities, the students performed more tutor and tutee behaviours in the building of words and vocabulary activity than the other types of activities. This suggests that different types of online learning activities stimulate different types of peer interactions. Furthermore, the findings show that the online EPK group had a significantly higher overall self-concept and reading comprehension scores than the control group. Additionally, the results demonstrate that students' online interactions were influenced by the complexity of the tasks and that students benefited from the scaffolding tools of EPK. **The findings of the study demonstrate that a peer-assisted learning strategy combined with synchronous computer-supported collaborative learning can have a positive effect on student collaboration and self-concept among elementary school students. The peer-assisted learning strategy can effectively enhance academic outcomes for elementary school students.**

Vlugter, P., Knott, A., McDonald, J., & Hall, C. (2009). Dialogue-based CALL: A case study on teaching pronouns. *Computer Assisted Language Learning*, 22(2), 115–131.

- The paper presents a computer-assisted language learning system that uses human-machine dialogue as its medium of instruction with learners. The system, designed to accompany an introductory course in Maori at a university in New Zealand, was developed to help students learn Maori personal pronouns and provide opportunities for the negotiation of meaning. The system played the role of a conversational partner and tutor at the same time. Learners were required to accomplish conversational tasks with the CALL system. The system used in this case study was Te Kaitito, a web-based application that supported written dialogue with learners. The system's utterances were presented to the learner who in turn typed their responses in a textbox. The tutorial participants were divided into three groups: a) the no-intervention group, b) the regular tutorial group, and c) the system/Te Kaitito tutorial group. Students in each group had to take three written tests: a pre-test (in week 5 before students engaged in the tutorials) and two post-tests (one in week 5, one in week 6) on the topic of personal pronouns. Each test, which lasted five minutes, introduced a dialogue situation involving a group of characters and consisted of five questions, which tested the students' ability to use Maori personal pronouns. The Te Kaitito tutorial group had to interact with the multi-speaker machine for thirty minutes. The findings showed no difference between the group that used the Te Kaitito tutorial and the regular tutorial group on the first post-test, but there was a significant difference between the two groups when the two post-test results were compared. The Te Kaitito group did not retain what they had learned in the tutorial as well as the regular tutorial group. The difference in the retention could be attributed to the novelty effect since they had never used Te Kaitito before. Alternatively, it could be simply because regular tutorials with the human tutor were more memorable than those with a computer system. **The study suggests that a multi-speaker human-machine environment (e.g., the Te Kaitito system) may be a promising platform for CALL as such an environment has the potential to support a variety of interactions and to simulate authentic dialogue.**

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Receptive Skills and CALL



Research on the skills of listening and reading, once referred to as “passive skills,” has flourished in recent years. As a result, these central skills have been reclassified as *receptive skills*, requiring a unique set of strategies and targeted tasks for their development (Taylor, 2019). As is the case with choosing any technology, Chapelle and Jamieson (2008) point to the importance of choosing CALL materials with spoken and written texts at the appropriate level (i.e., proficiency level, topic relevance, and activity types) for a given group of students. Research has demonstrated that learners develop their language abilities most when exposed to input that is just beyond their current level of understanding (e.g., Taylor, 2019). Choosing materials that are too difficult as well as those that do not have appropriate levels of elaboration (e.g., when students understand less than 90% of the vocabulary in a text [Taylor, 2019, p. 185]) will result in frustration on the part of students and teachers alike. It is essential that teachers look for or create tasks designed to improve learners’ listening and reading skills that have clear objectives and that encourage learners to focus on specific aspects of the language.

Vandergrift and Goh (2012) demonstrate that it is essential for learners to develop metacognition (i.e., that they “are self-regulated learners, who are aware of their own learning processes and the demands of their learning tasks” [p. 83]) and metacognitive skills, which enable them to become more successful listeners. One way to classify tasks that focus on developing listening and reading skills has to do with the way in which the spoken or written information is processed. Top-down processing requires learners to activate their background knowledge before and while reading. This encourages

learners to rely on previous experiences to help them in understanding a given text (Taylor, 2019, p. 181). Bottom-up processing is based in the language itself, and it helps the reader “decode the text” (Taylor, 2019, p. 181). Tasks that encourage bottom-up processing include those that focus learners’ attention on individual sounds, vocabulary, or grammatical structures. Both types of tasks have been shown to lead to improvements in L2 learners’ listening and reading skills. In addition, they may aid in the incidental learning (i.e., “Picking up of words and structures, simply by engaging in a variety of communicative activities, in particular reading and listening activities” [Hulstijn, 2003, p. 349]) of vocabulary items. The addition of images has been shown to aid in comprehension of both spoken and written texts (e.g., Salem, 2006).

Listening

Listening involves a number of tasks: a) decoding sounds into words; b) comprehending words and sentences; and c) interpreting the text as a whole. One difficult aspect of listening in the real world is that we are rarely able to go back and listen for a second time to what was said. In addition to this, speakers do not pause between words, and the sentences that they produce are often incomplete or full of disfluencies. Moreover, listeners often need to draw on background knowledge when trying to understand what was said. Listening tasks should ensure that learners engage in activities that encourage both bottom-up (i.e., decoding on the basis of individual sounds and words) and top-down processing (i.e., decoding on the basis of real-world knowledge and strategies for prediction). Perez (2019) notes that certain technology-

enhanced listening tasks have been successful at developing learners' bottom-up processing. For example, repeated listening tasks that allow learners to listen for specific sounds, words, and phrases, and that may require them to write down what they have heard, may enable greater comprehension of L2 texts (Faramazi, Tabrizi, & Chalak, 2019). Slowing down speech enables listeners to focus on the task of decoding the speech stream (Perez, 2019, p. 147). Learners can enhance their top-down processing strategies with pre-listening tasks that include vocabulary or comprehension questions (Perez, 2019, p. 149). Using images and storylines also help with the top-down processing of audio (Perez, 2019, p. 150). Captions are effective at developing both bottom-up (e.g., accessing and learning vocabulary) and top-down (e.g., understanding the storyline) processes.

Chapelle and Jamieson (2008) highlight a number of best practices when developing CALL listening tasks. First, it is important that **learners know the specific task that they will be required to carry out before they begin listening, as this enables them to focus their attention on the relevant information.** Second, because human memory capacity is limited, it is important to **provide learners with opportunities to check their comprehension as they listen to a longer text, not just after they have heard it.** Learners can therefore be encouraged to complete dictation tasks, take notes, or identify specific information as they listen. CALL resources that encourage learners to develop strategies to make predictions before they listen, make inferences as they listen, monitor their performance, and personally respond to what they have heard are considered among the most effective (Chapelle & Jamieson, 2008, p. 145).

In her recent review of research on technology-enhanced listening, Perez (2019) notes that new technologies make it possible for learners to access multimedia sources effectively. For example, it is possible for instructors to create and add subtitles or captions, which have been shown to be effective in understanding videos (Perez, Peters, & Desmet, 2013). In addition, because the speed of delivery can often be a problem for L2 learners (Graham, 2006), technologies can be used to slow down spoken texts (e.g., Chan, 2017). The results of research into the role played by technology in developing L2 listening comprehension have demonstrated that listening comprehension can be enhanced through opportunities for repeated listening (Faramazi et al., 2019; Vahdat & Eidipour, 2016), the use of authentic multimedia resources including podcasts, vodcasts, YouTube videos, TED Talks,

immersive online games, and Skype communication (e.g., Cigerci & Gultekin, 2017; Lan & Liao, 2018; Levak & Son, 2016).

When teachers are choosing listening materials and developing CALL tasks to focus on listening, it is important to consider the following aspects outlined by Perez (2019, p. 162):

- The **goal of the listening activity**; for example, whether it is meant to focus on bottom-up or top-down processing
- The **characteristics of the audio**; for example, whether it is appropriate for the proficiency level of learners and whether it contains dialectal speech or background noise
- The **characteristics of the accompanying visuals**; for example, whether the images or videos available support comprehension
- The **topic**; for example, whether learners will find the activity interesting and motivating, whether they will find the topic relevant, and whether they have the necessary background knowledge
- The **lexical profile**; for example, whether the vocabulary contained in the listening text is appropriate considering learners' proficiency level
- The **presentation of content**; for example, whether the input will be modified (e.g., captions, subtitles, keywords), whether learners will be permitted to listen or to view the text multiple times, and whether learners are able to control the presentation (e.g., speed of delivery)
- The **instruction**; for example, whether learners need assistance with the technology itself, and whether pre-listening tasks would be helpful

Reading

There are two main goals in teaching learners to read in their L2: a) to help them understand the meaning of multimodal texts; and b) to help them use the text to improve their language proficiency (Chapelle & Jamieson, 2008, p. 63). Research has also demonstrated the importance of reading *authentic* texts (i.e., texts written for an audience of native speakers) for developing literacy in the L2 (e.g., Gilmore, 2007). Although some research has shown that L2 learners may better comprehend printed texts (e.g., Singer & Alexander, 2017), Taylor (2019) notes that there are benefits to texts available on the internet, primarily that they offer teachers and students alike

freedom and convenience to access authentic material from virtually anywhere. Moreover, reading online allows learners to access a range of resources to construct meaning (e.g., dictionaries, further information about the topic available on other websites [Park, Yang, & Hsieh, 2014]). Nonetheless, the type of reading that we engage in when we read internet materials is quite different from other types of reading: it “is essentially reading with a purpose since the reader is usually looking for information, reading the news, or completing a school or work assignment” (Taylor, 2019, p. 180). For these reasons, the types of tasks that learners carry out may differ from those associated with reading; for example, a print version of a short story or a novel. Although reading onscreen is somewhat different from reading on paper, many of the strategies that students need (e.g., finding the main idea, guessing the meaning of words, skimming, and summarizing) are the same, regardless of the medium (e.g., Chapelle & Jamieson, 2008).

Technology offers a number of affordances for reading. For example, it is possible to highlight important vocabulary or grammatical features in a given text, thereby encouraging learners to notice the forms. This can be done, for example, through font choices (e.g., bolding, italicizing, using a different colour) or by frequently exposing learners to the given form (Chapelle & Jamieson, 2008). Tools like glosses (i.e., “extra information [e.g., vocabulary, grammar, cultural information] that accompanies a text to assist in understanding words or phrases” [Taylor, 2019, p. 185]) and embedded links encourage learners to interact with the written text, for example by enabling them to hear the pronunciation of a word or phrase, to see an image of it, or to read its definition (Chapelle & Jamieson, 2008). These tools can help learners develop reading fluency (Taylor, 2019) and learn new vocabulary items (Khezrlou, Ellis, & Sadeghi, 2017). Although there is some debate regarding whether glosses are more effective if they are provided in learners’ L1 or their L2, a recent meta-analysis of research on glosses has demonstrated that learners who are able to access glosses while they read tend to outperform learners who do not have access to them on measures of reading comprehension (Abraham, 2008).

Taylor (2019) highlights a number of added benefits of developing technology-mediated reading tasks. Teachers are able to determine the proficiency level of a given text with readability analyzers, which are available in a range of languages. Websites also exist that enable the creation of glossed texts. Learners can make use of mind maps

(e.g., MindMup) and digital annotation tools (e.g., Diigo) to encourage the activation of knowledge and to highlight information, identify themes, look up relevant words, and type a summary, often collaboratively, as they read a text. Research has demonstrated the effectiveness such tools in understanding words and sentences as well as comprehending texts (e.g., Thoms, Sung, & Poole, 2017). Moreover, the multimedia nature of computerized texts enables the embedding of images and videos, which may aid in reading comprehension (e.g., Majidi & Aydinlu, 2016; Serafini, 2010).

Literature Review

Listening

Çiğerci, F. M., & Gultekin, M. (2017). Use of digital stories to develop listening comprehension skills. *Issues in Educational Research, 27(2), 252–268.*

- This study examines the effectiveness of using digital stories for the development of listening comprehension in an EFL context. Digital stories incorporate multimedia tools (e.g., graphics, videos, music, text). The goal of the study was to determine the effect of the use of digital stories on the development of listening comprehension, as well as the learners’ and teachers’ attitudes toward digital stories. Sixty Grade 3 beginner-level EFL learners (9–10 years old) from an elementary school in Turkey with Turkish as their L1 participated in the study (experimental group: $n = 30$; control group: $n = 30$). Over a period of eight weeks, the learners in the experimental group completed learning activities based on eight digital stories (without access to the written text), which they listened to twice, focusing on various themes. Simultaneously, the learners in the control group completed traditional learning activities focused on the development of multiple language skills (e.g., reading, speaking) including teacher read-aloud traditional listening activities (with access to the written text). Learning outcomes were measured using a pre-test/post-test research design through a listening proficiency test comprised of short-answer questions, multiple-choice questions, and picture sequencing. Tests were assigned scores by the researchers. Results indicated learning gains in both groups and that the experimental group significantly outperformed the control group on the post-test. The results of classroom observations in both groups and semi-structured interviews with learners and the teacher from the experimental

group demonstrate that both the learners and the teacher showed positive attitudes toward the use of digital stories. Learners reported that they particularly enjoyed the multimedia affordances of digital stories. The teacher reported feeling the students were more attentive and focused on the listening task with digital stories. Overall, the results suggest that using multimedia digital stories for the teaching of listening comprehension in an EFL context may lead to more learning gains. **Digital stories may be particularly beneficial for the development of listening skills among young language learners, as they afford the opportunity to enhance the storytelling experience via a multimedia platform, which may foster an engaging and motivating environment.**

Faramazi, S., Tabrizi, H. H., & Chalak, A. (2019). The effect of vodcasting tasks on EFL listening comprehension progress in an online program. *International Journal of Instruction*, 12(1), 1263–1280.

- This study examines the effectiveness of using video podcasting, also known as vodcasting, for the development of listening comprehension in an online EFL program. The goals of the study were to determine both a) the effect of vodcasting on listening comprehension progress; and b) if there was a correlation between engagement and listening comprehension performance. A total of 120 intermediate-level English learners sharing Persian as their L1 were enrolled in a mandatory English course as part of their English translation degree. Over a period of four weeks, all participants were given the treatment of watching twenty vodcasts focusing on form (vocabulary and grammar) as well as content (documentaries, lectures, news). After watching the vodcasts, participants completed collaborative comprehension tasks online. Listening comprehension was measured using a pre-test/post-test research design through a multiple-choice listening proficiency test. Results indicate significant increases in listening comprehension. Engagement was measured by calculating the time spent watching the vodcasts and completing the tasks. In addition, there was a significant positive correlation between the participants' engagement and their listening comprehension performance. Overall, the results suggest that vodcasting supplemented by collaborative comprehension tasks may lead to better listening comprehension with the greatest level of benefit for the participants most engaged in the tasks. **Listening to vodcasts and completing comprehension tasks**

may be beneficial for the development of listening skills among language learners, as it affords the opportunity for repeated listening and exposure to authentic input.

Lan, Y.-J., & Liao, C.-Y. (2018). The effects of 3D immersion on CSL students' listening comprehension. *Innovation in Language Learning and Teaching*, 12(1), 35–46.

- This study examines the effects of engaging with the 3D multiuser virtual environment Second Life on the development of listening comprehension. The goal of the study was to determine the learning outcomes and the learners' attitudes toward 3D multiuser virtual environments. Twenty-one beginner-level Chinese as a Second Language (CSL) learners (with first languages of Indonesian, Vietnamese, Japanese, and Spanish) were enrolled at a university in Taiwan. Over a period of six weeks, the participants took part in four 50-minute listening comprehension sessions and were assigned audio materials (average time: 1:26 minutes). A within-subjects research design was implemented in which participants sequentially experienced two treatments. For listening comprehension sessions 1 and 4 (topics related to location/direction and renting a room), the participants took part in the 3D virtual reality immersive exploration treatment within Second Life. There they explored the environment with an avatar while the listening material was playing. For listening comprehension sessions 2 and 3 (topics related to transportation and sending parcels), the participants took part in the picture treatment that consisted of screenshots of the virtual reality environment that accompanied the listening material. Listening comprehension was measured after each session through a multiple-choice test focusing on vocabulary, syntax, and semantics. Results indicated that the participants had significantly better learning outcomes when the audio materials were supplemented by 3D immersion than with pictures. The results of surveys and interviews demonstrate that the learners showed positive attitudes toward 3D immersion, and they also reported feeling 3D immersion contributed to their learning as well as to an increase in motivation. Overall, the results suggest that the use of Second Life to supplement audio materials may lead to a greater development in listening comprehension skills. **Results indicate that 3D multiuser virtual environment programs may be particularly beneficial for the development of listening comprehension among**

language learners, as they afford an immersive authentic context in which to learn an L2 in a meaningful manner.

Levak, N., & Son, J.-B. (2016). Facilitating second language learners' listening comprehension with Second Life and Skype. *ReCALL: The Journal of EUROCALL*, 29(2), 200–218.

- This study examines the effectiveness of computer-mediated communication for the development of listening comprehension via Second Life or Skype. Skype affords text, voice, and video. Second Life is a multi-user virtual environment tool affording text, voice, and video via the virtual representation of avatars. The goal of the study was to determine a) the effect of the use of Second Life or Skype on the development of listening comprehension; b) the affordances of Second Life and Skype when used in an L2 context for the development of listening comprehension; and c) the learners' attitudes toward Second Life and Skype. Thirty-five mixed-level L2 learners participated in the study. Croatian L2 learners ($n = 17$) were from two universities in Australia. English L2 learners ($n = 18$) were from two universities in Croatia and in Bosnia-Herzegovina. Learners were placed in pairs comprised of one learner from each L2. The pairs were assigned to either the Second Life or the Skype treatment, and they participated in eight weekly 1-hour listening comprehension tasks comprised of 30-minute sessions in each language via their respective tool. The tasks revolved around topics from the learners' courses (e.g., "At the Café" and "Describing objects"). Listening comprehension was measured using a pre-test/post-test research design through a multiple-choice listening proficiency test based on the experiment topics. Results indicated significant development in listening comprehension in both treatments (Second Life and Skype) with more learning gains for the learners of Croatian than the learners of English (Second Life and Skype). Results also indicated that students using both tools had comparable learning outcomes. The test results and interviews identified that both treatments had affordances that fostered the development of listening comprehension, as they provided access to authentic content, synchronous communication, and instant feedback. Results also indicated that Second Life was particularly effective for cultural learning and to access virtual location (e.g., for the themes "At the Café" and "Shopping"), and that Skype was particularly effective for one-on-one conversations

where the relationship between the interlocutors is important (e.g., for the theme "Greetings and Introductions"). The results of interviews demonstrate that the learners showed positive attitudes toward both treatments, that they valued the opportunity to communicate with a language expert, and they also reported an increase in motivation. **Results indicate that engaging in synchronous spoken and written computer-mediated communication with a native speaker may be beneficial for the development of listening comprehension skills among language learners, as it affords for the learning of culturally authentic content and meaningful communication opportunities.**

Mohammed, M. M. K. (2018). Using audiobooks for developing listening comprehension among Saudi EFL preparatory year students. *Journal of Language Teaching and Research*, 9(1), 64–73.

- This study examines the effectiveness of using audiobooks for the teaching of listening comprehension in an EFL context. The goal of the study was to determine the effect of using audiobooks on the development of listening comprehension. Eighty-eight adult female learners who had been studying English for 10 years in their university preparatory year in Saudi Arabia (L1 = Arabic) participated in the study (experimental group: $n = 44$; control group: $n = 44$). Over a period of ten weeks, the participants took part in weekly 3-hour classes in which they completed listening comprehension questions based on texts that they heard. Both groups used the same texts and were assigned the same listening comprehension activities after each reading. The experimental group listened to the audiobook individually twice and then listened to the text a third time while silently reading a printout of the text. The experimental group was also provided with their own copy of the audiobook, the printout of the text, and took part in additional in-class activities related to the texts (e.g., completing graphic organizers, activating prior knowledge, writing summaries). The control group listened to the teacher read the text to the whole class twice. Learning outcomes were measured using a pre-test/post-test research design through a multiple-choice listening proficiency test. Results indicated significant learning outcomes in both groups and that the experimental group significantly outperformed the control group on the post-test. **Results demonstrate that a combination of audiobooks and the accompanying written text**

may be particularly beneficial for the development of listening skills among language learners, as they afford the opportunity for simultaneous listening and reading input at the learners' own pace as well as authentic listening experiences that include background sounds/music and exposure to various accents and voices.

Perez, M. M., Peters, E., & Desmet, P. (2013). Is less more? Effectiveness and perceived usefulness of keyword and full captioned video for L2 listening comprehension. *ReCALL: The Journal of EUROCALL*, 26(1), 21-43.

- This study examines the effectiveness of using captions on videos for the development of listening skills in an L2 classroom context. The goal of the study was to determine the effectiveness of using no captions, full captions, or keyword captions on listening comprehension as well as learners' attitudes toward captions. Keyword captions consisted of 14% of the total transcript and were intended to assist with meaning. The 226 intermediate-level French learners who all spoke Dutch as their L1 were enrolled in a mandatory French course at a Flemish university (full caption experimental group: $n = 81$; keyword caption experimental group: $n = 75$; no caption control group: $n = 70$.) All participants watched three identical authentic French television reports with the respective type of caption. They answered comprehension questions during a single 70-minute session. Listening comprehension was measured at post-test. Results indicated that the full caption experimental group significantly outperformed the two other groups with no difference found between keyword captions and no captions. The results of surveys completed after the experimental session substantiated the quantitative findings, as most participants preferred the full captions. They also showed a negative attitude toward keyword captions and identified them as being a distraction. Overall, the results suggest that when watching videos, full captions may be the most effective and preferred approach for listening comprehension. **Using full captions while viewing target-language videos may be beneficial for the development of listening skills among language learners, as it may lead to the improvement of a global understanding of the oral text.**

Vahdat, S., & Eidipour, M. (2016). Adopting CALL to improve listening comprehension of Iranian junior

high school students. *Theory and Practice in Language Studies*, 6(8), 1609-1617.

- This study examines the effectiveness of a CALL approach for the teaching of listening comprehension in an EFL context. The goal of the study was to determine if there were significantly greater learning gains using the CALL approach as opposed to a teacher-centred traditional method. In addition, the researchers were interested in determining whether CALL had an impact on the role of the teacher. Sixty beginner-level learners (average age: 13 years) from an all-girls junior high school in Iran with Persian as their L1 participated in the study (experimental group: $n = 30$; control group: $n = 30$). The participants took part in twenty 90-minute sessions over a 2-month period in which they completed the listening activities from the curriculum book *English Prospect 2*. While the researcher presented the listening content through cassette recordings or by reading the stories aloud to the students in the control group, each student from the experimental group accessed the listening content on a website. Learning outcomes were measured using a pre-test/post-test research design. Results showed significant learning outcomes in both groups. The experimental group significantly outperformed the control group on the post-test. Results also demonstrate that in the experimental group the teacher acted as a facilitator or guide who worked with students based on their individual needs as opposed to acting as a central figure working in a teacher-centred environment as in the control group. **Results indicate that CALL may be particularly beneficial for the development of listening skills among language learners, as it affords the opportunity for repeated listening and the exposure to a variety of accents.**

Reading

Chen, I. J. (2016). Hypertext glosses for foreign language reading comprehension and vocabulary acquisition: Effects of assessment methods. *Computer Assisted Language Learning*, 29(2), 413-426.

- This paper looked at the effects of three different types of glosses on reading comprehension and vocabulary as well as variations across four methods of assessment. The study had a total of 95 participants who were elementary ESL learners in their first year at a university in Taiwan. Participants were randomly assigned to one of three groups: in-text glosses, marginal glosses, and

pop-up glosses. During a 2-hour session the participants completed three readings and a reading comprehension post-test. The post-test had four components: summary writing, multiple choice reading comprehension questions, L2–L1 word translation, and L2–L1 word matching. All readings were at the intermediate level and between 150–220 words, with glosses created for 7–9 keywords for each passage. Results showed that the in-text gloss group performed best on all post-test components except for multiple choice, where the marginal gloss group performed best. The pop-up gloss group performed worst overall. Further analysis showed that gloss presentation affected scores for the different sections of the post-test. The most affected section was word translation then word matching, with multiple choice reading comprehension being least affected by gloss type. **It is recommended by the author that in-text glosses be used for developing vocabulary translation and matching, but marginal glosses are most helpful when practicing reading comprehension.**

Huang, H. C. (2013). E-reading and e-discussion: EFL learners' perceptions of an e-book reading program. *Computer Assisted Language Learning*, 26(3), 258–281.

- The purpose of this study was to investigate student perceptions of e-books, including functionality, reading process, and learning effects among L2 learners. The study lasted an entire academic year and involved 67 participants from two first-year EFL classes. Most participants were at an intermediate level of English and had studied it for approximately six years. Participants were required to attend a weekly 2-hour class, read one e-book per week, write reading logs after each e-book, and participate in a semi-structured interview at the end of the year. Participants were able to choose their own e-books according to interest and difficulty. Both audio and non-audio books were available in several genres, including fiction, adventure, fantasy, science fiction, and short story. An e-book site, with separate student and teacher interfaces, was constructed for the study; the website provided features such as online dictionaries, online searching, and e-book reading instructions. After completing an e-book, participants were required to write a log commenting on the time spent reading the book, reasons for their choice of book, the difficulty of the book, and a self-assessment of improved language skills. They were also required to write two forum posts, either asking or answering questions, related to what they wrote in their log. Each participant, on average,

read 37,174 words from 17 books over the course of the study. Data from a post-task survey were collected, and analysis showed that participants enjoyed the reading process and that they felt they experienced learning effects as a result of reading e-books. Students felt there were many positives to reading e-books, like enhancing their English overall and targeting their reading and writing abilities specifically. Over the course of the study they developed confidence related to reading authentic English books, and their reading speed increased. Nonetheless, they did not find that the format of e-books provided an easy method of reading. The author recommend that teachers who wish to incorporate e-book reading in classrooms develop a suitable e-book library; provide students with book plot summaries in the L1 and L2; combine book summaries with video material to increase motivation; encourage students to write journals to track reading accomplishments; and use a flexible reading schedule to not overburden students. **The convenience of using e-books, combined with the discussion of reading material within an online forum, may help students develop their reading ability, confidence, and target language skills.**

Khezrlou, S., Ellis, R., & Sadeghi, K. (2017). Effects of computer-assisted glosses on EFL learners' vocabulary acquisition and reading comprehension in three learning conditions. *System*, 65, 104–116.

- The purpose of this study was to compare explicit, incidental, and intentional learning for vocabulary acquisition and reading comprehension using multimedia glosses. Hulstijn (2003) defines incidental learning as “Picking up of words and structures, simply by engaging in a variety of communicative activities, in particular reading and listening activities” (p. 349). A total of 99 upper-intermediate EFL learners at a university in Iran participated in the study. Three intact classes were used, and each class was randomly assigned a learning condition: explicit, intentional, or incidental. Participants in the explicit group were given explicit instruction on the words and a vocabulary list in their L1 before they read a text. The intentional group was told to use the glosses as they read. Participants in the incidental group were given no instruction or prompting about the glosses. All groups read three texts, each containing eight unknown words, and were not told they would be tested afterwards. Over two weeks, the participants completed pre-tests, three reading sessions, of 45 minutes each, and a post-test,

immediately after their last reading. A 6-month delayed vocabulary post-test was also administered to each group. Results were consistent for both post-tests: for reading comprehension, participants in the explicit group significantly outperformed both the incidental and intentional groups on the written recall test. However, on the multiple-choice test, participants in the intentional group significantly outperformed the other two treatment groups. Overall, the results of the study indicate that **providing students with access to new vocabulary words and encouraging them to refer to the words before and during the reading process may lead to an improvement in their reading comprehension.**

Koyama, T., & Takeuchi, O. (2013). Does look-up frequency help reading comprehension of EFL learners? Two empirical studies of electronic dictionaries. *CALICO Journal*, 25(1), 110-125.

- This paper presents the results of two studies examining the look-up behaviour of students using electronic dictionaries and paper dictionaries and how that behaviour correlates to reading comprehension of a text. In the first study, 32 Japanese beginner-level EFL learners participated in the study. Each participant completed two readings; one reading was done with a paper dictionary, and the other reading with the equivalent electronic dictionary. Participants were required to circle all words they looked up during the reading. Following the readings, the participants completed a short reading comprehension test. The second study had 31 Japanese EFL learners at a significantly higher language proficiency than the first study. Those participants only read one text, which was deemed to be difficult for their reading level. Participants were assigned to an electronic or paper dictionary so that the proficiency levels in each group were even. Again, a comprehension test was completed after the reading. Results for both studies showed that **look-up frequency significantly increased when an electronic dictionary was used.** However, there was **no significant difference observed in the scores between groups for the reading comprehension tests**, for either study. **Electronic dictionaries may prompt more word look-ups than paper dictionaries, but this behaviour may not correlate to an increase in reading comprehension.**

Majidi, N., & Aydinlu, N. A. (2016). The effect of contextual visual aids on high school students' reading

comprehension. *Theory and Practice in Language Studies*, 6(9), 1827-1835.

- This study looked at the effect of contextually relevant visual aids (i.e., pictures), provided at different time points, on reading comprehension among high school EFL learners. A total of 95 intermediate high school students participated in the study, and they were randomly placed in one of four groups for the duration of the study. The control group did not receive visual aids, and the three treatment groups — pre-thematic, thematic, and post-thematic — were shown visual aids for different parts of the reading. The pre-thematic group saw images from the beginning of the reading, the thematic group saw images representing the climax, and the post-thematic group saw images representing the conclusion of the passage. Over eight weeks, participants received English instruction for 16 90-minute sessions, which included time dedicated to reading and reading comprehension. Results showed that all treatment groups scored significantly higher than the control group on the post-test, with the pre-thematic group scoring significantly higher than the other treatment groups. **Implications of this study suggest that providing contextually relevant images along with a reading passage can improve reading comprehension.**

Park, J., Yang, J., & Hsieh, Y. C. (2014). University level second language readers' online reading and comprehension strategies. *Language Learning & Technology*, 18(3), 148-172.

- The purpose of this study was to look at how L2 learners use online resources to aid reading comprehension. Furthermore, it investigated which processes they use to construct meaning during the task. Participants included seven EFL graduate students from a US university who had spent an average of 30 hours reading online. Based on their TOEFL and GRE scores, they were considered advanced readers in English. Each participant completed a pre-reading questionnaire, think-aloud training, a reading task, a comprehension test, and a post-reading interview. Before they began reading, participants completed a pre-reading interview used to determine their knowledge on each topic. They were required to answer questions that probed reading comprehension, vocabulary knowledge, and main ideas from the text. Following the readings, the participants participated in a final interview. Analysis of the data revealed that participants used prior knowledge of

the topic, online resources, website structures, and computer shortcuts (e.g., how to copy and paste information) during the reading tasks. Most participants searched for terms in their L2, but they all also sought out resources in their L1. **This study highlighted some affordances of CALL for reading comprehension, like the ability for learners to search in their L1 or L2, navigate different types of resources to construct meaning, and evaluate information through multiple sources.**

For a similar study see Chou (2012).

Thoms, J. J., Sung, K. Y., & Poole, F. (2017). Investigating the linguistic and pedagogical affordances of an L2 open reading environment via eComma: An exploratory study in a Chinese language course. *System*, 69, 38–53.

- This case study examines the linguistic and pedagogical affordances of a digital annotation tool (DAT), eComma. This tool provides a social reading interface that allows students or teachers to make text, picture, or video annotations, and it also can generate a heatmap of the most highlighted places for all readers in the virtual space. With a similar interface of an e-reader, it allows readers to make real-time annotations visible to others sharing the same virtual reading space. The eComma DAT was used in a second-semester Chinese language course in the US. Although 11 students participated in the study, the article focused on only four. In the course, students were given weekly reading assignments with follow-up comprehension questions, and two of the readings were administered using the DAT. The results showed that the majority of annotations were related to vocabulary, followed by content, and then grammar. Of a total of 90 annotations made on the two readings, 47 were new comments on a new piece of text, and the other 43 were follow-up comments. In their surveys, participants noted difficulties with eComma related to response timing, lack of content comments, and technical challenges. Recommendations for incorporating DATs into the classroom include having dedicated time for synchronous social reading, training the students on what makes a good versus bad annotation, dividing the students up into groups to tackle smaller sections of a text, and altering the tasks for more novice learners. **Through the use of a Digital Annotation Tool (DAT), L2 learners may be able to co-construct meanings of words or sentences and engage with the content to a greater extent than possible through more traditional forms of reading.**

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Grammar, Vocabulary, and CALL



Grammar and vocabulary are often considered the central components of language. As such, many CALL resources have been developed to encourage students to develop their grammatical knowledge and expand their vocabulary. Although many older resources represent little more than adaptations of grammar worksheets and flashcards, many recent apps are highly engaging and able to target learners at various proficiency levels. In addition, the internet provides learners with opportunities to access authentic language, thereby enabling the learning of vocabulary and grammar in context. The studies reviewed below, however, demonstrate some ways in which students can use CALL to develop their knowledge of grammar and vocabulary.

Grammar

The focus of many Canadian L2 classrooms has shifted from primarily grammar to students' ability to get things done in the target language, as can be seen, for example, in the use of "can-do statements" and formative assessment tools like language portfolios in frameworks such as the Common European Framework of Reference (Council of Europe, 2001). Nonetheless, at the very least, students need to be able to use the grammatical features of the target language with accuracy that enables them to be understood. Chapelle and Jamieson (2008) highlight the importance of carefully selecting CALL materials to focus on grammar. They note that teachers should consider a) difficulty levels of the grammatical forms; b) the extent to which students will be required to produce those grammatical forms; and c) the level of explicitness

of the grammar explanations (p. 41). In addition, the authors point to the importance of choosing resources that enable learners to practice grammatical structures in context (Chapelle & Jamieson, 2008, p. 41). **CALL tasks that enable learners to work together** (e.g., Castañeda & Cho, 2013) **as well as those that encourage students to focus on grammatical forms in context** (e.g., Hattem, 2012; Jung, 2016) **may encourage more enhanced learning of the grammatical forms**. In addition, **the integration of a variety of media sources may be especially beneficial for the acquisition of new grammatical concepts** (Lys, 2013). Finally, explicit, individualized written feedback along with the possibility for students to test their learning outcomes through quizzes are important aspects of effective CALL resources that target grammar (e.g., Chapelle & Jamieson, 2008, p. 60).

Vocabulary

Research has demonstrated the importance of knowing vocabulary for understanding written and spoken texts, and it has been proposed that readers need to know between 95% and 99% of the words in a text in order to be able to understand it (Laufer, 1997; Nation, 2001). Vocabulary is one aspect of language that must be taught, for example, through linking words with images or meanings (in either the first or second language), providing recordings of their pronunciation, and tasks that encourage memorization. Because words in many languages are assigned a grammatical gender, learners should learn the gender of words together with their

meaning (Arzt & Kost, 2016). Chappelle and Jamieson (2008) note that a first step to teaching vocabulary effectively involves choosing the words that are useful and of interest to students as well as those at the appropriate level of difficulty for the group of students (p. 13). **Common ways of targeting vocabulary via CALL include the following:**

- Flashcards
- SMS
- Glosses
- Gaming/virtual environments
- Subtitling

Digital flashcards (i.e., software that pairs a word in the L2 with its meaning, which can be in the form of a translation into learners' L1, an L2 synonym, or an L2 definition) **are an effective way to learn L2 vocabulary**, especially when learners can create their own flashcards, when support is offered in both the L1 and the L2, and when learners are able to access images, audio, and contextual information (Nakata, 2011). A recent meta-analysis by Sung, Chang, and Yang (2015) demonstrates that 70% of **learners who used mobile devices to learn vocabulary scored higher than those who learned without them**, and in their meta-analysis of studies comparing the effectiveness of SMS/MMS vs. apps for vocabulary learning, Lin and Lin (2019) found **potentially greater retention of vocabulary among learners who used an SMS- or MMS-based (as opposed to an app-based) mode for learning new words**. This result should be interpreted with caution, however, as it may stem from the fact that studies investigating SMS/MMS modes tend to be longer than those investigating the use of apps. Research has demonstrated that **glosses (i.e., notations about the meanings of words in texts provided either in the margins or within the text itself) can be an effective way to learn new vocabulary and that the benefits of glosses are often maintained in delayed post-tests** (Abraham, 2008). In addition, studies have shown that **learners are able to acquire significantly more vocabulary through digital game-based learning than through more traditional approaches, potentially because games maintain “a dynamic balance between individuals' ability and perceived task challenge”** (Chen, Tseng, & Hsiao, 2018, p. 70).

Although it is not covered in this literature review, one additional area of research in L2 vocabulary acquisition is the role of corpora as learning aids. A recent meta-analysis

by Tsai (2019) compares the results of using corpora to those using dictionaries on L2 vocabulary acquisition.

Literature Review

Grammar

Castañeda, D. A., & Cho, M. H. (2013). The role of wiki writing in learning Spanish grammar. *Computer Assisted Language Learning*, 26(4), 334–349.

- The purposes of this study were to investigate the development of grammatical knowledge through wiki writing and to gather information on the students' perspectives on wiki writing. The study focused on two verb forms of Spanish: the preterite and imperfect, both of which are notably difficult for English native speakers to acquire. A total of 53 students in an elementary Spanish class at a US university participated in the study. In each class, groups of 3–4 were assembled and given access to a wiki site. Over the course of 12 weeks, the groups were required to watch and summarize four videos and to complete two revision cycles for each summary text they produced. The writing sessions took place outside of class time after students participated in a grammar lesson on one of the studied verb forms. To produce the texts, group members worked one at a time, by each writing six sentences, and building on what was previously written by other group members. Implicit feedback in the form of prompts (e.g., “Are there any spelling mistakes?”) was given by the instructor to guide the revisions, which were completed collaboratively as a group. A pre-test/post-test design was used, with each test consisting of 30 multiple-choice items focusing on the accurate use of the new verb forms. The student perspective on wiki writing was gathered through a survey. Results showed that participants' grammar knowledge significantly improved over the 12 weeks. However, no control group was used, so the researchers were not able to determine if the improvement was solely due to the wiki writing. The survey on the students' perspective of wiki writing revealed an overall positive impression of the tasks. Students gave positive ratings to the collaborative design of the tasks and the topics of the tasks. Most students felt that reading and editing other students' writing helped them improve their own writing skills. **The results of the study indicate that collaborative**

wiki writing and editing engages language learners and that it may lead to improved production of targeted grammatical forms in the L2 classroom.

Hattem, D. (2012). The practice of microblogging. *Journal of Second Language Teaching & Research, 1(2)*, 38-70.

- The purpose of the study was to look at microblogging through Twitter as a grammar task to practice noticing (i.e., the act of being made consciously aware of a specific or target language feature in input) of new grammatical constructions. It also looked at student perceptions of microblogging through Twitter. A total of 49 students in an advanced ESL course at a US university participated in the study for one year, which corresponded to the length of a grammar course in their program of study. The course was divided into six 7-week sessions with 21 contact hours per session. The students had a variety of first languages and were between the ages of 25 and 34. During one of the sessions, participants were required to write a minimum of 50 tweets about their own lives or the classroom context. If the students wrote a tweet in which they used the target construction correctly, the instructor retweeted it for other students to see. If a student wrote a grammatically incorrect tweet, the instructor replied with corrective feedback. Over the 7-week period of the session participants wrote over 3,500 tweets. In addition to writing tweets, the participants also completed two surveys about their interactions with Twitter and perceptions of it as a tool for practicing grammar. With these tasks, the participants were able to practice noticing target language features with input, output, and interaction. Results from the surveys indicated that nearly all participants noticed new constructions in their classmates' tweets, and they paid attention to both form and meaning. Participants also indicated that they paid extra attention to form because their classmates would be reading their tweets. Finally, when provided with feedback on a grammatically incorrect tweet, there was a 90% uptake from students within one tweet after the feedback. Self-assessments showed that **most students felt that microblogging helped them improve their English writing and they were able to focus on the target grammatical constructions as they read and wrote short tweets.**

Jung, J. (2016). Effects of glosses on learning of L2 grammar and vocabulary. *Language Teaching Research, 20(1)*, 92-112.

- This study looked at the effect of glosses (i.e., "information provided about an unfamiliar linguistic item in the form of a definition, synonym, or translation, in order to reduce linguistic obscurity, and in so doing, assist reading comprehension" [Jung, 2016, p. 93]) on both the development of reading comprehension and the target grammar construction, English unaccusative verbs (e.g., "the snow melted"). Participants had not received any explicit instruction on this construction before the study began. A total of 52 EFL undergraduate students at a university in Korea participated in the study. They were randomly assigned to an experimental or a control group. Both groups participated in two sessions, with each session requiring them to read a passage from the TOEFL exam containing the target construction along with reading comprehension questions. The experimental group had access to L1 translation glosses of unaccusative verbs in the margin of the text, and participants in the control group did not have access to the glosses. The study used a pre-test/intermediate-test/post-test design, and assessment of learning gains was done through a grammaticality judgment test and a word form and meaning recognition test. Results demonstrated a significant development of grammar knowledge from the pre-test to the post-test and from the intermediate-test to the post-test for the experimental group. However, both groups showed significant learning gains for recognition of novel unaccusative verbs. Similarly, for vocabulary development, the experimental group significantly out-performed the control group for form and meaning recognition on the unaccusative verbs within the reading passages. No statistically significant difference was observed between the groups for reading comprehension. **The results of the study demonstrate that providing L1 glosses of novel L2 grammatical forms within a reading text may lead to improved performance on those forms.**

Kılıçkaya, F. (2015). Computer-based grammar instruction in an EFL context: Improving the effectiveness of teaching adverbial clauses. *Computer Assisted Language Learning, 28(4)*, 325-340.

- This study compared the efficacy of three different instructional methods on the development of grammar knowledge. It compared computer-based instruction, teacher-driven instruction, and teacher-driven grammar instruction supplemented by computer-based instruction. A total of 50 students enrolled in a private language institution in Turkey participated in the study. All participants were preparing to take an English language exam required of civil servants. The grammatical instruction focused on adverbial clauses. Each group received 20 hours of deductive instruction on the same material over two weeks. The experimental groups received online instruction through SoftChalk 6, a platform that allows for the easy conversion of lecture materials into interactive materials with quizzes and exercises. A pre-test/post-test/delayed post-test design was used to assess grammar knowledge development. On the first post-test, both experimental groups (i.e., those with computer-based instruction) scored significantly higher than the teacher-led control group. Similar results were observed on the 5-week delayed post-test, with both experimental groups significantly out-performing the control group. On both tests, participants in the experimental group that combined teacher-driven instruction and computer-based instruction scored higher than the experimental group that received only computer-based instruction; however, the difference between the groups' performance was not significant. **The results of the study indicate that interactive computer-based grammar instruction combined with classroom instruction from a teacher may provide students with an effective means of practicing new grammatical forms.**

Li, Z., & Hegelheimer, V. (2013). Mobile-assisted grammar exercises: Effects on self-editing in L2 writing. *Language Learning & Technology, 17(3)*, 135–156.

- This paper presented a mobile app called Grammar Clinic, which provided English grammar exercises in the form of sentence error detection and correction. A total of 15 grammatical error types are covered in the app, along with a grammar handbook that can be used as a rule reference. Error types covered include verb, noun, adjective, and adverb use; run-on sentences; sentence fragments; and word order. For each type of error there are multiple exercises that vary in difficulty. Users are provided with instant corrective feedback after each

item. A total of 19 undergraduate intermediate-level ESL learners at a US university took part in the study. Students were required to dedicate out-of-class time to Grammar Clinic, complete a grammar pre- and post-test, write four papers, and complete a questionnaire on their use and perceptions of Grammar Clinic. The first and last paper assignments together with the pre- and post-test were analyzed for the development of grammar and self-editing skills. Overall, few significant improvements were observed. Students performed less self-editing over time, and fewer errors were observed in the final paper, compared to their first paper, but the decrease was not significant. Similarly, there was no significant improvement from the grammar pre-test to the post-test, even though most students in the class scored higher on the post-test. Results from the questionnaire showed that most students had a positive perception of Grammar Clinic, but most students did not use it outside of the required assignments. Another possible factor in the lack of significant results was that the majority of students did not find the exercises in Grammar Clinic challenging. **The results of the study demonstrate that computerized grammar instruction does not always lead to significant improvements in grammatical accuracy.**

Lys, F. (2013). Computer-mediated grammar teaching and its effect on language acquisition over time. *CALICO Journal, 30*, 166–186.

- This study looked at student interactions with grammar sections of an online learning environment and the effect of those interactions on overall language development. Over the course of three semesters of second-year German, a total of 53 students at various US universities participated in the study. A pre-test/post-test design was used, with multiple assessments, including an oral proficiency test, writing production, and a cloze test. Participants, outside of their second-year language class, practiced German using the online learning environment Intermatik, which presented grammatical information through text, audio, graphics, and video. Language practice was made possible through various question formats and free-writing tasks. Participant interactions with Intermatik and performance in the online environment were also tracked. Results showed significant improvement for all assessments from the pre-tests to the post-tests. The results of a user survey showed that about 25% of

participants logged in every day, and half of participants logged in every second day. Most participants only quit their learning for the day after they had achieved a high score (80% or higher) on the chapter exercises and quizzes. Participants cited a variety of interactive exercises and online resources, such as grammar and vocabulary help, as being the most useful. Feedback on exercises was cited as being less important than good grammar explanations and a large number of practice exercises. **Online learning environments that provide grammar instruction and resources through text, audio, graphics, and video may encourage improvements in grammatical accuracy. Learners appreciate clear grammar explanations and a variety of practice exercises.**

Vocabulary

Cavus, N., & Ibrahim, D. (2009). m-Learning: An experiment in using SMS to support learning new English language words. *British Journal of Educational Technology*, 40(1), 78–91.

- The purpose of this study was to look at the efficacy of SMS text messaging for promoting vocabulary development in L2 English learners. The participants were 45 first-year university students enrolled in an English language class in Turkey; the vocabulary delivered to them through SMS were technical language words (e.g., “client,” “bandwidth,” “hardware”). For each SMS, the English vocabulary word/phrase was sent along with the Turkish definition. Participants were split into three groups, and each group received vocabulary on different days during the 9-day experiment. Between 9:00 to 17:00, students received 16 SMS messages. Group A received texts on days 1, 2, and 7; Group B received texts on days 3, 4, and 8, and Group C received texts on days 5, 6, and 9. A pre-test/post-test design was used to assess vocabulary development, and a survey was administered to gather student perceptions of the vocabulary delivery system. Results showed a significant score increase from the pre-test to the post-test, and survey responses were very positive, with the highest agreement to statements about enjoying the SMS system, being able to remember the vocabulary delivered through SMS, and feeling more motivated to learn vocabulary via SMS. **This study demonstrates that delivering vocabulary to L2 learners via SMS text messages may be an effective means of**

supporting vocabulary development. Moreover, learners may demonstrate positive attitudes towards learning vocabulary via SMS.

Chiu, Y. H. (2013). Computer-assisted second language vocabulary instruction: A meta-analysis. *British Journal of Educational Technology*, 44(2), E52–E56.

- This article provides a synthesis of EFL studies focusing on the effects of CALL on vocabulary learning. Vocabulary learning is one of the most studied areas within the CALL subfield; however, results are still conflicted regarding the efficiency of vocabulary learning through CALL. While some studies report positive results in favour of vocabulary learning through CALL, other studies, especially those focusing on glosses, report no effects. The synthesis focuses on four factors: treatment duration, education level of participants, game-based learning, and the role of teachers. In total, 16 studies were synthesized, which had a combined total of 1,684 EFL participants. Across the studies CALL was found to be beneficial for vocabulary learning. Short-term CALL usage (< 1 month) produced better results than long-term usage. **High-school and university students were found to benefit more from computer-assisted vocabulary learning than elementary school students.** The popularity of digital game-based learning (DGBL) has increased in recent years, and it has been shown to be an effective method for some aspects of language learning, but for vocabulary learning, traditional methods have been shown to be more effective. Finally, studies comparing teacher-led to independent learning indicate, though not significantly, that students learned more vocabulary without teacher intervention.

Groot, P. J. (2000). Computer assisted second language vocabulary acquisition. *Language Learning & Technology*, 4(1), 56–76.

- This article proposed a new CALL application — CAVOCA (Computer Assisted Vocabulary Acquisition) — to help intermediate L2 learners optimally acquire relevant low-frequency vocabulary, in order to improve their functional language use. This is especially true when L2 learners need to read and understand academic texts. The program divides word learning into four sections:
 - ↳ **Deduction**, in which learners are presented with a new word in three contexts, each with increasingly

obvious clues about the meaning of the new word. After each presentation, the user answers a question about the word's meaning and is given immediate feedback.

- ^ **Usage**, in which learners are required to make appropriateness judgments about the way words are used in sentences.
- ^ **Examples**, which contain short, authentic reading passages designed to encourage long-term retention of the words.
- ^ **Lexical retrieval**, which requires learners to use their active knowledge of the vocabulary to answer fill-in-the-blank questions.

Throughout the sections, there is opportunity for user interactivity and corrective feedback. Participants in these experiments were secondary or university students; control and experimental groups were compared with a pre-test/post-test/delayed post-test model. Results showed that long-term retention for words learned with CAVOCA was greater than with traditional word lists. However, participants with bilingual lists learned more words overall than those using CAVOCA. Ultimately CAVOCA combined with bilingual word lists is suggested as an effective method for long-term vocabulary acquisition. **The results of the study demonstrate that L2 learners may effectively learn low-frequency vocabulary via applications that promote word learning and retention through a series of steps that include deduction, usage, examples, and lexical retrieval.**

Hirschel, R., & Fritz, E. (2013). Learning vocabulary: CALL program versus vocabulary notebook. *System*, 41(3), 639–653.

- The study was carried out with 140 first-year English majors at a university in Japan with a wide variety of proficiency levels, as measured by the TOEIC English exam. Six intact classes were studied: two classes, with a total of 52 students, used the CALL program; one class of 26 students used vocabulary notebooks; and three classes, with 62 students total, acted as the control group. A pre-test/post-test/delayed post-test model was used with a total of 36 words from various levels of the Academic Word List. The CALL treatment group learned vocabulary via praxised.com, which provided L1 support, multiple examples for each word, and spaced repetition, for 30 20-minute sessions over two months, outside of class time. The vocabulary notebook group

was required to create a paper-and-pencil entry for each of the 36 words. Entries included parts of speech, L2 definition, L1 translation, example sentence, and collocations (i.e., groupings of two or more words frequently seen together, e.g., “saving time,” “doing homework,” “doing the dishes,” “making food”). Participants in this treatment group also participated in in-class quizzes. Overall, the notebook group spent 3–5 hours studying the target vocabulary over the course of two months. The control group encountered the target words through their course material, but they did not receive explicit instruction or dedicated practice measures for the vocabulary. Both treatment groups showed significant improvement from the pre-test to the post-test, but their scores decreased on the delayed post-test, five months after the treatment ended. The control group showed small learning gains, which did not decrease from the end of the study to the delayed post-test. **Online programs for vocabulary learning that focus on the development of vocabulary knowledge (e.g., L1 definitions, examples and spaced repetition) may be beneficial for the learning of new vocabulary items.**

Hsieh, Y. (2019). Effects of video captioning on EFL vocabulary learning and listening comprehension. *Computer Assisted Language Learning*, 33(5–6), 567–589.

- This study looked at the effects of five different types of video captioning on vocabulary learning and listening comprehension development. The five different groups were as follows: a) no captions, b) full caption with no audio, c) full caption, d) full caption with highlighting of target word, and e) full caption with highlighting and an L1 gloss of the target word. The participants were 105 low-intermediate L2 English speakers with an L1 of Mandarin. Each participant was randomly assigned to one of the five captioning groups and watched two 5-minute videos twice; for each video they wrote one comprehension test, and three vocabulary tests. All target words chosen for highlighting and testing were unknown to the participants prior to the study. The comprehension test contained multiple-choice questions, and the vocabulary tests had questions on form recognition, meaning recognition, and meaning recall. Results showed no significant difference on the comprehension test between groups. However, for vocabulary form recognition, those groups given audio and captions for a target word significantly out-

performed the remaining two groups. For meaning recognition and recall, the group that had full captions with highlighting and an L1 gloss of the target word significantly out-performed all other groups. **This study demonstrates that captioning is helpful for learning new vocabulary and that video captioning with target word highlighting and an L1 gloss may improve vocabulary learning more so than other types of captioning.**

Lee, H., Warschauer, M., & Lee, J. H. (2017). The effects of concordance-based electronic glosses on L2 vocabulary learning. *Language Learning & Technology, 21(2), 32-51.*

- This article looked at the effect of two different types of glosses on vocabulary development in a digital reading environment. The participants were 138 undergraduate South Korean EFL students at a B1–B2 CEFR level. There were nine intact classes with different instructors, but they all followed the same curriculum with the same textbook. Three intact classes were kept as the control group, and the students in the other six classes were randomly assigned to two treatment groups; the control group did not have any glosses in their readings. One treatment group received electronic glosses with three lines containing the word in context that encouraged participants to infer the meaning of the target word; the other treatment group had glosses that gave the dictionary definition of the target word. Participants completed three 500-word readings over three weeks for the study, with each containing ten target words with corresponding glosses. Four meaning-recall vocabulary tests were completed throughout the study; one acted as a pre-test prior to the reading tasks, and three were done as immediate post-tests following each reading task. Results showed that participants in the treatment groups scored significantly higher on the post-tests, with the definition-gloss group outperforming the inference-gloss group. **This study demonstrates that both definition-based glosses and inference-based glosses can improve L2 English learners' vocabulary.**

Nakata, T. (2011). Computer-assisted second language vocabulary learning in a paired-associate paradigm: A critical investigation of flashcard software. *Computer Assisted Language Learning, 24(1), 17-38.*

- This article looked at nine flashcard and paired-associate software studies for vocabulary learning and

evaluated them on 17 criteria. The vocabulary apps evaluated were all developed under the supervision of language researchers, were favourably reviewed in academic publications, and were freely available. Research on flashcard systems has demonstrated the following to be important features of effective applications: creation and editing of individual flashcards, multilingual support, collocations, additional information including contexts, images, audio, and support for data entry and flashcard sets. It is important for learners and instructors to be able to build their own vocabulary sets into the flashcard software, not just individual flashcards. A review of design features that best support learning has shown that the following are key features: presentation and retrieval modes, various exercise types, increased retrieval effort (i.e., retrieval sequencing based on increasing difficulty), promotion of generative use (i.e., learned words in new contexts), flexibility for block size (i.e., the number of words to be learned in a session), and re-view scheduling (i.e., intervals between reviews of words learned). Three of the software systems were designed for learners of English and the other six had ready-made flashcards in multiple languages and also allowed the user to make flashcards in any language. Inconsistencies were found in the design of the flashcard software, and the evaluation criteria used in the paper could act as development guidelines for new software. **A review of research-informed flashcard software revealed several important features of effective software: the ability for learners to create and edit individual and sets of flashcards; multilingual support; additional information on the flashcards, such as context, audio, and visual components; variety of exercise types; and flexibility in the review scheduling and the number of words seen in a learning session.**

Wu, Q. (2015). Designing a smartphone app to teach English (L2) vocabulary. *Computers & Education, 85, 170-179.*

- The purpose of the study was to test the efficiency of a developed vocabulary app for Chinese learners of English. The 1,274 words in the app were considered to be indicative of intermediate to high proficiency, and they were taken from the College English Curriculum Requirements for Chinese university students. An Android smartphone app was developed that allowed for the selection of words by users and, for each

word, the practice of spelling, pronunciation, and Chinese definitions. Users had the option of marking words as “known” or “unknown” and creating sub-lists of “unknown” words; they also had the option of completing sample tests of random words. A total of 70 fourth-year Chinese medical students participated in the study; half of the participants were randomly assigned to use the app to learn and practice vocabulary. Pre-test and post-tests were carried out using the sample tests of 100 words from the app. The treatment group using the app was found to significantly outperform the students using traditional vocabulary study methods, like word list memorization, and participants in the treatment group were found to have acquired on average 88 more words than the control group. Within the treatment group, most participants spent one to two hours per day using the app over a 6-week period. **A vocabulary app was developed and successfully helped L2 English learners acquire intermediate-level vocabulary words through the practice of spelling, pronunciation, and definitions for user-defined lists of unknown words.**

For recent meta-analyses of research into CALL and vocabulary learning, see Abraham (2008), Chen et al. (2018), Chiu (2013), Handley (2014), Lin and Lin (2019), Nakata (2011), Sung et al. (2015), and Tsai (2019).

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Culture and CALL



Current approaches to teaching language and culture focus on far more than the target languages and the countries where they are spoken. Although teaching culture is now an important aspect of language teaching, it presents a unique set of challenges. Teachers need to consider, for example, which aspects of which culture(s) to teach, which facts should be highlighted, and the extent to which certain aspects of culture should be contextualized (Omaggio Hadley, 2001). Galloway (1985) proposes four common approaches to teaching culture: a) the Frankenstein Approach in which a teacher chooses stereotypical cultural examples somewhat haphazardly (e.g., “a taco from here, a flamenco dancer from there”); b) the 4-F Approach that focuses on folk dances, festivals, fairs, and food; c) the Tour Guide Approach, which focuses on “monuments, rivers, and cities”; and d) the “By-the-Way” Approach, which includes “sporadic lectures or bits of behavior selected indiscriminately to emphasize sharp differences” (Omaggio Hadley, 2001, pp. 348–349). Researchers advocate for a more integrated approach to engaging with culture(s).

Today many would agree that it is important to “enable students to develop into multilingually and multiculturally aware world citizens” (Risager, 2007, p. 1). Recent approaches to teaching culture have thus focused on the development of **intercultural communicative competence (ICC), which is the “ability to ensure a shared understanding by people of different social identities, and the ability to interact with people as complex human beings with multiple identities and**

their own individuality” (Byram, Gribkova, & Starkey, 2002, p. 10). Guth and Helm (2019) note that CALL offers a wealth of opportunities for promoting culture as “complex, diverse, and multi-faceted” (p. 97). They describe how it can be used to connect geographically distant students to engage in telecollaborative² tasks designed to develop ICC. Such tasks make use of everyday communication tools such as email, social networking sites, and software and apps like Skype, Zoom, FaceTime, WhatsApp, and Adobe Connect. The authors also note that **the internet provides a) access to authentic cultural resources available in a range of media types; b) opportunities to communicate and collaborate, thereby enabling deeper engagement and opportunities for reflection; and c) the chance to bridge classroom language learning and internet use that involves identities that students have developed outside of class** (Guth & Helm, 2019, p. 100). They note the importance of **designing and sequencing appropriate tasks in their ultimate success** (p. 117).

In a recent systematic review of research into the extent to which learners develop ICC through online exchanges, Avgousti’s (2018) analyses highlight that students involved in such exchanges often gain cultural knowledge, eliminate stereotypes, and improve their cultural sensitivity. In general, participants greatly value the authentic experiences of interacting with native speakers. Notable challenges faced by participants included lack of equal participation from both sides of the telecollaboration, inappropriate tasks, and technological

2 Guth and Helm (2019) note that telecollaboration is often referred to as “virtual exchange,” “online intercultural exchange,” and “collaborative online international learning.”

difficulties. Other recent studies have demonstrated that **participating in well-planned synchronous and asynchronous written** (Angelova & Zhao, 2016; Zeiss & Isabelli-García, 2005) **and video-based** (Jauregi & Bañados, 2008) **CMC tasks, participating in a target language Facebook group** (Özdemir, 2017), **as well as producing blogs and podcasts** (Lee, 2009) **may lead to an increase in ICC and target language skills.**

Literature Review

Angelova, M., & Zhao, Y. (2016). Using an online collaborative project between American and Chinese students to develop ESL teaching skills, cross-cultural awareness and language skills. *Computer Assisted Language Learning*, 29(1), 167–185.

- The purpose of this study was to investigate the effect of CMC on the development of ESL teaching skills, cross-cultural awareness, and language skills. A total of 23 advanced undergraduates or graduate students from a US university were paired with 26 Chinese first-year university students of intermediate English proficiency. The Chinese EFL learners were required to introduce themselves to their American partners through an essay. The American students analyzed the essays for errors and created individual lessons and exercises for the Chinese students to be completed over five weeks. The American students were instructed to include as much authentic material and cultural information as possible in the lessons. Over the five weeks, the Chinese students were also encouraged to ask many questions, including questions about culture. The majority of pairs communicated using asynchronous CMC, but one group communicated with synchronous CMC. A second essay was submitted by the Chinese students at the end of the study. The development of both student groups was analyzed using the essays and CMC messages; specifically, the analysis focused on the Chinese students' American culture knowledge and the American student's grammar lessons and exercises. The EFL learners' essays were coded for culture awareness and language development. **Results from the qualitative data analysis show that the language skills of participants who took part in a 5-week written CMC-based collaborative project developed and that their cultural awareness increased. This study demonstrates that CMC can provide language learners with access to native speaker feedback and**

cultural information that can play a positive role in language development.

Jauregi, K., & Bañados, E. (2008). Virtual interaction through video-web communication: A step towards enriching and internationalizing language learning programs. *ReCALL: The Journal of EUROCALL*, 20(2), 183–207.

- This study used synchronous and asynchronous online communication tools to provide insights into whether language learning curricula can be enriched through international telecollaboration. L2 Spanish learners from the Netherlands at the B2 level ($n = 20$) were partnered with Chilean students studying to become L1 Spanish teachers ($n = 20$). Pairs of students from the different universities worked together to complete four tasks. Students used the synchronous video-web tool Adobe Connect and an asynchronous blog platform to complete the tasks. The first two tasks had students discuss stereotypes about Dutch and Chilean people and write down interview/follow-up questions to be answered in the subsequent task. The third task had students discuss student life at their respective universities. The final task was a literary debate, where Dutch students had to give short oral presentations on books and the Chilean students had to debate about who had the best presentation. Data were gathered from a questionnaire, recorded Adobe Connect sessions, and blog posts. Chilean students overall rated the experience more positively than Dutch students, but several of the Dutch students reported low participation and poor communication from their Chilean partners. Both groups rated their experience with the Web technologies positively, but some low ratings were due to technical problems with the software. Both groups viewed the tasks assigned favourably and enjoyed having a consistent speech partner. The results of this study indicate that **international telecollaboration making use of videos and blogs in which partners are required to complete specific tasks may enable language teaching and learning and promote intercultural communication.**

Lee, L. (2009). Promoting intercultural exchanges with blogs and podcasting: A study of Spanish–American telecollaboration. *Computer Assisted Language Learning*, 22(5), 425–443.

- The purpose of this study was to investigate the development of intercultural knowledge using blogs and

podcasts. Graduate students in an applied linguistics class in the US who had varying degrees of Spanish knowledge ($n = 10$) were partnered with advanced English speakers enrolled in an undergraduate English course at a university in Spain ($n = 23$). The platform Blogger was used to write blogs, Moodle was used to facilitate discussion, and Audacity and iMovie were used to create podcasts. Students from both universities were given three tasks to complete outside of class time, with 3–4 weeks to complete each task. Prior to the study, students formed small groups at their home universities and were then partnered with a group at the other university. The first task required L2 Spanish learners to write a blog post about the lives of young people in the US. The L2 English partners were required to make comments and provide linguistic feedback. In the second task the L2 English speakers produced a podcast on controversial topics in the US, and their partners were asked to engage with their opinions and reactions. For the last task, the L2 Spanish learners posted Spanish culture questions on the discussion board for their partners to answer. Qualitative data were gathered from the discussion posts and quantitative data were gathered from a survey administered at the end of the course. One challenge that was noted was the lack of participation by some of the undergraduate students in Spain. **This telecollaborative study, which made use of blogs, discussion boards, and podcasts, demonstrates that participants are able to share cultural knowledge and develop intercultural knowledge through engaging in clear tasks. Overall perceptions from students were positive, and they enjoyed the opportunity to gain deeper understanding of the target culture through the tasks.**

See Lee and Markey (2014) for another study investigating telecollaboration.

Özdemir, E. (2017). Promoting EFL learners' intercultural communication effectiveness: A focus on Facebook. *Computer Assisted Language Learning*, 30(6), 510–528.

- This study looked at the development of intercultural communicative competence (ICC) through the use of Facebook groups. Facebook facilitates the development of ICC through conversations with native speakers of the target language, with exposure to authentic interactions. Facebook can also be motivating for

students. The study consisted of 40 advanced EFL learners who were freshman in an English language teaching program at a Turkish university. Participants were randomly assigned to either a Facebook discussion group or an in-class discussion group. Over the course of five weeks, participants engaged in five discussions. The experiment utilized a mixed-methods design and had participants complete a pre-test/post-test using the intercultural effectiveness scale (IES). Qualitative data in the form of participant semi-structured interviews and written essays were collected. Participants in the Facebook group joined a public group for English language teachers, and they made comments on a video posted by the researcher. Since the group had 69,000 members, other members of the group engaged in the discussion to varying degrees. Results showed a significant increase of ICC from the pre-test to the post-test for the Facebook treatment group but not for the in-class discussion group. Three themes emerged from the qualitative data analysis: **a) students had positive perceptions regarding target language interaction on Facebook; b) students felt that Facebook enabled them to develop their ICC; and c) students expressed anxiety about interacting with native speakers and in public forums online. The results of the study indicate that the use of Facebook groups may support the development of ICC.**

Zeiss, E., & Isabelli-García, C. L. (2005). The role of asynchronous computer mediated communication on enhancing cultural awareness. *Computer Assisted Language Learning*, 18(3), 151–169.

- This study looked at how written asynchronous CMC affected L2 Spanish learner's self-perception and knowledge of the target culture. Two intermediate Spanish classes at a US university were chosen to participate in the study: the experimental class had 23 students, and the control class had 38 students. Both classes followed the same syllabus and received cultural information from their textbook and a Spanish TV show. However, the experimental group participated in three asynchronous CMC sessions with university students in Mexico over the course of a semester. Each CMC session involved the students participating in a discussion in an online forum. In the first session, students got to know each other; in the second session they discussed current events in the media; in the final session they discussed Hispanic food and holidays. The

first two CMC sessions were conducted in English and the final session was in Spanish. Both the treatment and control L2 Spanish groups were tested on cultural knowledge in the textbook and TV show, and all students completed a self-perception questionnaire at the end of the semester. Results showed that **students in the treatment group who engaged in CMC sessions with native speakers of the target language displayed significantly more cultural knowledge than the control group in areas such as daily life, education systems, and current events.** Questions that asked about information covered in the textbook or in the TV show showed no significant knowledge differences between the groups. Overall the results show that **making use of CMC sessions may provide learners with complementary cultural knowledge to that provided in the classroom. Students who participate in CMC sessions may demonstrate a greater awareness of certain cultural aspects than those who do not.**

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Assessing Learning and Providing Feedback in CALL

One of the most profound benefits of CALL is the ability to assess student learning quickly and to provide individualized feedback in a way that encourages the development of language. Assessment, defined as the “process of systematically collecting information about learning outcomes” (Goertler, 2019, p. 75), can fall into three main areas: assessment *of* learning, assessment *for* learning, and assessment *as* learning (Lam, 2019). Whereas assessments *of* learning provide learners with a summary of their learning at the end of a learning unit or semester, assessments *for* learning provide learners with ongoing feedback during the process of learning to support that learning. Finally, assessment *as* learning focuses on a learner’s capacity to improve their learning as a result of self-reflection (Lam, 2019, p. 79). Research has demonstrated that all of these forms of assessment play a role in L2 learners’ language development. Feedback, or evidence about the correctness of a learner’s language use, plays a central role in assessment. Youngs (2019) notes that feedback can take a number of forms including visual (e.g., a look of surprise), auditory (e.g., a request for clarification), or written (e.g., teacher corrections on a written assignment). In a CALL environment, assessment and feedback can be provided by a person (e.g., teacher or fellow student) or by a computer (Youngs, 2019).

Assessing Learning

In their comprehensive review of research on assessing learning in CALL, Chapelle and Voss (2016) identified two lines of research: a) studies investigating the efficiency of assessment in CALL; and b) studies investigating the

innovation of the technologies employed. **One type of technology-mediated test that has demonstrated incredible efficiency is the computer-adaptive test, which adjusts the question difficulty on the basis of whether or not a learner answered the previous question correctly.** García Laborda (2007) indicates that the use of such tests allows for quick correction, feedback, and reporting of student performance. Chapelle and Voss (2016) note that, among other benefits, using computer-adaptive tests means that learners only need to spend time responding to items at their own level, that a range of media types can be readily integrated into the exams, and that it is possible to measure students’ automaticity by looking at the amount of time they take to respond to a given item. At the same time, Goertler (2019) notes that computer-adaptive tests are challenging to design. **Automated writing evaluation (AWE)**, such as that described in Wang, Shang, and Briody (2013), **offers learners quick, easily accessible feedback on their written work.** Another area of research into efficiencies of CALL assessments compares the results of human assessments with those provided by technology (Chapelle & Voss, 2016). Researchers and test developers alike are interested in the extent to which automated ratings of speech can be successfully rated by computers, and they have found that **recent developments in the technology allow for some aspects of speech to be more accurately assessed by a computer than by a human.** That said, **human raters are still necessary for the assessment of certain components of student work**, for example the extent to which learners develop the content over time (Wang & Sun, 2018).

Although research has demonstrated that learners are comfortable reading texts on a computer screen (e.g., Sawaki, 2001), it has been shown that they may be less comfortable speaking to a computer screen than speaking with a human interlocutor (Kenyon & Malabonga, 2001; Nakatsuhara, Inoue, Berry, & Galaczi, 2017). Learners' comfort with writing essays on a computer may depend on a number of factors including their proficiency in the L2, their L1, and their age, to name just a few (Wolfe & Manalo, 2004).

When it comes to innovations in assessment, many researchers are interested in the extent to which efficient computerized tests are potentially better and more useful than those that do not make use of technology (Chapelle & Voss, 2016). For example, making assessments available online has expanded the accessibility of language testing for students, teachers, and authors of tests (Roever, 2001). Researchers are also interested in the extent to which test takers learn not only from the results of an assessment but also from the *process* of assessment (Chapelle & Voss, 2016). While a final score (assessment *of* learning) provides learners with an idea of how they performed on the test, one of the main benefits of the innovative nature of CALL assessments is the possibility of providing individualized feedback to learners as they learn (i.e., assessment *for* learning [Godwin-Jones, 2001, 2008]). Ultimately, it is expected that learners become better language learners as a result of the feedback they have received.

Tasks such as online portfolios encourage formative assessments of student learning. Portfolios can focus on a range of productive and receptive skills as well as learners' development of grammar, vocabulary, and cultural understanding. Learners may be taken through a checklist of can-do statements to demonstrate whether they have developed a given set of skills. For example, when assessing their learning about culture, students may indicate the extent to which they are able to compare their own culture with the target culture or interact appropriately with target language speakers (Guth & Helm, 2019). Computerized assessment *of*, *for*, and *as* learning of the productive skills of speaking and writing may focus on improved speaking or writing development, learners' ability to make use of the feedback provided, and the impact of performance reports provided to students and teachers (e.g., Chen & Cheng, 2008). Research has demonstrated that the effectiveness of computerized

assessment systems may depend on students' familiarity with them (Chen & Cheng, 2008). Regardless of what is being assessed, Reinhardt and Thorne (2019) remind us that **assessments “should focus on the particular objectives” of the task** (p. 224).

Providing Feedback

Feedback plays an important role in language development. Ellis, Loewen, and Erlam (2006) note, however, that there are a number of questions about corrective feedback, including these: a) the types of errors that should be corrected; b) who should correct the errors; c) which type of feedback is most effective; and d) what is the best timing for providing feedback. Although research has not provided definitive findings, Goertler (2019) notes that **“feedback options should be optimized with the goal of being efficient, individualized, valid, accurate, and reliable”** (p. 72).

Within the field of L2 learning, researchers have investigated the effectiveness of various types of feedback. Two that are especially relevant in CALL settings include recasts (i.e., feedback in which the instructor repeats with the student's utterance with their correction) and metalinguistic feedback (i.e., feedback in which the instructor provides information about the proper form used in a given context). **The extent to which one type of feedback may be more effective than another in a CALL environment remains to be determined** (e.g., Loewen & Erlam, 2006). Importantly, researchers are interested in the degree of uptake (i.e., a learner's response to corrective feedback, usually in the form of self-correction or utterance revision), as this is a sign of integration of the feedback. Recent research has demonstrated substantial uptake of CALL feedback, especially when the feature being targeted is a higher-order learning task (e.g., Lavolette, Polio, & Kahng, 2015). Recent research into feedback provided in a CALL setting focuses on **Intelligent CALL (ICALL, which involves the use of artificial intelligence and often natural language processing, in CALL software). ICALL enables feedback on a wider range of tasks, including those that are more spontaneous. The results of a range of studies have demonstrated that ICALL may be quite effective at diagnosing errors** (e.g., Lavolette et al., 2015), but determining the source of the errors and providing learners with this sort of information is often somewhat of a challenge (e.g., Ai, 2017).

In their meta-analysis of item-based feedback in computer-based environments not specifically related to language learning, Van der Kleij, Feskens, and Eggen (2015) demonstrated that **elaborated feedback (i.e., feedback that provides learners with both the correct answer and an explanation) is more beneficial than feedback regarding the correctness of a given item (i.e., “right” or “wrong”) as well as feedback that only provides the correct answer.** This has been demonstrated, for example, in studies investigating the development of language learners’ writing, spelling, and perceptual skills (AbuSeileek, 2013; Heift & Rimrott, 2008; Lee & Lyster, 2016). Although there is some variation in findings, researchers have found that **providing immediate feedback may be more helpful than delayed feedback, especially when dealing with lower-order learning tasks (e.g., vocabulary learning and grammatical accuracy)** (e.g., Shintani & Aubrey, 2016). Research has demonstrated greater effectiveness of feedback overall for university students as compared to those in high school or elementary school. The authors further note that “providing [‘intelligent tutoring’] feedback that gradually becomes more elaborate in an interactive manner could be used to adapt the feedback to the needs of learners” (Van der Kleij et al., 2015, p. 504; Ai, 2017).

Literature Review

Assessing Learning

Kenyon, D. M., & Malabonga, V. (2001). Comparing examinee attitudes toward computer-assisted and other proficiency assessments. *Language Learning & Technology, 5(2), 60-83.*

- This study compared test-taker attitudes towards two computer-assisted oral proficiency exams for L2 learners of Spanish, Arabic, and Chinese. Based on the ACTFL Oral Proficiency Interview (OPI), the Simulated Oral Proficiency Interview (SOPI) is a self-administered and recorded oral exam. The Computerized Oral Proficiency Interview (COPI) is based on the SOPI. The COPI contains approximately 100 tasks that elicit speech at the recognized ACTFL levels including Novice, Intermediate, Advanced, Superior, and Distinguished. Each task also has several multimedia components, including written instructions, visual files, and audio prompts. Both the SOPI and the COPI are assessed following the ACTFL Speaking Proficiency Guidelines.

A total of 55 students participated in the study from each of the ACTFL proficiency levels; 24 were studying Spanish, 15 were studying Arabic, and 16 were studying Chinese. Participants completed both the SOPI and the COPI along with questionnaires that asked participants a) about aspects of the tests that might have influenced their performance and b) to directly compare the SOPI and COPI. Additionally, the students studying Spanish completed a face-to-face OPI. Results indicate that **across proficiency levels, the scores among the tests remained consistent. The first questionnaire did not reveal any significant differences in perceptions between the SOPI and COPI for factors that might have influenced the test-takers’ performance.** The results from the second questionnaire revealed significant differences when directly comparing the two exams. The majority of **participants found the computerized OPI easier and felt they were better able to demonstrate their language skills during the test.**

Nakatsuhara, F., Inoue, C., Berry, V., & Galaczi, E. (2017). Exploring the use of video-conferencing technology in the assessment of spoken language: A mixed-methods study. *Language Assessment Quarterly, 14(1), 1-18.*

- This study compared face-to-face and video-conferencing delivery modes for speaking tests from the test-takers’ and examiners’ perspectives. Specifically, the researchers looked at test-takers’ scores and their linguistic output, and they analyzed the examiners’ behaviour for test administration and marking for both delivery methods. The teleconference software Zoom was used for the virtual test delivery. There were 32 participants in the study; all participants were enrolled in an IELTS preparation course in the UK, with a representative range of language proficiency based on the broader IELTS test taking population. The speaking test was structured based on the one-on-one IELTS Speaking test, which has three sections: a) a back-and-forth interview; b) a test-taker long turn (i.e., a monologue); and c) a back-and-forth discussion. Participants took part in both the face-to-face and teleconference tests, with different examiners for both tests. In addition to the examiners, three researchers observed the tests and took field notes. **Results showed no statistically significant differences in scores or difficulties for the face-to-face and**

teleconference speaking tests. An analysis of the linguistic features of both tests showed interesting differences in three language functions. Participants asked for more clarification during the teleconference tests and participants used *comparing* and *suggesting* functions more in the face-to-face tests. Interviews with **the test-takers revealed that they thought it was more difficult to relate to the examiners over teleconference.** Field notes revealed differences in how the examiners interacted with the test-takers. During the teleconferencing, examiners tended to speak slower and articulate more clearly than in the face-to-face test. Examiners also noted difficulties with turn-taking during the conversational parts of the test. Examiners also remarked on how poor sound quality negatively impacted their perception of test-taker pronunciation and grammar. **Overall, this study demonstrates differences between language exams carried out face-to-face as compared to those carried out via teleconference, with demonstrated benefits for the face-to-face format.**

Suvorov, R. (2015). The use of eye tracking in research on video-based second language (L2) listening assessment: A comparison of context videos and content videos. *Language Testing, 32(4), 463–483.*

- The purpose of this study was to look at viewing behaviour of test-takers during a video-based L2 listening test. Two types of videos were tested: context videos and content videos; context videos provide visual “information about the context of the spoken discourse” (p. 465), and content videos provide semantically relevant visual information to the information presented through the audio. In addition to the differences in viewing behaviour, the researcher also looked at how viewing behaviour correlated to the video test score. Two groups of participants took part in the study: 25 were undergraduate and graduate students enrolled in a mandatory ESL class given their low TOEFL scores; the eight remaining participants were graduate students and more advanced non-native English speakers. Most participants also had an L1 of Mandarin. The listening test used consisted of six video clips, approximately 3–4 minutes in length, with 30 multiple choice questions. All video samples were from academic lectures posted on YouTube. Half of the videos were content videos, and the other half were context images. Results showed that participants in the content

condition spent more time fixating on content videos. Finally, no relationship was found between the viewing behaviour of the participants, for either video type, or their score on the multiple-choice questions. **This study suggests that content videos may be more engaging to participants, but listening comprehension scores may not be affected by the choice between context and content videos.**

Wang, Y. J., Shang, H. F., & Briody, P. (2013). Exploring the impact of using automated writing evaluation in English as a foreign language university students' writing. *Computer Assisted Language Learning, 26(3), 234–257.*

- This study looked at the use of automated writing evaluation (AWE) to develop the writing skills of EFL university students in Taiwan. The AWE software used was CorrectEnglish. It takes a holistic approach and provides feedback on grammar, style, and word usage. It also has built-in English grammar instruction available in seven languages. A total of 57 participants in their first year of an applied English program took part in the study; on average, the participants had been learning English for ten years. One intact class was assigned as an experimental group ($n = 31$) and the other class was assigned as the control group. The study used a pre-test/post-test design, and students had to write 300 words on a given topic they were familiar with. For 14 weeks, each group spent three hours per week on writing. During each 3-hour session, the participants were introduced to a topic, wrote on that topic, and then revised their draft. For the experimental group, participants used the AWE to get feedback on their draft. The control group received feedback on their submitted writing from the instructor. **Results comparing the pre-test and post-test results showed a significant increase in accuracy for the experimental group that received automated writing instruction over the control group.** Responses to the questionnaire and interview questions revealed that **participants had generally positive perceptions of the AWE software, with most students using it to check sentence structure, verb tense, and appropriate word usage.** Participants self-reported that the **AWE helped them organize their writing throughout the task, as they could prompt the AWE for feedback as many times as they wanted during their writing.**

Wang, Z., & Sun, Y. (2018). Comparison of human rater and automated scoring of test takers' speaking ability and classification using item response theory. *Psychological Test and Assessment Modeling, 60*(1), 81–100.

- This paper compares L2 English speech rating scores from human markers and the SpeechRater software. The SpeechRater system is an automated spoken language scoring engine and is used by the TOEFL Practice Online program. Responses are scored holistically, but the score is assigned based on rubrics for multiple aspects of speaking: fluency, grammatical accuracy, vocabulary choice, and topic development. The speech samples used in the study were 5.5 minutes with two free-speech tasks and four tasks that involved a spoken response. A total of 66,000 speech samples were taken from 1,100 tests. The human rater scores were gathered and then each speech sample was assessed by SpeechRater. The researchers looked at different scoring scenarios (e.g., human raters only, human raters in combination with SpeechRater, and SpeechRater only) and the final score for a speech sample in each scenario. Results showed that the lowest correlation in scores was found between human only scores and SpeechRater only scores. The SpeechRater scores were most reliable. **The research suggests that a combination of both human rater and automatic scores be used for rating oral exams**, with further research needed into the optimal ratio of human to SpeechRater scoring. Currently human raters are still necessary for grading this task as there is a “topic development” grading rubric which cannot be assessed using SpeechRater.

Providing Feedback

AbuSeileek, A. F. (2013). Using track changes and word processor to provide corrective feedback to learners in writing. *Journal of Computer Assisted Learning, 29*(4), 319–333.

- This study looked at the effects of corrective feedback through track changes and word processing software on writing development. Track changes allows for a type of implicit feedback through the identification and recasting of an error, and word processing software, Microsoft Word, displays metalinguistic explicit feedback. A total of 64 EFL participants enrolled in a university writing course were assigned to one of four feedback groups. The groups gave and received

feedback through a) track changes only; b) word processor software only; c) track changes and word processor software together; or d) they did not give or receive feedback. Participants came from an intact class, and instruction on writing was given over eight sessions in eight weeks. Each week the students wrote and provided feedback to their peers on a short 200-word writing task. A pre-test/post-test/delayed post-test design was used to measure recognition and production development in 11 writing areas (e.g., capitalization, fragmentation, word misuse, negation). Results showed that **providing corrective feedback in the form of track changes and word processing correction may provide an effective means to target grammar in the L2. Participants in the combined feedback group (track changes with word processing correction) significantly out-performed the other treatment groups on the post-test, and all treatment groups significantly out-performed the control group, which did not receive or give feedback.** Results also indicated that **as the study progressed, students were able to find more errors to correct, and by the end of the study, students were making fewer errors.**

Ai, H. (2017). Providing graduated corrective feedback in an intelligent computer-assisted language learning environment. *ReCALL: The Journal of EUROCALL, 29*(3), 313–334.

- The study explored how graduated corrective feedback (CF) was implemented in an intelligent computer-assisted language learning (ICALL) environment to assess learners' language production through the use of an open-ended translation task. The study involved six students enrolled in a one-on-one 8-week enrichment program with the researcher to learn the Chinese *ba*-construction. The participants were college students taking third-semester Chinese courses at a public university in the US. The participants completed an English–Chinese translation task that required them to use the *ba*-construction. During this task, an intelligent CALL (ICALL) system provided a series of graduated CFs to the participants: the CF progressed from implicit and general to explicit and specific. The data were collected from video screen recordings, website logs, audio and video recordings, and post-enrichment interviews. The participants' interactions with the ICALL system were recorded by Camstasia (a video screen recording software). The researcher viewed the video and audio recordings to identify

instances in which the system identified or failed to identify the participants' problematic areas. The findings showed that generally, the ICALL system was effective in identifying the participants' problems in regard to various syntactic elements of the *ba*-construction and in providing pertinent and meaningful graduated CF for them to revise their answers. Furthermore, the results revealed that the graduated CF provided by the ICALL system was effective in helping the participants to identify and correct a number of grammatical errors (e.g., punctuation, grammatical objects and verb complements) related to the *ba*-construction. The graduated CF was also effective in drawing the participants' attention to more difficult aspects of the construction. Nonetheless, there were instances in which the ICALL system failed to locate the source of errors. **The study suggests that a graduated approach to corrective feedback provided by an intelligent computer-assisted language learning system may be effective in helping students to self-identify and self-correct a number of grammatical issues and that the amount of assistance learners need can be taken as an indication of their developing abilities in language learning.**

Heift, T., & Rimrott, A. (2008). Learner responses to corrective feedback for spelling errors in CALL. *System*, 36(2), 196–213.

- This paper looks at student responses and learner uptake while using a spell-checker for spelling errors with three types of corrective feedback. The first type of metalinguistic feedback highlighted the error in context and provided a word list of suggestions to replace the misspelled word. The second type simply suggested a word list but did not highlight the misspelled word in the sentence. Repetition was the third type of feedback given. All participants were English native speakers and enrolled in university-level German language courses. Half of the 28 participants were at the beginner level and half were at the intermediate level. Participants used the E-Tutor CALL system for approximately 15 hours over 15 weeks and completed a variety of grammatical and vocabulary exercises. A total of 1,268 misspellings were identified and analyzed from the 28 participants. The group that got metalinguistic feedback with highlighting had significantly higher learner uptake than the other two feedback types. Similarly, the two metalinguistic feedback groups

submitted significantly more correct responses than the repetition group. Finally, for the feedback that provided word suggestion lists, participants were significantly more likely to resubmit the correct response when the correct word appeared in the list. **This study demonstrates that providing learners with an indication that they have made an error together with suggestions for correction may be more helpful than simply indicating that they have made an error.**

Lavolette, E., Polio, C., & Kahng, J. (2015). The accuracy of computer-assisted feedback and students' responses to it. *Language Learning & Technology*, 19(2), 50–68.

- This study looked at the accuracy of the feedback given by an ICALL system and student responses to the feedback, with four different variables considered. The ICALL system, called Criterion, was used to provide metalinguistic feedback on written submissions. The influence of four different variables was also considered: type of error, accuracy of ICALL in diagnosing the error, time, and timing of feedback. Two timing delays for feedback were compared: a) immediate feedback, after the writing task was finished; and b) delayed feedback, one to three weeks after the writing task. Participants in the study included 32 ESL learners, most with a native language of Chinese, who were enrolled in a grammar and composition course at a US university. Students wrote four essays based on TOEFL prompts and revised each composition on the basis feedback from Criterion. The Criterion system was able to correctly identify and code 75% of errors (e.g., missing articles, capitalization, sentence fragments, subject-verb agreements). Results showed that participants' self-corrections in response to feedback varied depending on the type of error. Simpler errors, like capitalization and missing punctuation, had a lower uptake (50%) compared to more complex errors, like ill-formed verbs, which had an uptake of 85%. The results demonstrate that learner uptake significantly increased from the first writing submission to the last one. Finally, with regard to feedback timing, no significant difference was observed in learner uptake or writing accuracy between treatment groups. Essentially, learners performed similarly whether the feedback was immediate or delayed. **The study demonstrates that learners' self-correction of**

complex errors that require a deep knowledge of the L2 system (e.g., verb conjugation) may improve over time with the introduction of explicit, computer-generated feedback.

Lee, A. H., & Lyster, R. (2016). Effects of different types of corrective feedback on receptive skills in a second language: A speech perception training study. *Language Learning*, 66(4), 809–833.

- This study investigated the effectiveness of different types of corrective feedback on the perception of two English vowels. Participants of the study were 100 Korean native speakers learning English in Montreal, either through a private language learning institute or through a university. Learners self-rated their English proficiency levels as intermediate to advanced. The study used a pre-test/intermediate-test/post-test design. After the pre-test, participants were randomly assigned to one of four feedback groups or a control group. The types of feedback given to incorrect answers were the following: a) rejection followed by target form; b) rejection followed by non-target form; c) rejection followed by both target and non-target form; and d) “Wrong” displayed visually. Audio recordings of minimal pairs were played (e.g., *heat* vs. *hit*). If *heat* was the target form, but *hit* was selected, the feedback for A to D would have been as follows: a) “*heat was said*”; b) “*hit was not said*”; c) “*it was heat not hit*”; d) visual display of the word “Wrong.” Over two weeks, the participants completed eight training sessions of 1.5 hours each. Each training session consisted of 48 trained words. The pre-test/intermediate-test/post-test consisted of 48 trained words and 48 untrained words. Results showed that all groups that received feedback outperformed the control group in their perception of trained words, with group C (i.e., rejection followed by both target and non-target form) showing the highest increase in accuracy across tests, followed by group A, then group B, then group D. For untrained words, feedback groups A to C outperformed group D and the control group. **The results of this perceptual study demonstrate that participants who receive specific feedback on the spoken target form may outperform those who only receive an indication that their answer was wrong.**

Loewen, S., & Erlam, R. (2006). Corrective feedback in the chatroom: An experimental study. *Computer Assisted Language Learning*, 19(1), 1–14.

- This study partially replicated a classroom-based study, and it compared two types of corrective feedback in a synchronous CMC environment. The target grammatical feature was the regular English past tense. Thirty-one L2 English learners attending a private language school in New Zealand were enrolled in elementary-level English classes. The students had a variety of L1s including Japanese, Korean, Arabic, German, Thai, Portuguese, Spanish, French, and Chinese. Participants were randomly assigned to one of two treatment groups or a control group. The treatment groups were a) implicit feedback in the form of recasts and b) explicit metalinguistic feedback. Students in the control group received no feedback. Participants completed two tasks in their groups that required them to retell stories using the regular past tense. Participants received feedback from the researchers on average on 80% of errors in the CMC chat. Learning gains were measured using a pre-test/delayed post-test design with two grammaticality judgement tests. No statistically significant differences were observed between either treatment group or the control group from the pre-test to the post-test. A possible limitation of this study and the lack of results could be attributed to the low language proficiency of the participants or that regular past tense for L2 English learners is usually acquired later. Another possibility is the lack of learner uptake, given that no participants repeated the correction or practiced self-correction. **Two methods of corrective feedback — recasts and explicit metalinguistic — were compared in a chatroom environment. Participants in both treatment groups did not show a significant improvement from the pre-test to the post-test.**

Shintani, N., & Aubrey, S. (2016). The effectiveness of synchronous and asynchronous written corrective feedback on grammatical accuracy in a computer-mediated environment. *The Modern Language Journal*, 100(1), 296–319.

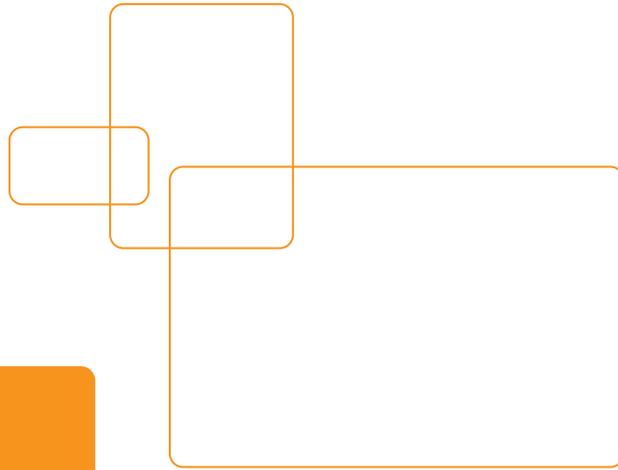
- This study looked at the effects of immediate (synchronous) versus delayed (asynchronous) corrective

feedback on writing production accuracy for English hypotheticals. Google Docs was used to facilitate the writing tasks, as it allows instructors to view, in real-time, student compositions. Instructors are also able to provide explicit feedback as the students are writing. A total of 76 English learners in their second year at a Japanese university participated in the study. Participants were of intermediate proficiency (i.e., averaging 460–500 on a paper-based TOEFL at the outset of the study). Participants were randomly assigned to one of three groups: a) an immediate feedback group, which received feedback while they were writing; b) a delayed feedback group, which received feedback after their writing was finished; or c) a control group, which received no feedback. The study used a pre-test/post-test/delayed post-test design with text reconstruction tasks. These reconstruction tasks had students respond to a pre-task assignment, which helped them develop the vocabulary necessary for the task. Results show that both treatment groups improved significantly from the pre-test to the first post-test for writing accuracy, with the immediate feedback group significantly outperforming the delayed feedback group. Scores decreased from the immediate post-test to the delayed post-test, although this decrease was not significant. **Participants who receive immediate feedback may demonstrate improved grammatical accuracy on written assignments. This may be attributable to the opportunity to improve accuracy while composing texts.**

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Computer-assisted language learning (CALL) can be effective in enabling learners to work autonomously, to receive individualized feedback, and to be exposed to real-world language in a range of varieties and voices. Deciding on which technology to use and then learning how to use it, however, represent onerous tasks for teachers. To make this process easier, CASLT commissioned researchers from the Language Research Centre (LRC) at the University of Calgary to review and summarize selected research on implementing CALL effectively, both inside and outside of language classrooms.



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