Multimedia materials can provide for a richer and deeper processing of the material. For example, Jones and Plass (2002) found that students listening to aural texts in French that included written and pictorial annotations scored higher on recall protocol comprehension tests than those who listened to the aural text alone. However, much of the research for multimedia language learning has focused on vocabulary acquisition, possibly because vocabulary knowledge is easier to test for. Jones and Plass also found that learners with written and pictorial annotations performed better on a subsequent test of new vocabulary from the listening material. Al‐Seghayer (2001) concluded that words glossed with text and video were more readily recalled than those with text plus a static picture. In a review of multimedia research for listening, Jones (2006) noted examples of listening studies showing (1) a stronger effect for visual annotations alone for high relative to low verbal ability students, (2) a text recall advantage for students working collaboratively with multimedia annotations in pairs rather than independently, (3) student attitudes toward multimedia improving with familiarity, and (4) value in providing

ongoing comprehension feedback during multimedia listening tasks. Although the research is generally positive regarding multimedia as an aid to richer processing during listening activities, the number of studies is limited. In recent years, the term multimedia in CALL research seems largely to refer to just captioned video (Leveridge and Yang 2013; Li 2014) or even video as opposed to audio (Yang 2014).

Electronic glossaries and dictionaries: Cardenas‐Claros and Gruba (2013) categorize both electronic glossaries and electronic dictionaries as explanatory help options. Functionally, though, they can be quite different. Glossed words and phrases typically provide an in-context explanation of their meaning, requiring intervention by materials writers at the development stage. In contrast, electronic dictionaries are independent of the text in which the links to their entries occur, so learners must interpret the results relative to the context in which an item occurs. Besides dictionary definitions, some electronic dictionaries will automatically link to Wikipedia entries (e.g., http://wordweb.info) to allow for elaboration.

The previous research on mixing pictorial and written annotations of items in an audio text is relevant here, but there is little else covering electronic dictionaries and listening. Jin and Deifell (2013) report results of a survey study where of 211respondents to a question regarding the use of online dictionaries, only 21.3% employed them for listening in the target language as opposed to 73.9% for reading. As noted in Levy and Steel (2015), usability is one of the primary issues for electronic dictionaries in this context.

A functionality missing from virtually all listening material is the ability to click on a word or phrase in a caption (automatically pausing the video) and get an instant popup definition in the desired dictionary. However, this is possible within transcripts for videos at the Clilstore site (http://multidict.net/clilstore/), a multilingual project funded by the European Union.

Play Speed Controls: One of the more remarkable affordances of digital technology is the potential to speed up or slow down speech rate. This is done through programs and media players that compress or stretch the time domain of the digital signal without shifting the

frequencies of the sound waves. This means that language learners can slow the speech rate down to allow for more processing time, but that the pitch of the voice still sounds relatively natural. So, unlike analogue systems where slowing speed also means lowering pitch, the original pitch can be maintained at the changed speed. Results of early research with slowed speech were somewhat mixed, but Zhao (1997) demonstrated clear advantages for comprehension when learners were allowed to control the speed rather than teachers or researchers.

Shifting from research to practice, an important work in this area is Rost and Wilson (2013). Most previous books that focused on the teaching of second language listening, like Field (2008) and Flowerdew and Miller (2005), have limited references to computer‐based technology. As noted above, Vandergrift and Goh (2012) devote a full chapter to it, emphasizing the role of metacognition in the selection of tools and techniques for listening. In contrast, in Rost and Wilson, the use of digital technology is interspersed throughout as a natural part of language instruction.

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The book is organized around the concept of active listening, which they paraphrase as "engaged processing." Building on prior theory, research, and practice, they conceptualize listening across five frames: affective, top‐down, bottom‐up, interactive, and autonomous. For the affective frame, for example, student motivation is a key element. With respect to technology integration, the authors suggest how activities involving personal interests like hobbies can be supported through learner selection and the presentation of YouTube videos. In another suggested activity, Wrong Words, they direct the teacher to select songs and play mp3 recordings or online music videos. The lyrics to the songs are downloaded from one of several suggested websites, and the teacher changes the text to include words that sound similar to but are different from the actual lyrics. The learners' task is to locate the mistakes in the transcript when they hear the music played. There are similar examples provided for the next three frames.

It is in the autonomous frame, however, that technology moves into playing the most central role. Rost and Wilson note that new technologies allow for out‐of‐class listening,

individualization of goals and tasks, and strategic use of comprehension and learning supports of the types described in Cardenas‐Claros and Gruba's (2013) help option typology.

The majority of the ten activities described in their chapter on the autonomous frame require listening mediated by technology, and several others include an optional technology component.

Examples include using transcripts with online listening materials, listening to news sites, listening‐based Webquests (http://webquest.org), creating a listening library of online materials, interacting through web‐based discussion boards, using online listening games, and learning something new through narrow listening (Krashen, 1996) using multiple short audio or video clips on the same topic.

A key concept in developing autonomy for continuing a student's progress in listening outside of class and once the course is over is learner training. Romeo and Hubbard (2010) report on a pervasive learner training model employed in an advanced ESL listening course that

incorporated a three‐hour independent listening project each week. The model integrated technical training (how to use the controls and help options in media players and dedicated listening sites), strategic training (what to do to enhance comprehension and learning, especially of new vocabulary), and pedagogical training (why to utilize certain techniques and procedures, such as pre‐listening and dictation, for specific objectives). Through pre‐ and post‐testing, they found substantial gains on a listening proficiency test. Evidence from weekly reflective reports, bi‐weekly individual tutorials, and exit interviews showed qualitative changes in the way students approached their independent listening, greater reflectivity over time, and a more positive attitude toward listening. A subsequent paper (Hubbard and Romeo, 2012) examined diversity among students in several areas including the selection of material and development of different sets of preferred strategies. The conclusion was that although all students benefited to some degree from learner training, some incorporated it more rapidly and successfully into their work than others. The study underscores the fact that response to training is highly individual and may be affected by factors outside the control of instructors.

Current Trends and Future Directions

A growing trend in multiple areas of language learning is the use of mobile devices, and listening is no exception. Demouy and Kukulska‐Hulme (2010) report that the majority of students in an online French course were initially not using the mp3 players they had to practice listening, but after a course project employing these players, "They quickly saw the benefits of using their device to maximise exposure to the language in spaces and at times that suited their lifestyle". Kukulska‐Hulme (2012) notes that several interviewees in a study on mobile language learning, "…appreciated the experience of learning a language while not being fully focused on it, for example, by simultaneously engaging in another task, and they noted the unobtrusiveness of mobile learning. There was a sense of wanting to immerse oneself in the target language by listening to it often and getting used to its sounds and intonation" (5–6). This suggests a role for mobile devices in incidental rather than intentional language learning through listening (Hulstijn 2003b). Hoven and Palalas (2013) report on a design‐based research study for creating a system to enhance ESP (English for specific purposes) learners' listening skills

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using mobile devices. The project employed podcasts, many of which were produced by students themselves either individually or collaboratively.

Podcasting is highly beneficial for learners for example they can

- ❖ Record classes
- ❖ Students record episodes
- ❖ Good for assessing pronunciation
- ❖ Short radio shows
- ❖ Flexibility
- ❖ Playback
- ❖ Synchronization of Episodes
- ❖ University FM Radio

- Learners and teachers can create their podcasts for their classrooms. They can use the following sources: Podomatic (http://www.podomatic.com): Get a free podcast, share your favourites.
- GabCast (http://www.gabcast.com) Is a podcasting and audio blogging platform offered to virtual communities, individuals etc
- ODEO (http://www.odeo.com): Insert your audio and create a podcast to share in your blog.

Through highlighting listening, it integrated other language skills into tasks as well, in particular speaking and vocabulary development. Another trend in the development of content for listening involves the collection of enriched media for the learner in terms of topic, language level, and other features, a process known as content curation (Hubbard 2011). Curation offers both teachers and learners access to freely available online material, providing them with additional information relevant to making informed choices. Lying somewhere between unordered collections and fully articulated listening lessons, curated collections for listening ideally involve the input from a language learning expert. Analogous to a curator in a museum, a curator for listening materials locates and collects them, organizes them into logical groups and sequences, provides language-level information of various sorts (vocabulary level, speech rate, speaker accent, etc.), and adds pedagogical support (pre‐listening information, key vocabulary, etc.). Ideal content characteristics for a curated set of materials include being freely and legally

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available, likely to be interesting to the targeted audience, good technical quality, stable, accompanied by captions and/or transcripts, and linked to complementary material. A prototypical source meeting these requirements is www.ted.com: an example of curated TED Talks by the author is available at http://web.stanford.edu/~efs/TED1. As noted previously, the Clilstore site (http://multidict.net/clilstore/) also includes curated material for listening. In this case, audio and video content from over 50 languages is available, indexed by Common European Framework levels and accompanied by transcripts linked to a variety of bilingual dictionaries.

Little has been said here about the interactive listening typical of face‐to‐face encounters.

The role of technology in the past has been primarily in (1) demonstrating interactive listening through recorded examples of it and (2) enabling audio and video computer‐mediated communication (CMC). An understudied and underdeveloped area is the digital recording and subsequent analysis by learners (alone, with peers, or with an instructor) of the language that appears in those contexts. Applications such as Evaer (http://www.evaer.com) allow both audio and video recording of Skype interactions, for example. For both online social interactions and online language course work, such technologies can be an important new source of feedback to learners, allowing them to replay what they heard. As Robin (2007) points out, “The notion that L2 learners must grab a flow of speech on the first try or lose the meaning is valid only for those events where the audio is not repeatable”. Perhaps as important, recording technology allows us to capture not just the meaning but the form for future reflection and learning.

Looking to the future, one could produce a wish‐list of resources and technologies, some of which have already been mentioned. Larger and more sophisticated curated collections can assist both teachers and learners in selecting materials that provide a close match to their needs. Media players optimized for instant repetition, adjustment of play speed and capability of streaming any online video would be helpful, as would a technology to automatically double or triple the pauses between thought groups to increase available processing time. The affordance of time-shifting as embodied in instant repetition, play speed controls, and automatic pause insertion has the potential to influence perceptual accuracy and potentially the process and

quality of connected speech processing. Along with these technologies, it will be important to adapt existing strategies and procedures and create new ones more targeted at capturing the power of such mediation.

Yet we can only go so far in predicting what future technologies will bring to second language listening. At the time of this writing, smart watches are bringing wearable computers into our everyday lives, and 3D immersive environments are on the rise. How will these and other innovations impact the field? Moving forward, the rapid pace of technological change means that it will be even more important to consider the affordances digital technology offers in general rather than in device or environment ‐ specific terms so that research and practice from today can transfer and still have relevance in the future. Simple binary questions like "Are L2 video captions helpful or not for language learning?" are no longer appropriate if they ever were. Rather, using frameworks such as those described here and others yet to be developed, we need to continue to expand our research base to understand the conditions under which such features

are more and less helpful, passing those findings on to developers, teachers, and learners who will, in turn, help us to refine them.

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Lesson 14

Technologies for Teaching and Learning L2 Speaking

- Theoretical frameworks
  - Sociocultural theory
  - The Interactionist Hypothesis
  - Autonomy and student agency
  - Cognitive perspectives on speaking proficiency: Accuracy, complexity, and fluency
- CALL pedagogical frameworks for speaking: Task-based instruction (TBI)
- CALL learning environments
- Tutorial CALL and speaking
- Feedback with tutorial CALL
  - Computer-assisted pronunciation training (CAPT)
  - Asynchronous CALL storytelling
  - Digital sound tools: Unleashing student creativity
  - CMC

Theoretical Frameworks

In theoretical terms, the use of CALL to promote L2 speaking is framed by some of the same fundamental ideas normally aired in the L2 literature. Each of the theories described here has a different way of conceptualizing how L2 learners develop their ability to speak, and therefore each provides a useful perspective on how instruction can help.

Sociocultural Theory

Fundamental to all modern language instruction—face - to - face in the classroom or virtually through CALL—is Vygotsky´s (1962) notion of the Zone of Proximal Development

(ZPD) in sociocultural theory (Lantolf and Thorne 2007). The idea that two or more individuals working together can produce more accurate, or at least more elaborate, L2 utterances underlies

all L2 group activities. In essence, Vygotsky asserted that language, first or second, is always learned and used in a social setting. Accordingly, any CALL pedagogy for speaking must necessarily be situated within this broad framework of providing students with ample opportunities to collaborate with other speakers, native or non - native, with the resulting benefits of participating in language interactions with others. Vygotsky's seminal ideas also underlie the approach of other L2 researchers, known as interactionists, who sought to reinterpret the role of input in more complex ways than what Krashen (1985) had espoused.

The Interactionist Hypothesis

Schmidt (1990) observed that all L2 learning requires learners to first notice their deficiencies or gaps between their present L2 capacity and where they still need to go, as loosely defined by what a native speaker might be able to do with the target language. Long (1991), Long and Robinson (1998), Varonis and Gass (1985), Gass (1997)—to cite only a handful of the many studies carried out in this area—have shown that small groups of learners interacting with other learners or native speakers tend to engage in the negotiation the meaning of unfamiliar structures—whether words, grammar, or pragmatic situations—especially when breakdowns in

communication occur. Gass (1997) described this process of negotiating meaning as an important mechanism for priming the pump of second language acquisition (SLA). A pedagogical approach developed to create opportunities for noticing during meaning ‐ oriented learning activities is Focus on Form (FonF, Long, & Robinson, 1998) where the breakdowns, once again, give rise to an examination of new linguistic structures that remain to be learned and controlled by the L2 learner.

Still other researchers, such as Ellis and Sheen (2006), have focused more specifically on the feedback learners received when breakdowns occur, which includes linguistic recasts or reformulations that more proficient partners provide L2 learners in response to the ongoing

conversational exchanges. As part of this feedback routine, Swain (2000) also included the L2 speaker´s feedback loop that arises when pressed to produce output during a conversation; in other words, at the moment of speaking, the L2 learner must try out specific grammatical forms

and lexical items, which in turn, results in felicitous or infelicitous utterances. The process of trying something out can be a point of learning, particularly if the speaker notices his or her lack of knowledge and then discovers how to modify and improve the original utterance.

Autonomy and Student Agency

In general, current constructionist educational approaches endorse a more student-centred learning environment over a traditional teacher-centred model. Accordingly, many researchers have focused attention on creating an atmosphere where the principles of student autonomy and self ‐ agency are heightened (Little 2007), which is especially relevant for the CALL context (Blin, 2004; Guillen, 2014; O´Dowd, 2007; Schwienhorst, 2008). Briefly, autonomous learning means that students take responsibility for their learning process, which should not be confused with self ‐ instruction. This approach emphasizes learner empowerment, language reflection, and, finally, appropriate L2 usage. The teacher is involved at all stages as a guide, whereas with self ‐ instruction there is no instructor presence at any point.

In the CALL context, increased student agency not only guides how students use technology but also implies that they become creators of L2 texts through their active creation of blogs, wiki entries, chat exchanges, audio and video postings (Blake 2013). Some blog creation sites have been shared with you.

- ***Blogger (http://www.blogger.com):*** It is a free blog publishing tool from Google for easily sharing your thoughts with the world. *Blogger* makes it simple to post text, photos and video.

- ***Wordpress (http://www.wordpress.com):*** It is web software you can use to create a beautiful website or blog.

- ***Blog (http://www.blog.com):*** It provides a fully-featured publishing platform for *free. B*

Cognitive Perspectives on Speaking Proficiency

Accuracy, Complexity, and Fluency

A cognitive perspective on speaking proficiency is useful for understanding the intended outcomes of speaking pedagogy. Cognitivists see it as consisting of three separate but interrelated constructs (House, &Kuiken 2009): (1) accuracy (i.e., the lack of phonological, lexical, or grammatical errors), (2) complexity (i.e., the number of words or clauses per T - units or sentences; see Bardovi - Harlig 2012), and (3) fluency. Unfortunately, none of these factors is easy to define or measure (Kormo, & Denes 2004). For instance, the concept of L2 fluency depends on a series of relative time measures such as the delivery speed and length of the utterances, the number of pauses, repetitions, lexical lapses, or discontinuities/ interruptions in spontaneous speech. Clearly, not all native speakers would score well concerning these factors, let alone L2 learners, making these constructs difficult to pin down in absolute terms when assessing L2 speaking proficiency.

Hulstijn (2011) considers speaking accuracy to be part of what he calls the basic linguistic proficiency that all native speakers have acquired, but the complexity and, to some

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extent, fluency, belongs to the realm of extended linguistic proficiency that is attained only by advanced study of the L1 or the L2. In Hulstijn's framework, an evaluation of speaking should not confound the characteristics of basic vs. extended linguistic proficiency. Nevertheless, in practice, both researchers and instructors look to L2 students to perform well on both scales at the same time when they are speaking. In other words, instructors expect learners to improve globally in terms of accuracy, complexity, and fluency, while also commanding a good pronunciation or accent, the latter being something that is extremely difficult for any adult L2 learner to obtain.

To further complicate matters, speaking proficiency also depends on the type of task the L2 student is asked to carry out, which is the focus of the next section. Not all tasks contribute equally to the goal of increased accuracy, complexity, and/or fluency, as Bachman and Savignon (1986) observed long ago about the ACTFL Oral Proficiency Interview, a widely recognized measure of speaking proficiency, and has since been an area of extensive research and theorizing.

Likewise, all CALL speaking activities take place in response to specific task requirements. Accordingly, task type must always be part of the pedagogical considerations for using CALL to promote speaking.

CALL Pedagogical Frameworks for Speaking

Task-based instruction (TBI)

In the previous section, we briefly reviewed some of the important theoretical notions that underlie best practices in L2 teaching, whether in the classroom or in a CALL supported environment. A sound curricular implementation of some of these tenets is perhaps epitomized by task‐based language teaching (TBLT), although this general label can refer to any number of realizations that underscore language production and analysis of meaning through real‐world

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activities, collaborations, and problem‐solving or information‐gap activities (Robinson 2011; Skehan 2003; Willis and Willis 2009; see also Gonzalez‐Lloret, this volume for further discussion). Most of the time, a TBI approach also includes an analytic post‐phase that carefully studies the linguistic structures needed to accomplish the assigned tasks (Willis 1996). Skehan (2003) suggests that the best tasks are those that (1) are carefully structured with both a pre‐planning and a post‐task phase, (2) are organized around familiar information, (3) require analysis or justification, and (4) are interactive or dialogic in nature by virtue of asking the participants to work together. Obviously, the role of the instructor in choosing appropriate tasks is indispensable, especially in CALL contexts where students are necessarily required to be more autonomous while actually completing the task.

CALL Learning Environments

A common misconception about CALL is that it only refers to specific programs or mobile apps when, in fact, CALL activities not only consist of asking students to engage with the L2 by responding to prompts given by the computer, but also deal with students engaging in

conversations with another person mediated through the use of the computer. The first case is called tutorial CALL and the second, social CALL, or computer-mediated communication (CMC). CMC activities themselves can be further divided into asynchronous communication events (ACMC) in deferred time or synchronous chat (SCMC) carried out in real‐time. Each CALL context has its own unique set of affordances, as do the tasks themselves (Skehan 2003). Creating an online curriculum for L2 speaking, then, is not so much about choosing one type of CALL activity over another, but rather about combining the CALL tools and appropriate tasks in a variety of productive ways for L2 development (Chapelle 2001; Doughty and Long 2003; Hampel 2006). Both tutorial CALL and ACMC tend to allow students more pre‐planning time, which should enhance speaking accuracy and complexity and lower individual frustration levels, while SCMC often stimulates students to produce more utterances (Abrams 2003) with a fluency that mirrors more closely the spontaneous turn‐taking behaviour found in real-world, face‐to‐face conversations. Skehan (2003) and Robinson (2011) have endeavoured to untangle the

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complex relationships that exist among language tasks and the main components of speaking proficiency: namely, accuracy, complexity, and fluency. No single task and no single CALL activity can be expected to address all three aspects of speaking proficiency at the same time. Nevertheless, the language profession needs to cultivate better knowledge of the CALL options and their corresponding affordances, as we will outline below.

Tutorial CALL and Speaking

Tutorial CALL allows students to engage in different forms of self‐directed speech practice in the absence of conversational partners or classroom instruction. While classroom

instruction provides opportunities for students to notice gaps in their L2 knowledge, individual language practice facilitates not only memory storage but also the retrieval of L2 words, collocations, and other details about appropriate usage (Loucky, 2006; Teixeira, 2015). Fortunately, computers are a good fit for this type of speak‐aloud individual practice, especially for languages with a heavy morphological burden or unfamiliar sounds.

Ideally, students should sub‐vocalize or speak out loud when they are learning vocabulary lists (Arispe, 2012). In the past, many tutorial CALL programs have been tagged with the unfavourable name of drill and kill, but Hubbard and Siskin (2004) have argued convincingly that tutorial CALL has a well‐justified place in the language curriculum. Usually, the speaking tasks offered by tutorial CALL programs ask students to compare their audio recordings with those of native speakers of diverse accents. Nevertheless, one obvious drawback of this type of exercise for improving L2 speech is the lack of any feedback. Here is where programs that offer some form of automatic speech recognition (ASR) can play an important role.

Feedback with Tutorial CALL

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ASR systems work best when applied to clearly circumscribed linguistic sub‐domains or micro‐worlds: for example, words that only deal with the family or some other specific semantic domain, or important phrases used most often in public places such as banks, airports, pharmacies, and so on. Accordingly, the ASR system asks students to carry out specific tasks, such as individual sound practice, word recognition, or short sentence repetition (Ehsan, & Knodt, 1998). Several commercially available programs provide ASR capabilities: for example, Dragon Naturally Speaking or Dragon Anywhere app from Nuance.com, and TeLL Me More, an algorithm that has been recently integrated into the RosettaStone.com online exercises.

The Dragon software offers a set of intriguing dictation tools that turn foreign language speech directly into text for American English, Australian English, Asian English, Indian English, UK English, Dutch, French, German, Italian and Spanish. This dictation tool is normally

marketed to businesses, but there are obvious applications for the L2 curriculum. If the L2 pronunciation of a target word or phrase deviates too much from the statistical norms programmed into Dragon, the written dictation will come out corrupted and, therefore, oblige the user to analyze and restate the utterance in a more comprehensible way, thus providing an excellent feedback loop along the lines of forced output as described by Swain (2000). Plagwitz (2014, 2015) described how he used a similar tool from Windows, the W7ASR automatic speech recognition software (now available for Chinese, English, French, German, Japanese and

Spanish), to carry out this type of pronunciation practice both in and outside of class by having students convert previously designed writing practice into speaking activities with the feedback loop being provided by the output of the text files. Dictation studies have a long and valued track record in foreign language instruction, as Swain and Lapkin (1998) have shown in their dictogloss implementations. Surprisingly, few CALL studies or practical applications have taken advantage of dictation software such as Dragon, despite its obvious affordances for enhancing L2 speaking—something that the CALL field needs to look at more closely in the future.

Rosetta Stone has also incorporated an ASR feature into its exercises, available in 25 languages, and based on the TeLL me More algorithm originally developed by Auralog.com. These exercises tend to focus on single-word recognition, short collocations, or phrases. The ASR routines offer students a wave‐analysis comparison of their recordings with those of a native speaker, but the visualizations are based on sound intensity and entail some trial‐and-error experimentation on the part of the learner in order for them to be helpful as feedback. Rosetta Stone also offers online tutoring and its version of a social network, but that service falls under the heading of CMC discussed below.

Computer‐assisted Pronunciation Training (CAPT)

Pronunciation and intonation, of course, are part and parcel of learning to speak an L2 well.Many researchers (Bley‐Vroman, 2009; Hulstijn, 2011) have argued that learning native‐like pronunciation and intonation is a difficult or even impossible goal for most adult L2 learners and, in the overall scheme of communication, may have less importance than gaining adequate control of the frequently used lexical and grammatical structures of the target language.

However, O'Brien (2006) has argued that effective communication cannot take without comprehensible pronunciation and, therefore, it merits serious attention. Since class time is limited, the tutorial CALL context, again, becomes the ideal venue for computer-assisted pronunciation training (CAPT), which is designed to allow students to take control of their learning in the risk-free environment offered by working with a non‐human helper. In other words, CAPT software provides more practice time, patience, flexibility, and no penalties for making errors. Eskenazi (1999) has stressed the importance of implementing CAPT software in a way that offers diverse speech sounds from different speakers and registers.

Chun's research (1998, 2002) has focused on giving students clear feedback about L2 intonation through the use of CALL software. Both Chun (1998) and O'Brien (2006) have stressed the importance of linking instruction on L2 pronunciation with that of L2 intonation.

Gorjian, Hayati, and Pourkhoni (2013) have extolled the virtues of having students study L2 pronunciation and intonation using the PRAAT acoustic analysis software. However, as in the case of the TeLL Me More sound graphics, students need training on how to use these visualizations to improve their accent and prosody and only students who are committed to understanding and making use of visualization techniques may see their pronunciation improve. Once again, the issue of student autonomy raises its head here.

Asynchronous CALL Storytelling

Students can also become multimedia storytellers by using digital storyboard applications such as StoryKit to produce their narratives complete with captions and audio recordings. With this program, students work either individually or in groups to bring their narratives to life with images, photos, text bubbles, and audio recordings. In the process, the participants receive

feedback from the teachers and their peers on their L2 speaking while working on projects that are meaningful to them—their own multimedia creations.

VoiceThread.com provides another popular and easy ‐ to ‐ use online tool to combine images, photos, text, and audio comments with the added advantage that individuals from different geographical sites can easily collaborate on a VoiceThread project. When VoiceThread slides are shared online, the creators can allow anyone with an Internet address (URL) to add comments or answer questions posed by the creators, thereby enriching the entire project. The

creator/instructor can always maintain control over which comments are posted by choosing the < moderate comments > option under the publishing menu. Because VoiceThread permits the formation of learning groups at a distance, it might also be considered a form of asynchronousCMC, but we have included it in tutorial CALL because individuals can always develop single ‐ authored presentations on their own in a completely independent fashion. In practice, VoiceThread can be used to conduct both tutorial CALL for speaking or asynchronous CMC.

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Learners should use the following storytelling tools:

- **Omeka** : Open or Hosted resource for archiving and displaying images and content. Free
- **Timeline.js** : Using Java and a Google Sheets template, you can quickly create interactive timelines with images, videos and other content.
- **We Video** : All in One, scalable web based story editor
- **Neatline** : Mapping and Timeline Tool for Omeka Projects.

- **ArcGIS Online** : University of Minnesota ArcGISonline Server access.

- **Census Data Viz** : Examples of data visualizations from Census Data.
- **Canva** : Freemium graphic design tool with infographic templates.

Digital Sound Tools: Unleashing Student Creativity

In addition to the applications presented above, L2 students have at their fingertips many digital tools that can easily be used to embellish their own stories with images and sound to produce multimedia materials for the Web.3 Blake and Shiri (2012) described how the first year Arabic students at UC Berkeley demonstrated their speaking progress at the end of the term by publishing their audio‐enhanced finished products on YouTube.com. Several groups of students in this Arabic class opted for simple hand illustrations with hand‐written Arabic captions, adding in later their audio narration (http://www.youtube.com/watch?v=Gc4gw6Ig564). These easy‐to‐use techniques result in an impressive finale to a language course to the great satisfaction to both students and instructors alike and can be viewed by the entire class to provide feedback on the students' L2 speaking.

We recommend some authentic video sources to use in the ESL classroom.

- University channels (Berkeley, Harvard, Standford, Oxford etc)
- All major TV channels – BBC/ITV/Sky
- News sites – BBC/The Argus
- YouTube (TEFLclips)

- TrueTube
- Videojug
- National Geographic
- Real English and other EFL video sites
    - ❖ 100 best video sites for ESL

http://www.edudemic.com/best-video-sites-for-teachers

- **JenniferESL: With over 153,000 subscribers, Jennifer's best videos are her lessons on idioms (kitchen idioms, driving idioms, colour idioms**
- **MisterDuncan: Considered one of the original English teachers on YouTube. He covers lessons on fluency and speaking English naturally.**
- **Voice of America Learning English: Join over 98,000 other subscribers and learn English with captioned news reports read at a slower speed.**
- **BBC Learning English: Another popular site, with over 64,000 followers.**

CMC (Computer Mediated Communication)

The other important CALL context deals with using the computer to mediate communication between people; what researchers in the field refer to as CMC. CMC has a long and established record starting with asynchronous textual exchanges. The main thrust of earlier CMC studies was to show that online text exchanges produced opportunities to negotiate meaning and to generate feedback in ways similar to what had already been documented in face - to - face encounters (e.g., Abrams, 2003; Blake, 2000; Loewen, &Erlam, 2006; Meskill, 2005; Pellettieri, 2000; Peterson, 2009; and Warschauer, 1997; to name only a few). Early on in this line of research, Kern (1995) noticed that there existed many linguistic similarities between

L2 oral speech patterns and asynchronous computer writing, which is why we include SCMC textual exchanges in this chapter on L2 speaking, although other writing considerations are involved here as well (undoubtedly, some degree of sub - vocalization is occurring when people write via the computer keyboard, although this has not been sufficiently studied, as yet).

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Interesting enough, Kern found that the experimental group exchanging text messages via Daedalus.com writing software produced more utterances with more complexity than the control group speaking to each other in a face‐to‐face context.

Further evidence suggesting that SCMC writing helps L2 speaking emerged from Payne and Whitney's (2002) study where student keyboarding had a significant effect on improving L2 speaking proficiency. Nowadays, the linguistic congruities between texting and speech hardly would surprise anyone, especially given the way people generate tweets on Twitter or text on mobile phone. Despite being a form of written communication, tweeting has been proven to be an effective tool for creating what sociocultural research calls a community of practice with geographically disperse speakers, native and non‐native, who tend to respond back and forth as if they were chatting to each other in a cafe (Lomicka, & Lord, 2011).

Gradually, SCMC began to include the exchange of voice‐over IP sound (VoIP), giving speakers two channels in which to communicate (Blake 2005). Many learners continued to prefer keyboarding perhaps because of its visual persistence (the text stays on the screen) and extra processing time in comparison to the pressures of responding quickly to audio prompts. In the case of Sauro's (2009) study, the preference for keyboarding took on gender overtones. Two Japanese students of English, one male and one female, were assigned a collaborative CALL task. The male participant started by dominating the voice channel (VoIP) to take control of the task, which prompted the female participant to switch to using only the text chat modality to communicate. Eventually, her behaviour forced the male partner to follow suit, tone down his aggressiveness, and respond to her textual directions and entries to finish the assigned task together.

VoIP sound soon gave way to true telephonic sound (i.e., synchronous audio) and now, synchronous video. Today´s CMC tools seamlessly combine asynchronous (text) and synchronous (sound and/or video) channels. Each application accents certain affordances, as Lafford and Lafford (2005) have analyzed in detail. Videoconferencing tools promise a

communicative experience most like face - to - face encounters, but this modality also demands lots of bandwidth, which puts great pressure on the user's local network. If the local network is not robust, instructors need to make informed choices to use tools that are less greedy for bandwidth. Adobe's Connect is perhaps the most complete videoconferencing program, but its cost is high and usually, only institutions can afford it (Connect demands lots of bandwidth, too). Skype is free and ideal for working in pairs. For larger group chats up to ten individuals, Google Hangout is also free and provides a transparent interface that leverages many of Google's other applications such as YouTube, Google Drive, and other third party Google friendly applications.

In addition, many learning management systems (LMS) operate on platforms that allow users to record videos on the fly using Flash plugins to smoothly incorporate these clips into the LMS message system, posts, or discussion forums. The real question is how to design activities with these tools to enhance L2 speaking opportunities. Guillen and Blake (2015) have examined

the speaking benefits from allowing students to post their best video recording through an LMS platform, with the added benefit of being able to rework and improve their video responses until they finally capture their best effort. These researchers found that the students' asynchronous video postings in Spanish exhibited more complex sentences and better accuracy than in their conversations from synchronous video sessions—as Robinson (2011) might have predicted given the increased planning time afforded by the asynchronous best recording format. Again, the choice of task is all - important (Hampel, 2006) and needs to be carefully thought through by the instructor because speaking proficiency, as we have previously discussed, involves accuracy, complexity, and fluency.

Nevertheless, certain linguistic structures, such as intricacies of the Spanish subjunctive, in this particular case, will continue to cause difficulties for the students at the intermediate level

no matter the instructor's interventions or assigned tasks. L2 acquisition takes a long time, which is another motivation for using CALL in the foreign language curriculum as a way of increasing the time on task (Munoz, 2006, 2008).

The availability of fully synchronous video has put SCMC activities at centre stage concerning fostering L2 speaking. Videoconferencing has become the norm for most telecollaboration (O'Dowd, 2007), tandem learning (Guillen, 2014), and social media exchanges (Lin, Warschauer, and Blake in press)—all topics that are addressed elsewhere in this volume.

Synchronous speaking tasks now form part of most hybrid or fully online language courses(Blake, 2011). Videoconferencing gives students an alternative to the speaking practice that is assumed to occur in the classroom. In fact, small group videoconferencing—for example, with one instructor working with two to three students—represents a far more intensive speaking experience than sitting in class and responding only two or three times in an hour. During the hour‐long videoconference session, students are constantly taking turns speaking in the L2, which can be an extremely active and rigorous experience by the students' admission (Blake, 2015). Naturally, the instructor must prepare the conversational tasks ahead of time so that the

students know exactly what to expect and are primed with the appropriate vocabulary and grammar constructions needed to bring the task successfully to completion. In this way, students can gradually build up greater fluency and smooth discourse transitions, which are important components of speaking proficiency.

Unfortunately, speaking progress via videoconference usage has not been well tracked or measured to date, partly because defining the construct of speaking proficiency remains a daunting, if not insurmountable, undertaking (Hultstijn, 2011) whether in the face‐to‐face or CALL context. Hulstijn (2015) has recently challenged researchers in the L2 field to test out empirically whether or not speaking proficiency should be conceived as a continuum or, as he has suggested, a dichotomy (i.e., basic vs. extended linguistic proficiency). These same L2 theoretical issues are relevant to CALL research, as well, and deserve serious attention in future CALL research.

Chatbots have revolutionized academia as well as business. Amazon and other international e-commerce tycoons use these chatbots. Dialogflow, a platform supported by

Google, can train chatbot without any coding skill, even students of humanities have modified and built new chatbots from scratch. These chatbots have been designed with variety of technology, diversified instances in different languages of the world for instance Babbel, Rosetta Stone, Duolingo, Memrise, Andy, Mondly etc

In the course of discussing SCMC, we do not wish to imply that videoconferences are exactly like face‐to‐face exchanges with all the same transparency, despite the existence of the computer screen mediating the experience between interlocutors. Ware and Kramsch's (2005) warnings, which were made concerning ACMC exchanges, should still be heeded: the interface changes the conversational dynamics. Students and instructors alike need the training to help to avoid, or at least come to understand better, any intercultural miscommunications that might occur during these CALL contexts, especially during cross‐cultural Internet collaborations. As always, well‐designed tasks are needed to impact student outcomes significantly by promoting successful and satisfying online exchanges—videoconferencing being no exception.

Conclusions

At present, SLA theory is a long way from providing precise definitions for even such basic concepts such as speaking proficiency, especially when the choice of the task impacts student outcomes so dramatically and varies so much from one instructor to the next. With respect to stimulating L2 speaking, the different CALL contexts described here equip the instructor with a rich array of options that can be used to stimulate more and better L2 production.

Undoubtedly, one size does not fit all and teachers will have to adapt tasks and tools to each group of students they deal with. Likewise, new tools are being invented all the time, which is a good thing but it also creates the daunting task for the instructor of keeping up with these changes in the CALL field. Using technology can be intimidating because it keeps changing so

rapidly. Continued training in the use of CALL applications to promote L2 speaking, or any other aspect of language proficiency, should be part of everyone's agenda.

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Lesson 15

Technology-Enhanced SLA Research

- Defining SLA and SLA research
  - Cognitive approaches to SLA
  - The interaction approach
  - Sociocultural theory
- Defining SLA-relevant research in computer-assisted Language learning (CALL)
  - Three SLA‐relevant CALL studies
    - Cognitive approach
    - Interactionist approach

- Sociocultural theory

Defining SLA and SLA Research

Second language acquisition (SLA) is the study of the human capacity to learn languages other than the first, during late childhood, adolescence, or adulthood, and once the first language or languages have been acquired (Ortega, 2009). Within the field of applied linguistics, of which SLA is a part, there is a distinction typically made between second and foreign language acquisition, with the former occurring where the target language (the language being learned) is spoken by the local community and the latter occurring in settings in which the target language is not spoken by the local community. In this chapter, the terms acquisition and learning will be used interchangeably as will the terms second and foreign language (L2).

SLA is a broad and diverse field, which has been rapidly expanding in scope and methodology ever since it emerged in the 1960s. Today the field remains interdisciplinary as it was in the past, with as many as 60 theories, models, hypotheses, and theoretical frameworks of SLA (Long, 2007). According to VanPatten and Benati (2010) some of the (broad) questions that SLA theories are developed to address include the following:

- What do learners do when acquiring another language?
- What stages of acquisition do they go through?
- What does their developing second language (interlanguage) “look like”?
- What is the nature of their errors?
- What factors affect SLA?
- What are the mechanisms that learners use to understand and produce an L2?
- How does fluency develop?
- How do we explain learner variability in the eventual attainment of an L2?

In attempting to answer these and other major questions, several competing SLA theories, approaches, and frameworks have emerged, bringing with them their own set of ontological, epistemological, and methodological stances, which largely determine the specific questions as

well as what the researchers count as data, and accept as evidence. This fact makes it difficult to talk about SLA as a cohesive entity. Accordingly, we frame our discussion of technology‐enhanced SLA research in terms of three theoretical frameworks that are widely researched and especially compatible with CALL inquiry: cognitive approaches, the interaction approach, and sociocultural theory.

- **Cognitive Approaches to SLA**

There are a host of cognitive approaches to SLA, which can be broadly classified into traditional information processing and emergentism (Ortega, 2009). Cognitivists believe that to properly understand the final state of fluent L2 development we need to understand the processes by which this expertise came about. Cognitive science is also concerned with functional and neurobiological descriptions of the learning processes, which, through exposure to representative experience, result in change, development, and the emergence of knowledge (N. C. Ellis, 2002). Information processing theories all share the belief that human cognitive architecture is made up of representations and access. Mental processing is comprised of automatic (unconscious) operations and voluntary or controlled (conscious) operations. Cognitive resources such as attention and memory are limited, and performance is variable and vulnerable to stressors, such as those factors that make a language learning task more difficult such as time pressure.

In contrast, emergentist SLA scholars argue for a usage‐based explanation of language development (including SLA). They argue that fluent language use is exemplar-based and is made up of "a huge collection of memories of previously experienced utterances" rather than knowledge of abstract rules (the latter explanation championed by generative linguistics). Emergentists take most language learning to be "the gradual strengthening of associations between co‐occurring elements of the language," and they see fluent language performance as "the exploitation of this probabilistic knowledge" (Ellis, 2002, 173). Cognitive theory directs researchers to investigate constructs such as working memory, which can be assessed through the use of technology.

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- **The Interaction Approach**

The interaction approach (IA) grew out of Long's Interaction Hypothesis, which was first developed in the early 1980s. Since then, it has been updated (Long, 1996) and rigorously researched. The IA essentially says that through input and interaction with interlocutors, language learners have opportunities to notice (Schmidt, 1990) differences between their formulations of the target language and the language of their conversational partners. They also receive corrective feedback, which both modifies the linguistic input they receive and pushes them to modify their linguistic output during the conversation. This interaction helps draw learners' attention to or lead them to notice a linguistic problem (Long, 1996).

Attention as a result of interaction may also lead learners to notice linguistic input in the absence of a problem. Interactionally modified input, is that which occurs as needed during goal‐oriented conversation and is argued to be more effective (in terms of learning the target word or structure) than pre‐modified input, which is modified to be target‐like before any learner error occurs (R. Ellis et al. 1999). An example of pre‐modified input might appear in a listening passage that provides simplified or glossed language for vocabulary referring to technical

concepts. Thus, the major constructs of this approach to SLA include input, interaction, corrective feedback, attention and output (Gass, 1997). Some of the most commonly investigated phenomena that inform these constructs include negotiated interaction (Long, 1996), whereby learners first have a breakdown in understanding and then regain understanding through a series of communication moves, such as recasts, which are a type of corrective feedback and learner uptake, whereby a learner appropriates the target language forms of their interlocutor in some productive way (Lyster, & Ranta, 1997). Such constructs have also been investigated in settings where technology is used to mediate the interactions.

- **Sociocultural Theory**

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Sociocultural theory (SCT) has its origins in the work of Russian psychologist Lev Vygotsky in the early part of the 20th century. SCT argues that while human neurobiology is a necessarycondition for higher mental processes, learning is essentially a social process whereby the most important forms of human cognitive activity develop through participation in cultural, linguistic, and historically formed settings such as family life, peer group interaction, and institutional contexts like schooling, organized social activities, and workplaces. SCT posits that everything is learned on two levels—first on the social level (between people) and only later on the individual level. Human mental functioning is a mediated process. That is, just as humans use material tools such as a hammer to mediate the act of building a table, we also can create and use inwardly directed symbolic tools such as language to mediate our psychological activity which connects the entire world in the global village. As children (and language learners) develop they move through stages whereby they are controlled first by the objects of their environment (object‐regulated), then by others in this environment (other‐regulated), and finally they gain control over their own social and cognitive activities (self‐regulated).

From the SCT perspective of SLA, language learning is facilitated by social interaction. During the interaction, learners and more capable peers engage in a collaborative dialogue involving scaffolding. This type of interaction is viewed as central to the learning process, as it facilitates the operation of the zone of proximal development (ZPD). The ZPD is "the distance

between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978). One of the most compelling aspects of the ZPD is that rather than measuring the level of development a learner has already attained, the ZPD is forward-looking in that it suggests that what one can do today with mediation is suggestive of what one will be able to do independently in the future. The notion of dynamic assessment and systemic‐theoretical instruction have recently emerged as pedagogical applications of SCT including applications using technology (Lantolf, & Poehner, 2014).

Defining SLA-relevant Research in Computer-assisted Language Learning (CALL)

The rapid development of computer technology has afforded SLA researchers many possibilities to investigate aspects of SLA theory, which are not available to them in a face‐to‐face environment. Most times this type of research employs computer technology as a tool to control or regulate some aspect of the instructional environment. Such studies, despite their use of computer technology, are not considered CALL studies since the study is not primarily concerned with employing computer technology for teaching and learning foreign languages. An example of this type of research is DeKeyser (2005) who used the computer to execute a speeded grammaticality judgment test. These types of technology‐assisted SLA studies have been outlined in detail elsewhere (Hulstijn. 2000), and will not be discussed here.

What is most interesting for this volume on Technology in Second Language Teaching andLearning is the difference between an SLA‐relevant question asked in a CALL study and one that does not yield SLA‐relevant results. That is to say, just as not all applied linguistics or L2 pedagogy research questions have direct relevance to SLA, not all CALL studies ask SLA questions or yield SLA‐relevant results. Indeed, SLA‐relevant CALL studies are still rather rare even if they are now growing in number and sophistication. CALL has only begun to emerge as a cohesive area of inquiry since the 1980s. During the early years, CALL was an avocation, not a vocation for most CALL practitioners (Fischer, 2012). Many came to CALL

from other academic fields having no formal training in CALL because of the newness of the field. Most early CALL scholars were faculty members in foreign language departments who had primary professional responsibilities in literature or linguistics. Fischer points out that in those days the technology was the focus, but in the 1990s a shift from technical matters to language learning matters occurred. Success in CALL no longer lay in writing software alone, but rather in using this software to help students learn L2 vocabulary and specific language structures, for example. In other words, interest grew in the use of computers for second language acquisition (Fischer, 2012).

Today, those interested in the nexus of CALL and SLA critically evaluate the use of

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a particular tool or app in terms of its potential for facilitating L2 learning. Embracing this challenge sets SLA‐relevant CALL inquiry apart from CALL research that is not SLA‐relevant. For example, CALL studies that solely explore learner attitudes toward using a given application in the L2 classroom or learner perceptions of an app's facility for L2 learning, though important and interesting, may not be directly relevant to SLA. In order to change CALL research to be SLA‐relevant, clear connections need to be made, for example, between student attitudes toward technology X and, say, learner motivation regarding their present L2 learning context. The researcher would work within an SLA theoretical framework that links attitudes, motivation, and instructed SLA.

Some of the questions that one needs to consider in determining the degree of SLA relevance of a CALL study are the following: (1) Is this study a CALL study? As mentioned above a CALL study is defined here as one that is primarily concerned with employing computer technology for teaching and learning foreign languages. Note that computer technology is broadly defined here and includes desktops, laptops, tablets, handheld devices, and smartphones, among other technologies, (2) Is the CALL study firmly grounded in an identifiable SLA theoretical framework? A theoretical framework refers to the theory or approach that researchers select to guide their research. It is the application of a collection of interrelated concepts and coherent explanations of certain phenomena that guide the research and allow researchers to test aspects of the theory and describe the results. The theoretical framework helps determine what

the researcher will measure, what variables will be examined, the relationship between these variables, and what research questions will be raised, (3) Does the study examine key assumptions, constructs, hypotheses, and so on, which are relevant to this theoretical framework for SLA? Not only do researchers need to introduce a theoretical framework that informs the study, but the study must also reflect an exploration of specific constructs and hypotheses that emerge from and are relevant to that same theoretical framework, and (4) Does the study explicitly or implicitly investigate some aspect of the argued affordances of CALL environments for SLA? In other words, there are some expectation that the affordances of the specific CALL environment in the study, including the specific CALL tasks in question (Chapelle, 2001), may impact some aspect of learner processes, interactional patterns or outcomes?

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The most compelling SLA‐relevant CALL studies are those that have a strong theoretical rationale for hypothesizing that the affordances of a specific CALL environment are likely to impact the results at a process or outcome level (question 4 above). For example, in an examination of explicit recasts in an SCMC environment, Smith (2012) argues that such written corrective recasts are necessarily more explicit (and therefore more noticeable) than those found in oral recasts due to the written nature of the medium itself as well as the message permanence afforded.

Three SLA‐relevant CALL studies

Using the four considerations discussed above, I outline three exemplary SLA‐relevant CALL studies from three of the most widely employed theoretical frameworks. Each of these studies focuses on computer‐mediated communication in one form or another, reflecting CMC's predominant position in CALL research in recent years.

- **Cognitive Approach**

Payne and Whitney (2002) used Levelt's (1989) model of language production as well as key concepts from Working Memory theory (Baddeley, 1986) to explore whether SCMC can help

improve learners' L2 oral proficiency by developing the same cognitive mechanisms that underlie spontaneous conversational speech.

Is the study primarily concerned with employing computer technology for teaching and learning foreign languages?

Four sections of a third semester university‐level Spanish course were used for this study.

These were intact groups with the students in the experimental groups (meeting online in a chat room) engaged in the same activities on the same days as those in the control groups did face to

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face. All groups engaged in weekly threaded discussion as preparation for synchronous discussions, weekly online drills and practice activities with feedback, weekly online quizzes with feedback, independent viewing of the video accompanying the textbook, and a collaborative research and writing project involving multiple drafts of an essay. One important question when studying text‐based chat interaction is whether such interaction can yield cross‐modal benefits for spoken proficiency. They asked the following CALL‐related research questions: Can L2 oral proficiency be indirectly developed through chat room interaction in the target language? Can individual differences in working memory capacity effectively predict the rate of L2 oral proficiency development for different types of learners in a chat room setting?

Is the study firmly grounded in an identifiable SLA theoretical framework?

Though Levelt's model of language production is one of L1 production, many researchers have used and adapted this model to depict L2 language production processes. For example, deBot (1996) combined Levelt's model with Anderson's (1982) notions of declarative and procedural knowledge as he explored Swain's Output Hypothesis (1995, 2005) from a psycholinguistic perspective. Likewise, Payne and Whitney (2002) employed Levelt's model in combination with another psycholinguistic concept, working memory, to propose mechanisms that influence L2 acquisition. SLA studies have shown that verbal working memory capacity is

an especially important variable in predicting L2 vocabulary development and overall L2 proficiency.

Does the study examine key assumptions, constructs, hypotheses, and so on, which are relevant to this theory of SLA?

Key to many cognitive approaches to SLA are the constructs of controlled and automatic processing. All processing falls into one or the other category. Controlled processing involves "a temporary sequence of nodes activated under control of, and through attention by, the subject" (Schneider and Shiffrin 1977, 2–3). Put another way, controlled processing is that which is under the conscious and intentional control of the individual and these processes are constrained by the

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number of attentional resources available. In contrast, automatic processes are the activation of a sequence of nodes that "nearly always becomes active in response to a particular input configuration," and that "is activated automatically without the necessity for active control or attention by the subject" (2). That is to say, automatic processes require comparatively few cognitive resources and can be performed in parallel with other automatic processes. Initial learning requires controlled processes, which require attention and time. With practice the linguistic skill requires less attention and becomes routinized, thus freeing up the controlled processes for application to new linguistic skills. L2 learning, then, is viewed as the process by which linguistic skills become automatic. Cognitively‐oriented SLA researchers drawing upon Levelt's (1989) model acknowledge that controlled processing plays a central role in L2 production in terms of lexical access and articulation (at least until a high level of L2 proficiency has been achieved). Indeed, L2 fluency seems to vary as a function of automatic processing ability. In Levelt's (1989) model, working memory is associated with controlled processing. Since controlled processing plays such a central role in L2 lexical access and articulation, then limitations in working memory capacity are likely to have an impact on L2 performance and arguably SLA.

Does the study explicitly or implicitly investigate some aspect of the argued affordances ofCALL environments?

Payne and Whitney (2002) argue that the affordances of synchronous chat interaction can help to improve some L2 processes. For example, the rate of delivery during (written) SCMC interaction is much slower than that in spoken interaction. It should reduce the processing demand on learners. Also, the message permanence afforded by the chat environment allows learners to refresh memory traces, which is not possible in spoken interaction.

All of this suggests that learners with lower WMC will benefit from the SCMC environment where processing demands are reduced, but the task and other features of the interaction are the same. Essentially, then, in terms of the first research question, Payne and Whitney predicted (and found) that the participants in the CALL environment (experimental

group) would show at least the same degree of oral proficiency development over one semester as those participants in the control group. In terms of research question 2, there was a lower correlation between oral proficiency gain scores and one of the WMC tests in the experimental condition (SCMC) as compared with the control condition (F2F), indicating that learners with a lower WMC benefited from the chat environment.

- **Interactionist approach**

In a study of teacher‐learner (text‐based) SCMC interaction during online conferences, Smith and Renaud (2013) used eye‐tracking technology to explore the relationship between L2 recasts, noticing, and learning of the recast targets.

Is the study primarily concerned with employing computer technology for teaching and learning foreign languages?

This study examined the effectiveness of teacher‐provided corrective feedback during one-on-one online conference with students. The task was for students to meet virtually with the instructor and discuss (in the target language) a draft of a written assignment due the next week. The teachers were asked to provide full recasts to learners when it seemed natural to do so. Recasts may be defined as discourse moves by an interlocutor that, within the context of communicative activity, correctly restate or rephrase all or part of a learner's utterance to be

more target‐like by changing one or more sentence components, while still acknowledging and retaining its central meaning. For example, when a learner of German says something like Ich habe Hunger nicht* (I am not hungry) the teacher may provide the recast Ah, Sie haben keinen Hunger (Oh, you're not hungry). The online conferences were viewed by the instructors as part of the regular curriculum, and they typically held either face‐to‐face or online conferences with students for each of three major writing assignments over the course of the semester. In this way, instructors had integrated computer technology as a tool to facilitate the teaching and learning of the target language.

Is the study firmly grounded in an identifiable SLA theoretical framework?

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This study espouses a cognitive interactionist theoretical framework. From this theoretical perspective, corrective feedback provided in the form of recasts is thought to be especially beneficial for learners as they provide a focus on formal aspects of the learner's output as problems arise while retaining the overarching focus on meaning and not significantly hindering the flow of communication. That is to say, by using recasts (a form of implicit negative feedback), teachers may deal with many of their students' language problems incidentally while working on their subject matter of choice, with fewer of the interruptions and other unpleasant side effects caused by traditional overt "error correction" practices (Long, 2007).

Does the study examine key assumptions, constructs, hypotheses, and so on, which are relevant to this theory of SLA?

Attention to and noticing formal aspects of the target language are key elements in the interactionist approach to SLA. The assumption is that learners can attend to and make use of the positive input and negative feedback that recasts supply, provided that they can notice the recast's corrective intent. Smith and Renaud's (2013) study employed eye‐tracking technology as a measure of what learners attended to in the corrective feedback.

These eye‐movement records were compared with learners' performance on individually tailored post‐tests that consisted of both target‐like and non‐target‐like learner‐generated sentences from the original online conference. In this way the researchers could determine the degree to which learners attended each recast and, based on the post‐test results, they could calculate the effectiveness of the recasts.

Does the study explicitly or implicitly investigate some aspect of the argued affordances of CALL environments?

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The potential benefits of text‐based SCMC for language learning include increased participation among students, an increased quantity and heightened quality of learner output, enhanced attention to linguistic form, and an increased willingness to take risks with their L2. The slower speed of typing as well as a software‐ and network‐induced lag time between turns, coupled with the heightened salience of input and output afforded by the permanence of the written message on the screen means that interlocutors have more time to both processes incoming messages and produce and monitor their output. This increased planning time is argued to contribute to L2 performance by freeing up attentional resources. Learners have been shown to make use of this increased planning time to engage in careful production that results in the more complex language (Hsu in press; Sauro, &Smith, 2010). In this study, many instructors provided recasts were complex, whereby one recast targets more than one linguistic item in the participant's previous message. Although partial recasts that target a single linguistic item have been argued to be easier for learners to attend to, we might expect the increased processing time and message permanence afforded by the chat interface to mediate this partial/ complex issue by making the multiple targets in complex recasts more salient to learners.

- **Sociocultural theory**

Most of the current research on gaming in L2 settings espouses some form of sociocultural theory as its theoretical framework. For example, Rama et al. (2012) conducted a qualitative study that examined two college‐age Spanish learners' experiences while participating in the Spanish‐language version of the wildly popular massively multiplayer online game (MMOG) World of Warcraft (WoW).

Is the study primarily concerned with employing computer technology for teaching and learning foreign languages?

This study posed the single research question—what affordances for second language development and socialization might online gaming environments offer? As part of the class,

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participants were each given a Spanish‐language version of WoW. They were asked to play the game at their discretion throughout a seven‐week period and were encouraged to play about five hours per week. Data collection included journal entries kept by students reflecting on their gaming experience each week, regular meetings, and semi‐structured interviews with the instructor, and chat logs of the text‐based interaction that occurred during each gaming session. The gaming sessions occurred outside of the classroom, but were connected to a specific Spanish course and, therefore, can be viewed as extracurricular (Sylvén, &Sundquist, 2017).

Is the study firmly grounded in an identifiable SLA theoretical framework?

The authors explicitly identify sociocultural theory as the guiding theoretical framework. As mentioned above, SCT views language learning as emerging from the learner's interactions with other people and the environment, which are mediated by symbolic (in this case language) and material (in this case the WoW game) tools. Indeed, from this theoretical perspective, any opportunity for authentic and active interaction in the target language is viewed as beneficial for L2 learning. Further, as Vygotsky's Zone of Proximal Development (ZPD) emphasizes the interplay between a learner's capabilities and the learning environment, this study focused specifically on the interactions with Spanish native speakers by an expert gamer with lower

Spanish ability. These interactions were contrasted against the interactions of another student, who was a novice gamer but an advanced Spanish speaker.

Does the study examine key assumptions, constructs, hypotheses, and so on, which are relevant to this theory of SLA?

The unit of analysis in this exploratory study was not only the affordances of the learning environment or discrete aspects of the individual learner's linguistic output (or input received), but rather the affordances for second language development and socialization that emerge from the learner's interactions within the learning context. Indeed, MMOGs are argued to offer a range of affordances for L2 learning due to the engaging communicative contexts of these

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environments. Play in these environments requires collaborative interaction, which in turn is mediated by meaningful target language use. From a sociocultural perspective, these interactions, often with more capable others, may provide opportunities for learners to build on their existing competencies in a supportive and engaging context.

The data analysis occurred in two steps. First, the researchers employed an inductive process aimed at identifying patterns in the participants' language use identifiable from the chat logs. These included type of utterance, length of pauses between utterances, the role that participants played in the exchanges, and changes over time. This phase also examined participants' journal entries and interview transcripts to identify emerging themes. Step 1 revealed the notion of affordances for language learning and socialization as an important organizing construct. The second step of the data analysis coded for specific examples of (and references to) affordances for language learning in the data. In addition to confirming affordances found in previous research on gaming in similar contexts, the study identified three new affordances of WoW: it allows for and supports the creation of safe learning and languaging spaces; it emphasizes communicative competence, or the ability to communicate meaningfully and effectively within a given context, and it promotes goal‐directed collaborative action between experts and novices.

Does the study explicitly or implicitly investigate some aspect of the argued affordances of CALL environments?

Text‐based CMC interaction has long been argued to reduce the anxiety felt by many learners as they attempt to communicate in the target language. This is largely due to the mediated nature of the online exchanges as well as the written modality. In a text‐based CMC environment learners are not required to speak, just type. This low‐anxiety setting has been described in previous game‐based research. Additionally, CMC interaction research has identified dyadic or small group interaction as the most likely to yield more linear and cohesive dialogue.

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Though not explicitly investigated, the creation and use of guilds (rather than the general chat channel) in this study, which afford more private and manageable chat interaction with smaller groups of people, is consistent with this CALL affordance. Further, synchronous CMC environments potentially offer extensive opportunities for purposeful target language use in an authentic and engaging communicative context. Not only can learners take risks with language (with little downside to non‐target like utterances in text‐based SCMC, at least), they receive a potentially vast amount of linguistic input from a variety of partners across many communicative contexts. They may review their own and others' target language use because of the message permanence and slow motion nature of the interaction (compared to that in F2F). Rama et al. (2012) describe this affordance in terms of the WoW space "providing opportunities for language learners to interact with native speakers in ways that allow time for reflection on language production" (335). One of the participants in this study (Silvania) made limited contributions to the group chat, however, these tended to be in complete, grammatically correct utterances. This participant's journal entries suggested that the CMC medium provided her with the opportunity and motivation to improve her writing (and speaking) skills. Though evidence of gains in specific aspects of language proficiency is sparse in this study (nor was such evidence explicitly sought), there is ample evidence of growing familiarity with certain Spanish vocabulary, expressions, and phrases that suggest a strengthening of learners' communicative competence in the MMOG environment. Upon seeing an example of one of the learner's chat

transcripts, the learner's professor commented to one of the researchers that the learner had completely formulated a question and expressed himself in Spanish in a manner that exceeded the level of most of the other students in the class. Though anecdotal, this expert comment may be taken as evidence of target language development that can be traced to participation in the MMOG. Indeed, just as CMC research, in general, has found increased participation among students, an increased quantity and heightened quality of learner output, enhanced attention to linguistic form, and an increased willingness to take risks with their L2, among other benefits, results of this study suggest that participation in these spaces can have a positive impact on students' confidence and perceived competence, as well as their willingness to interact in the target language.

Data in SLA-Relevant CALL Research

CALL researchers can employ computer technology to gather a variety of types of data that are not available to them in face‐to‐face learning settings. Generally speaking, CALL researchers collect and analyze SLA‐relevant learner data in two environments. The first type is that yielded by Human‐Computer interaction (HCI). An example of HCI is a learner independently using multimedia or a web‐based language learning program such as an e-tutor for learning German (Heift, 2010). The other type of learner data is that yielded by human-human interaction (HHI). In HHI learners use the computer as a vehicle for interacting directly with other language learners, native speaker peers, or teachers. An example of HHI is using a synchronous chat program to complete some language learning tasks with another learner. In both HCI and HHI computer technology can be especially beneficial in helping researchers capture the best possible record of how learners are engaging with computer programs and/or other learners. This can be referred to as learner process data (Chapelle, 2003). A distinct, but related affordance is that computers are well suited for simultaneously capturing multiple forms of learner data (allowing for richer interpretations and triangulation), which will potentially strengthen the plausibility of data‐driven interpretations they will make.

Multiple Modality Methods in Data Collection

The method of data collection employed has long been acknowledged to affect outcomes in applied linguistics research (Beebe and Cummings 1995; Smith 2012). Computer technology affords researchers with opportunities to simultaneously record visual, audio, and textual data in a way that is easily synchronized for later analysis. For example, relying solely on an audio file of a stretch of learner interaction may lead to a different interpretation of the data from a video record (plus audio) of the same interaction. In a study that illustrates this very point, Smith and Gorsuch (2004) explored the nature of task‐based learner‐learner interaction during SCMC.

Findings clearly showed video and audio data merged and re‐interpreted with traditional chat scripts can provide a fuller picture of what learners do while engaged in task‐based SCMC than chat scripts alone. The visual data captured also showed that other factors such as facial expressions and body language often provided essential information required to sufficiently interpret aspects of SCMC learner interaction. For example, facial expressions (if captured) can show an indication of non‐understanding in instances where the chat transcript and audio records do not, something that is very important from an interactionist theoretical perspective.

In an exploration of how task‐based language teaching (TBLT) operates in real teaching contexts, Seedhouse and Almutairi (2009) employed Transana3 software to align video, audio, and tabletop computer screen records with the transcripts of the interaction onto a single screen, making several data sources available simultaneously for a multimodal and holistic analysis. This approach allowed them to compare task‐as‐work plan (what is supposed to happen) with taskinprocess (what actually happens). Their findings suggest that during task‐based interaction, a significant amount of learners' attention is spent on coordinating verbal elements with non‐verbal elements of interaction and with task‐related actions in a precisely timed, multi‐dimensional manner. It is only through capturing and tracking multiple modalities of learner interaction is such subsequent analysis and conclusions possible. A study by Suzuki (2013)

conducted within a sociocultural theoretical framework also provides a clear illustration of the benefits of multimodal data collection.

Capturing Learner Process Data

Researchers investigate what students do when they use a particular program or tool (Fischer2007, 2012) or engage in a particular CALL task (Chapelle, 2001). Tracking techniques such as computer logs have shown that there is often a mismatch between students' reported and actual use of specific CALL program components. Fischer (2007) found that students were not

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consistently aware of what they did as they used a particular program, which calls into question the accuracy of their perceptions of the value of the program's components. Fischer (2007) also explained how tracking in CALL can be used to investigate SLA constructs such as input enhancement, negotiation of meaning, corrective feedback, noticing the gap, sociocultural learning, hypothesis testing, and metalinguistic reflections. He argues that through tracking learner behaviour many studies have not only confirmed the operation of fundamental SLA principles but have also extended our understanding of these principles.

For example, in terms of input enhancement, tracking shows that whereas perceptual saliency (e.g., adding colour and/or boldface) has an impact on students' behaviour, it is functional saliency (e.g., elaborating word meanings and grammatical features with multimedia annotations) which has an impact on students' learning.

Tracking Learner Behavior

Researchers track learners' behaviour by recording keystrokes, mouse clicks, scrolling up and down and other actions concerning a stimulus from the computer program (in HCI) or interlocutor (in HHI). When learners perform these actions is easily identified through timestamps. Moreover, researchers can use video screen capture programs to inspect how learner navigates a computer program or other online task in real-time. More recently, some researchers have been employing eye‐tracking technology in SLA‐relevant CALL studies. The following illustrates various forms of tracking used in such SLA‐relevant studies.

- **HCI (Human Computer Interaction)**

Drawing upon the SLA frameworks of strategies (Cohen, 1998; O'Malley, & Chamot 1990;Oxford, 1993), individual differences and learning styles (Reid, 1995; Skehan, 1989), Pujolà(2002) developed a web‐based ESL program, ImPRESSions, focusing on listening and reading comprehension for Spanish‐speaking students. The program presented the content of

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the same news stories in both written and video formats within the software, and students had virtually complete control over their learning in the program. Recording students' actions with ScreenCam as they used the program, Pujolà hypothesized that students with lower decoding abilities in English would make more use of the available transcripts and subtitles for the video clips than students with higher decoding abilities. However, he discovered that students within each group behaved in varied, idiosyncratic ways in how they navigated through the program and accessed its help devices. The tracking data allowed Pujolà to derive two categories of usage patterns: a global approach in which students infrequently sought the help of any kind and compulsive consultors in which students repeatedly clicked on various buttons, especially the rewind/replay buttons for the video clips because they thought they had to understand every detail of the material to be learned.

Drawing on constructs from processing instruction (VanPatten, 1993, 1997), noticing (Schmidt, 1990), and consciousness-raising tasks (Ellis, 1995; Smith, 1993), Collentine (2000) tracked the number of times students accessed various components of a Spanish learning program and the amount of time they spent on each. Using regression analysis he estimated the contribution of the amount of time spent on each component to students' post‐test scores. On the one hand, his analysis revealed that students' use of the audio component contributed significantly to their post‐test performance but that they underutilized this component as they (2001)

navigated through the program. On the other hand, students' use of the video component did not contribute to their post‐test performance even though they over‐utilized it.

- **HHI**

In her exploration of the relationship between linguistic complexity in the input in a 3D environment and subsequent learner output in SCMC, Collentine (2013) used the tracking mechanism built into the 3D environment to track the nature and amount of computer‐generated input, learner responses, and the order in which learners interacted with objects in the virtual world. Results of quantitative and qualitative analyses suggest that for linguistic

complexity to be evident in learner SCMC output, the input must have certain linguistic features and contain propositional information to assist learners in completing the task. Her data question the notion that linguistic complexity in input necessarily elicits linguistic complexity in output (Leow et al., 2003).

Writing from a cognitive interactionist theoretical perspective, Sauro and Smith (2010) examined the chat interaction by learners of German engaged in dyadic task ‐ based SCMC.

They examined typed and sent L2 output as well as that which is typed but then deleted (unsent) during synchronous written computer ‐ mediated communication. Video screen capture records were used to get at the unsent output, which is normally not available from chat transcripts. The chat interaction was coded and analyzed for syntactic complexity, productive use of grammatical gender, and lexical diversity. Results showed that chat output that exhibited evidence of online planning displayed significantly greater linguistic complexity and lexical diversity than chat output that did not exhibit online planning. They argued that L2 learners appear to make good use of the increased online planning time afforded by chat to engage in careful production and monitoring.

- **Eye Tracking**

CALL researchers have only recently begun employing eye ‐ tracking technology in explorations of instructed SLA in CALL environments. Eye tracking affords researchers the ability to capture aspects of learner process data not available during face ‐ to ‐ face interaction. Eye movements during reading (in this case during text ‐ based SCMC) can be used to infer moment ‐ by ‐ moment cognitive processing of a text by the reader without significantly altering the normal characteristics of either the task or the presentation of the stimuli (Dussias, 2010). These eye movements are considered indicators of perceptual and cognitive processes. For example, eye ‐ movement patterns reveal cognitive processes during pronoun resolution and co ‐ reference and resolving lexical and syntactic ambiguity during reading in both L1 and L2

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(Rayner, 1998). The duration of an eye fixation is interpreted as an indicator of the processing time applied to the object being fixated on. A long fixation duration indicates either difficulty in extracting information, or greater engagement with the object (Just, &Carpenter, 1976).

Smith (2010, 2012) investigated the use of eye‐tracking technology to help pinpoint learners' attention to and noticing of feedback in an L2 SCMC task‐based environment. Recasts were chosen as the specific type of corrective feedback (CFB) investigated. Using eye fixation data as a measure of "noticing events" learners were found to attend about 60% of the intensive recasts they received by a native speaker interlocutor. Lexical recasts were much easier than grammatical recasts for learners to notice, retain, and accurately produce on subsequent chat interaction and delayed written post‐tests.

Using heat map records and stimulated recall records, Smith (2012) found that both stimulated recall and eye‐tracking records were favourable predictors of learner noticing with the eye‐tracking record being slightly more discriminating in its prediction on immediate posttest success. There was no significant relationship between the linguistic category of the recast and noticing in the eye‐tracking condition. However, in the stimulated recall condition learners were much more likely to report having noticed recasts targeting semantic features than morphological recasts. This last finding has implications for SLA as it suggests that learners show evidence of heightened attention to recasts, regardless of the linguistic category of the

target. When considered in combination with the results from Smith (2010) these findings suggest that even with heightened attention on morphological recasts, learners were less able to attend to these features at a level that allowed them to make use of the teacher recast on the post‐test. For SLA theory this is important as it is consistent with previous research by Mackey, Gass, and McDonough (2000) and Nabei and Swain (2002) who had positive findings for noticing lexical feedback over other types. This evidence is also compatible with an input processing theoretical perspective (VanPatten, 1996), which argues that learners prefer to process information lexically over other features in the input and also emergentist notions of blocking and overshadowing (Ellis, & Sagarra, 2010).

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In simple terms, learners can conduct following types of researches in the perspective of CALL and language technology:

i. To test functionality, accuracy of language technology tools for instance Voyant, MONK, TAPOR, POS taggers, ManyEyes, DocuBurst etc

ii. To conduct HCI research, application of tools on humans and their cognition/ mind/ learning. To what extent how can a tool increase reading speed of learners. Usually, these are experimental researches with pre-test and post-test.

iii. Tools can be extended, or new languages can be included. Such work can be done with computer prgrammers.

iv. Humans exploit these tools for better learning an detaching purposes. One tool can be used in different situations to acquire different results for instance social media mining can be done for prediction of election results, detecting hate crimes, forensic linguistics, analysis of persons who want visa on arrival etc

v. Presently, the world has tilted to digital humanities, text mining and multidisciplinary studies.

vi. Open shelf, data visualization tools are in vogue. There is need to to introduce them in academia, research, pedagogy.

vii. New linguistic varieties should be built and analysed. Code mixed and code meshed language can be studied.

viii. New corpora are emerging for instance Coronavirus corpus has been built recently. They should be studied to explore idiosyncratic knowledge patterns.

ix. Review analysis of products and sentiment analysis have become very popular in the world.

x. Here are two hundred tools for learning and research. You can conduct research on them. Find them from the given link: https://www.toptools4learning.com/

xi. These text mining tools are in vogue in academia.

- **Voyant-tools.org** : "Voyant Tools is a web-based reading and analysis environment for digital texts."
- **Wordle** : A robust word cloud generator with extensive shape, color and font options.

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- **Google Books NGram Viewer** : Analyzes historical word occurrence, usage and changes over time and allows users to download data for more intensive research
- **Culturomics - Google Ngrams Addon** : An add-on for Google Ngrams to download data sets.
- **Time Magazine Corpus** : Offers access to American Mainstream Culutural Text Analysis via the complete text of the Time Magazine Archive (1923-2006)
- **Juxta** : Juxta is a cross-platform tool for collating, comparing, and analyzing any kind or number of textual objects

xii. These tools facilitate in data visualization.

- R-Project: R is an integrated suite of software facilities for data manipulation, calculation and graphical display.
- Data-Driven Documents (D3js) : D3.js is a JavaScript library for manipulating documents based on data. D3 helps you bring data to life using HTML, SVG, and CSS
- Walrus - Graph Visualization Tool : Walrus is a tool for interactively visualizing large directed graphs in three-dimensional space. By employing a fisheye-like distortion, it provides a display that simultaneously shows local detail and the global context.

xii. The given diagram illustrates the learning tools.

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Top 200 Tools for Learning 2018
Top 10
Use the interactive table to view tool categories
Compiled by Jane Hart from the results of the 12th Annual Digital Learning Tools survey

Conclusion

One of the major challenges in conducting SLA‐relevant CALL research is dealing with the seemingly irreconcilable relationship between fast‐paced technological development on the one hand and our need to fully explore in a principled way whether and how these technologies can be employed to facilitate second language acquisition, on the other. It is clear that the effectiveness of CALL for SLA cannot reside in the medium itself. Rather, effectiveness must be judged in how these technologies are put to use in ways that are consistent with theoretical and pedagogical developments in instructed SLA. Indeed, research suggests that L2 courses supported by instructional technology are at least as effective as and perhaps superior to those courses with no technology (Grgurović, Chapelle, and Shelley 2013), though it is difficult to imagine the latter. The current environment is fostering a degree of confluence of instructed SLA research with SLA‐relevant CALL research, which has the potential to inform and shape SLA theory. Likewise, assertions, predications, and expectations from SLA theory must "hold up" in CALL environments and F2F environments alike. It is precisely this convergence of SLA and CALL research that may provide the building blocks for a developing CALL theory, which, as Hubbard (2008) describes, reflects a set of claims about the meaningful elements and processes within some domain of CALL, their interrelationships, and the impact that they have on language learning development and outcomes.

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Xing, M., Zou, B., Wang, Y., Sun, M., & Xiang, C. H. (2014). Computer-Assisted Foreign Language Teaching and Learning: Technological Advances.

Recommended Books

The Use of Technology in English Language Learning: A Literature Review by Mohammad Reza Ahmadi

No Shelf Required: E-Books in Libraries. Editor: Sue Polanka

URLs

https://etad.usask.ca/802papers/antifaiff/antifaiff.htm

https://online.purdue.edu/ldt/learning-design-technology/resources/designing-curriculums-around-technology

https://en.wikipedia.org/wiki/Electronic_assessment

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