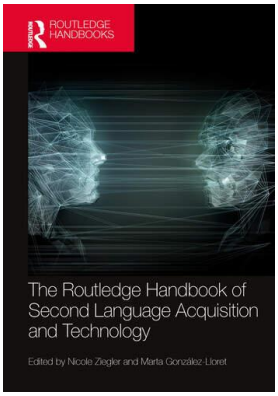

The Routledge Handbook of Second Language Acquisition and Technology

Nicole Ziegler, Marta González-Lloret

Technology-mediated SLAEvolving Trends and Emerging Technologies

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Robert Godwin-Jones
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TECHNOLOGY-MEDIATED SLA
Evolving Trends and Emerging Technologies

Robert Godwin-Jones

Introduction

In recent years we have seen major developments in technology which have had a profound influence on everyday life as well as on education at all levels. Those include the rise of artificial intelligence (AI), the ubiquity of social networks, the increase in data collection and cloud services, and the revolution in mobile technologies, just to name a few. As advanced technologies become widely available to the general public, at least in developed economies, there is inevitable pressure on educators (from students, parents, administrators, legislators) to take advantage of these developments to enhance educational practices and outcomes. This is no different in second language acquisition (SLA), in which areas such as online resources or videoconferencing have been increasingly incorporated as "normalized" practices (Bax, 2003). The 2020 novel coronavirus pandemic has accelerated the need in all disciplines for instructors and institutions to have sufficient technology tools and services integrated into teaching practice to provide the flexibility to pivot to online or hybrid learning as necessary. In instructed language learning, one hopes that the process of technology integration is informed by SLA research findings.

While we cannot with any confidence predict future technology developments, we can extrapolate from current trends to imagine likely directions, at least in the short term. In this chapter we shall do that, as well as to look at emerging technologies which would seem to hold promise for SLA, including virtual assistants, the Internet of things, extended reality technologies, robotics, and ubiquitous networks. At the same time, we will discuss how technological advances and their use in learning mesh with current theories of second language acquisition. We should point out at the outset that the extent of current and future technology integration into instructed SLA can vary dramatically, depending on socio-economic and other factors. It is also the case that adoption of any given product or approach in a second language classroom is rarely based primarily on research findings in SLA or on accepted best practices in computer-assisted language learning. Often adoption decisions and classroom practice are influenced heavily by issues such as cost, teacher acceptance/training, or curricular/accrediting considerations.

Evolving Trends

The chapters of this volume point to the variety of current uses of technology in the service of SLA. One of the trends that looks likely to continue and accelerate is simply the wide choice learners have in terms of resources. These are predominately available online and outside of the classroom

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yet may be combined with some degree of formal instruction. The variety of services and resources allows learners to find and use online L2 resources which fit their own particular contexts.

SLA through Online Entertainment

One of the most significant trends is the growth in informal language learning, with studies in recent years of SLA in the "digital wilds" (Cole & Vanderplank, 2016; Sundqvist & Sylvén, 2016). This has been documented especially for English, for which vast online resources have become more easily accessible. That is particularly the case for streaming audio and video, which is available worldwide on YouTube or through commercial services such as Netflix. Studies by Sockett (2014) and Kuysk (2017), among others, have shown how the use of such resources—repeatedly watching English language films with or without subtitles, binge-watching a whole season of a popular television series, or listening over and over again to pop songs while reading the lyrics—can lead to development of English language skills in both receptive and productive areas. The learners in these studies were engaging in the online L2 activities not primarily for language learning, but rather for entertainment or socializing, with SLA as a byproduct. Online learning resources for other languages are not likely to be as abundant yet may still offer significant opportunities for informal learning (see Chik & Ho, 2017).

Incidental language learning may come through other online pursuits conducted in an L2 which may typically be classified as leisure activities. Those include online gaming (Sundqvist, 2019) and participation in fan-based communities (Sauro, 2017). While engaging in such activities, L2 users are being exposed to input that is abundant, rich, and authentic, seen as key conditions for implicit language acquisition (Ortega, 2017). However, users are not likely to be focusing conscious attention on language, but rather on content and meaning. Mainstream SLA theory holds that the cognitive process of intake necessitates some attention to actual language form (Schmidt, 1990). It can be argued, however, that the context of informal language learning today requires a reconsideration of that position, at least for this specific context. The high motivation many have in participating is likely to lead to more extensive language exposure as well as to a high degree of personal engagement, resulting in enhanced L2 identity formation (Norton, 2014). Learner agency is enabled and strengthened above all through access to resources on personalized mobile devices (Godwin-Jones, 2017c).

L2 users watching multiple episodes of a soap opera, situation comedy, or movie series are likely to become intensely invested in the characters' lives and fortunes (Sockett, 2014). At the same time, watching the same characters repeatedly in similar scenarios involves hearing similar language patterns used in a variety of situations (Sundqvist & Sylvén, 2016). That process can lead to the kind of "statistical learning" and entrenchment of language patterns that is seen as fundamental to usage-oriented SLA (Ellis, 2017). This provides a significant contrast—in resources and motivation—to exposure to a L2 in a classroom setting, which is inevitably more limited and less personally compelling. Users are likely to engage in socialization through their L2 related activities, for example, in participating in game or fan related online forums or in the use of popular social media platforms such as Twitter, Facebook, or Instagram. Studies have highlighted the linguistic complexity of social networks such as Facebook and the potential for engaged and extensive L2 use (Kulavuz-Onal & Vásquez, 2018; Sockett, 2014). Recently, commercial language learning services (such as Duolingo or Babbel) have become very popular. They offer Web-based access as well as mobile apps, typically combining grammar/vocabulary lessons/practice with conversational opportunities with fellow users. Recent studies of such services provide mixed results (Lin et al., 2016), with attrition identified as a major issue in their use (Stevenson & Liu, 2010).

One of the signature benefits of language learning through commercial services is the opportunity they supply for L2 learner-users to use the target language in communities of fellow learners. The language gains possible through these and other community-oriented online environments align

with sociocultural theory, which emphasizes the affordances of social learning (Lantolf & Thorne, 2006). Studies have shown great potential for this kind of learning through one-on-one exchanges enabled through telecollaboration or virtual exchange (Çiftçi & Savaş 2018). The growth in the use of this activity reflects the benefits of having students use their target language in real communicative activities. The process has been enabled as well by technical progress, namely the availability of free videoconferencing tools. The recent growth and interest in this activity relates also to its potential to enhance participants' intercultural communication competence and to foster the spread of global citizenship (Godwin-Jones, 2019c; O'Dowd, 2019).

Complex Personal Learning Environments

It is likely that many L2 learner-users will be active in a variety of modes and services, using multiple devices, including a smartphone, tablet, and computer. The choice of which activity to choose depends on the context—using a phone, for example, for chatting but a laptop for playing the massive multiplayer World of Warcraft. These choices will be contextual as well as highly personal. That is true as well of the activity level, which may ebb and peak, depending not only on interest level, hence motivation, but also on work/school schedules, personal routines, and interactions with friends/family. The wide selection of online resources makes it difficult for SLA researchers to be able to attribute learning gains to the use of one particular online source, as it is likely L2 learner/users will be using a variety of apps and services and potentially interacting with multiple online communities. Unless learners are maintaining a comprehensive learning diary or online activities are being continuously logged, identifying cause and effect may be problematic (Godwin-Jones, 2019b). Researchers have found that qualitative studies of individual learners or of small groups, followed over time, can identify patterns of resource usage, peer interaction, and individual agency/motivation which point to successful learning trajectories. Papi and Hiver (2020) used process tracing (Bennett & Checkel, 2015) to analyze individual language learning histories, while Lee et al. (2019) found clustering techniques and data mining to be successful in uncovering revelatory sets of behaviors/outcomes.

Atkinson et al. (2018) describe the dynamic of "multiple teaching/learning types and resources, often operating simultaneously" (p. 473) as a "distributed teaching and learning system." Formal teaching/learning environments are increasingly being supplemented, or, in some cases, replaced by learning distributed in a variety of ways. While the emphasis in research in this area has been on digital environments, we have also seen important studies on face-to-face learning in leisure or working environments. Researchers use conversation analysis to follow and analyze the learning processes in such encounters (Eskildsen & Cadierno, 2015). This approach to SLA highlights the adaptive integration of learners into the environment, pointing to the importance of non-verbal communication and to the role of objects in the learning process. The complex world of "mindbodyworld" (Atkinson, 2014) points to the recognition of the "contextualized, situated and embodied nature of communicative activity" (de Bot et al., 2013, p. 202). This aligns with the increasing use of ecological frameworks in SLA (Kramsch, 2008; van Lier, 2010) and computer-assisted language learning (Chun, 2016), according to which individual cognitive processes are seen as embedded in and shaped by the social environments in which interactions occur. Specific theories which incorporate this perspective include socio-cultural theory (Lantolf & Thorne, 2006), language socialization (Duff, 2007) and SLA identity theory (Norton, 2014). These approaches have in common an emphasis on process and context. Studies aligned with these theories point to the complex and evolving role of the L2 learner/user in the learning process (see Ortega, 2017). Another ecological approach, complexity theory or complex dynamic systems, emphasizes the variation and unpredictability in learning outcomes, given the great variety in learners' initial conditions and the multitude of learning options and trajectories available today (Larsen-Freeman,

2018). This approach aligns particularly well with informal language learning online (Godwin-Jones, 2018a; Sockett, 2014).

Socio-cognitive and ecological frameworks tend to be built on a usage-based theory of language. Rather than viewing linguistic knowledge as being comprised of a set of rules, usage-based linguistics emphasizes the prominent role of formulaic expressions and often repeated multi-word chunks of language. From this perspective, lexis and syntax are inseparable (Ellis, 2017). This view of language has been supported by studies in corpus linguistics (Mukherjee, 2004) and the practice of conversation analysis (Hall, 2019). In fact, corpus-based language learning has become mainstream in recent years (Boulton & Cobb, 2017), as "corpus use integrates well into constructivist and learner-centered approaches to language acquisition. It supports the mandate in contemporary communicative language instruction for the use of authentic language materials and for the development in learners of metalinguistic knowledge and learner autonomy" (Godwin-Jones, 2017a, p. 6). Corpus access often involves using inductive methods featuring discovery learning, leading students to uncover patterns based on real language usage, rather than to focus on rules. This aligns with constructivist theories of learning, as students build knowledge from personal interactions with the linguistic material (Boulton & Cobb, 2017)

A usage-based understanding of language necessarily leads to a quite different theory of learning from traditional SLA, resulting in evolving views on widely used theories such as the monitor model (Krashen, 1982) or noticing theory (Schmidt, 1990). Recent studies of informal language learning in digital environments have emphasized the role of repetition with variation, as L2 users are exposed to items through multiple encounters in different contexts, and acquiring the ability to understand, use, and re-formulate sequences of language (Kusyk, 2017; Sockett, 2014). The variability in individual language learning trajectories, guided by differentiated—and typically fluctuating—SLA goals and through encounters with widely different L2 resources online, lead inevitably to personal and unique learning repertoires (Hall, 2019). The personalization of language learning has been accelerated through the advent of the smartphone (first iPhone in 2007), which created a new relationship between learner-users and digital devices (Godwin-Jones, 2017c). The reliance on the anywhere/anytime availability of one's phone has become a mainstay of everyday life in many parts of the world. This shows no sign of changing in the near future, although the form factors of available models are likely to continue to evolve while the continuing proliferation of apps of all kinds allows for ever greater personalization. The personal learning environments afforded by mobile technologies will become in the future even more widely differentiated, depending on the mix of formal and informal learning environments, evolving choice of resources and services, and the different contexts of language use/need.

Emerging Technologies

If language learning today is complex and multifaceted, it is likely to become even more so in the near future, through advances in artificial intelligence, embodied/wearable/home digital devices, and faster processors/networks. These developments promise to supply even more options in space and time for SLA, as well as to provide more opportunities to tailor learning to individual needs and desires. At the same time, we need to keep in mind that access to advanced technologies will not be universal. The digital divide will not only continue to be present between developing and developed nations, but also remain evident within wealthy nations—a second order digital divide—where growing economic inequality manifests itself in widely different access across communities (especially in poor urban and rural areas) in terms of device availability/age and speed/reliability of networks. The 2020 pandemic brought into sharp relief these divisions. Access to online resources may be limited as well by cultural factors, such as extended parental control or the influence of religious institutions. Political considerations can play a role as well, controlling or banning particular online services or platforms.

Online Access: Speed, Flexibility, Ubiquity

One of the more noticeable developments in recent years has been the sharp increase in devices capable of connecting to the Internet and interacting in a variety of ways with the user and online services. It has become increasingly common for users to have multiple devices capable of connecting to the Internet, from wearable devices such as smartwatches or smart glasses, to smartphones, tablets and laptops, all of which are personalized with continuous cloud-based syncing and updating. The promised "Internet of Things" is being built on faster and more widely encompassing networks, especially through the arrival of 5G, also known as ultra-wideband, the 5th generation of wireless networking technology. 5G networks are not only an order of magnitude faster (exceeding most fiber optic connections), they can also serve many more devices at the same time. With more efficient hand-off connectivity (among nodes and among devices), there is lower latency (connection time), enabling near instantaneous communication with cloud services. Faster response times are crucial for devices such as self-driving cars, but that speed also can enable educational uses, such as immediate video downloads or immersive applications, with instant identification of objects in the environment or the production of real-time stitched-together 360-degree images.

Faster and ubiquitous networks will enable more accurate tracking of user location and user situation/context (i.e., at home, on the bus, at work). This in turn will enable the availability of more contextualized learning to be available. We have already seen significant developments in this area for SLA, especially through place-based apps and games. Mobile games created on the ARIS platform, such as *Mentira* (Holden & Sykes, 2012) or *Chrono-ops* (Little & Thorne, 2017) combine interactions with local landmarks/people with group collaboration to provide powerful—and highly motivating—language learning opportunities. These games leverage the availability of location services through GPS and detailed geographic data through continuously updated mapping services to add rich contextual content through augmented reality (AR). AR places the learner into the immediate environment, helping to integrate language learning into real world contexts, seen as a primary aspect of constructivist learning theory (Lan, 2020). Using a smartphone camera, a user receives an enhanced view of a building, square, or other landmark which can provide cultural, historical, or linguistic information (Godwin-Jones, 2016). The rich use of environmental context in AR aligns with SLA theories which emphasize embodied learning and ecological frameworks (Aktinson, 2014), highlighting the potential for this technology. This aligns with a task-based approach to language learning (Ellis, 2003) in which learners engage in a real-world task using the target language.

Virtual Assistants

One of the recent innovations in consumer products are virtual assistants, small hub-like devices or speaker-microphones that interact with the user through voice recognition and synthesis. Those include Amazon's Alexa, Google Assistant, and Apple's Siri. These services are also available on mobile devices as well as through earbuds. They offer not just voice-based Internet access but also typically multilingual capabilities including translation services. Commercial products are available today which provide on-the-fly language help and translation. Google's Pixel Buds, for instance, are capable of recognizing and generating speech in 40 languages. The deep learning algorithms, along with massive dual language corpora, allow quite sophisticated responses to queries, which can be then rendered in a variety of languages. In addition, advances in speech technology have allowed much more natural sounding synthetic voices, coming close to human speech patterns. As such systems improve in imitating human speech, they have the potential to support cognitive SLA approaches which emphasize interactionist principles (Chun, 2016). In contrast to conversation practice with a fellow human being, interactions with a computer-generated partner provide a safe (and face-saving) environment for practice and experimentation.

In fact, we are starting to see experimentation with the use of such devices for pronunciation and speaking practice in instructed SLA (Kiy et al., 2019). Since the integrated automatic speech recognition (ASR) is based on native speaker pronunciation, interacting in conversation with the devices offers learners the opportunity to test the intelligibility of their L2 output. Underwood (2017) found the use of virtual assistants was highly motivating to grade school age novice learners. Moussalli and Cardoso (2016) found that to be the case for intermediate level adult learners as well. At the same time, there is a potential for frustration or embarrassment in experiencing repeated misinterpretation by the voice recognition system. These are not systems designed to supply helpful feedback on non-standard language use. However, voice recognition systems continue to improve through access to larger speech databases and improved language models (Godwin-Jones, 2019a). Added functionality for virtual assistants is available through 3rd-party add-ons, such as Alexa's "skills." An interactive storytelling skill was used in a project involving ESL students in Japan and proved to be useful in creating interactions in English (Dizon, 2017). Kiy et al., (2019) leveraged the development of an Alexa skill to create a virtual tutor and recommendation system. These systems are widely used in home and mobile environments, thus integrating into learners' lived experiences. We are also seeing such systems specifically designed for language learning, such as Mondly, which features a chatbot (available in 33 languages) and an AR module (Fryer et al., 2020).

Artificial Intelligence and Big Data

Apps and online services have become more powerful through continuing advances in AI as well as the wide collection and analysis of speech data. On the one hand, big data is valuable for learner analytics, showing which approaches, tools or applications hold promise for success, depending on user contexts. On the other hand, data collection can be used to construct an individual learner profile (Kay & Kummerfeld, 2019). This can be the basis of differentiated learning/teaching pathways, tailored to student needs and experiences. This reflects the growing emphasis in SLA theory on the importance of individual learning paths and on a "person-centered" approach to language development (Benson, 2019, p. 6), which includes SLA research into individual learner differences (Dörnyei, 2013). However, the process of building individual profiles is problematic. Building a useful learner profile depends on the ability to collect data from the variety of resources an L2 learner is likely accessing. That can be difficult due to the absence of APIs (Application Programming Interface) to collect the data or to proprietary approaches, which for business reasons, prohibit data sharing (Godwin-Jones, 2017b). There are also privacy concerns about how data is collected, shared, and used which have become of increasing importance in recent years.

This concern is compounded by authentication issues, namely ensuring that data is indeed associated with the named individual. While advanced security processes such as two factor authentication or face recognition have become commonplace, it seems likely that future security will be built around more heavily encrypted systems such as Blockchain, the open source framework behind crypto-currencies such as bitcoin. In a Blockchain system, every user is a node with a unique address and a private key. The software accessing the Blockchain networks (the "wallet"), installed on learners' devices, validates and relays information about every transaction (creating "blocks"), while the user remains pseudo-anonymous. Devine (2015) outlines how this could function in an educational setting, using "smart contracts." Sharples and Domingue (2016) echo this call for the use of Blockchain for distributed digital record collection. Quantum cryptography or lattice-based encryption promise to supply even more unhackable options for authentication (Korolov & Drinkwater, 2019).

An area which has seen dramatic improvement through AI and massive data collection is machine translation. That is evident in the most widely used such service, Google Translate (Stapleton & Kin, 2019). Beginning in 2016, Google has used an artificial neural network to power its translation service, which has significantly improved the quality and accuracy of translations (Wu et al.,

2016). Studies have examined the use of Google Translate in formal language learning, mostly oriented toward students' attitudes in its use or assessment of its accuracy (Stapleton & Kin, 2019). However, most of those studies were conducted before the recent upgrade and thus in terms of translation reliability, do not represent the current state of the art. More recent studies (Tsai, 2019) show marked improvement, in this case in English – Chinese translation. Stapleton and Kin (2019) show that having students use Google Translate to compare their L2 draft with Google Translate generated versions of their L1 writing resulted in improvements in students' L2 writing. Translation as a learning activity has been seen as incompatible with a communicative approach to SLA, which favors target language only use in instruction (Savignon, 1991). Recent emphases on multilingualism in SLA (Ortega, 2017) suggests leveraging students' knowledge of their L1 to enhance meta-linguistic awareness and to align with real-world multilingual practices, especially online. This new awareness of "translanguaging" (Garcia & Li, 2014) puts translation in SLA in a new, more positive light (Kramsch & Hua, 2020).

There is no doubt that advances in AI and in data collection will lead to continuous improvement in the ability of smart devices and language bots to communicate in a variety of languages. At their present stage of development, they are capable of handling effectively various kinds of transactional language use. That might include asking directions, ordering in a restaurant, or even interacting in a bar. Such conversations will clearly not range too far afield in terms of conversation topics, nor would they be altogether natural, should an electronic interpreter be in use. More importantly, machine translation—no matter how intelligent—is not likely to be able to handle the nuances of human communication. That includes variations from standard language due to region, class, education, or non-native status. The nuances most difficult to detect and to use are likely to be cultural, the pragmatic aspects of language use, for which there are no hard and fast rules, but rather contextual appropriateness (see González-Lloret, 2019). Translating engines, based on massive databases, will likely recognize idiomatic and formulaic expressions, as well as possibly being able to detect the general context of the conversation. However, they are not likely to pick up subtle variations in phrasing, intonation patterns, or nonverbal cues. Those limitations, in an instructional environment, could be used to discuss with students how far removed real language is from rule and grammar-based models, often the principal language model of the classroom and textbooks.

Immersive Technologies and Robots

While AR projects add data onto views of real-life scenes, simulated reality immerses the user in an artificial environment which mimics reality. In language learning, Second Life was an early implementation of that technology. Such software, sometimes called *social virtualities*, allows users to project themselves as avatars into a 3D environment which may represent an imitation of an aspect of the L2 culture or be a totally fictitious world (Thorne et al., 2009). Learners interact with others as well as with the environment and are able to contribute to building community. A more truly immersive approach (using headsets) has become available through virtual reality (VR). This technology has been available as well for some time but has seen renewed interest in recent years with the advent of more portable and less expensive headsets. Google's Cardboard, in particular, has garnered a good deal of interest, due to its low cost and convenience (Brown & Green, 2016). VR is based on scenes created or filmed in 360° views, allowing the user to have the experience of being fully surrounded by the virtual environment. As is the case with virtual assistants, VR can provide a "safe space" for learners to practice their L2 skills (Hu & Smith, 2019). Currently available implementations of VR and language learning offer users preconstructed scenarios with which to interact, such as shopping or sightseeing with limited, formulaic language production options, often in the form of multiple-choice responses to prompts (Greenberg, 2018).

Those limitations apply as well to another technology under development, robotics. While uses such as warehouse robots are today widely implemented, this is the not the case for the educational use of robots. A recent study (Cheng et al., 2018) points to language learning as one of the most promising areas for the implementation of social robots. In fact, there have been projects which have integrated robots into language instruction, typically for school children (Schicchi & Pilato, 2018). Yang et al. (2019) describe an implementation which features robots in combination with TPR (total physical response) and storytelling. He and Smith (2019) discuss a project that uses robots to monitor and assist in conversation among language learners. The learner response to robot implementation is typically quite positive, as is the case with virtual assistants. As with any other new technology, that enthusiasm may be generated by the novelty involved, rather than the usefulness of the devices or the services. A meta-analysis indicates that learning outcomes from robot projects have been modest (van den Berghe et al., 2019).

While robots, with improving voice technology and advanced natural language processing, will become more capable language partners, they remain machines, incapable of affective responsiveness, essential in real human communication. The importance of human emotions in language learning has been increasingly recognized in SLA theory (see Oxford, 2015). Implementation of robotics in language learning has attempted to mitigate the mechanical interface by supplying robots with faces or bodies (Schicchi & Pilato, 2018). It is likely that, informed by advances in AI and in speech technologies, robotic interlocutors will become much closer to sounding human. That may include the ability to use facial recognition to decipher human emotion as well as to mimic affects displays or gestures (Gunes & Hung, 2016). Still, the robots remain lifeless intermediaries, not flesh and blood conversants using language in creative and unpredictable ways. Ethical concerns have also been raised over the idea of "robot teachers" gaining children's trust and threatening a loss of human contact (Kukulska-Hulme, 2019). Beyond ethical, pedagogical, or emotional concerns, there is a practical issue for both VR and robotics of cost and availability. These are fast evolving technologies so that investments in development, programming, and training, which may be substantial, may be for naught if a company discontinues a product, or a much better rival emerges. It is also the case that educators lag behind in technical developments and that technologies may have become obsolete by the time they reach the classroom (see Sykes & González-Lloret, 2020).

Conclusion

The contexts for SLA vary so greatly that it is foolhardy to try to make general statements on optimal approaches to the process. There is not likely to be one method of learning a second language that is universally applicable. It is not only the contexts for learning that vary, but also the personal background of the learners as well as the reasons for learning an L2. That latter condition might vary from a university student fulfilling a liberal arts requirement to an immigrant struggling to cope with the language and culture of a new host country. In the latter case, as Sykes (2018) discusses, the modalities of SLA will be quite different than they are in a university classroom. As a general rule, a consensus among SLA researchers is that the optimal situation for most learners (especially beginners) is a mix of formal and informal modalities, combining explicit and implicit learning (Dörnyei, 2013; Little & Thorne, 2017).

How technology is integrated into classroom instruction depends on the learning and learner contexts. Thorne and Reinhardt (2008) advocate the use of "bridging activities" in which students seek out resources of interest outside of class which are then integrated into class activities and course content. Sundqvist & Sylvén (2016) provide a number of examples of successful implementations of bridging activities. The optimal mix of formal and informal learning depends on many factors: the individual learner, the instructional setting, the available resources for the target language, and the instructional and curricular goals. More studies are needed that examine this dynamic in different

contexts, most profitably through narrative inquiry and qualitative studies (Benson, 2019). Case studies provide the most effective demonstration of how individual learners in different contexts have optimized language learning resources for their particular context and need. One of the more powerful mechanisms for combining informal language learning and instructed SLA is through the controversial position advocated in Godwin-Jones (2018c) that smartphone use be integrated into the language classroom: "Allowing mobile devices to be part of the classroom learning experience acknowledges the reality of today's integrated, complex L2 development environment" (Godwin-Jones, 2018a, p. 21). With the advent of multiple, wearable online devices, the dynamic of student Internet access in the classroom is likely to become even more complex.

While hybrid teaching formats would seem to offer an optimal integrative approach, a recent study indicated widespread student dislike of that format (Lomicka & Lord, 2019). The authors discovered, however, that the dislike was not based on interaction with online resources, but rather that the resources used—predominately publisher supplied electronic workbooks—were uninspiring, ineffective, and costly. An alternative is the use of OER, free "Open Educational Resources" which can range from mini-lessons to full online textbooks (Blyth, 2017). The uncertain provenance and quality of OER can be counteracted by the use of peer-reviewed collections such as Merlot or OER Commons (Hanley, 2015). Godwin-Jones (2018b) provides an example for immediate language instruction which combines instructor-created lessons, student curated resources, and integrated third-party OER. That project demonstrates one of the potential advantages of OER, namely to enable a more flexible sequencing and variety in course content than is the case with a textbook, thus allowing for some degree of individualization and student choice.

One of the benefits of integrating online resources into instructed SLA that has been increasingly recognized as signally important is the enhancement of cultural awareness and metalinguistic knowledge. In particular, interactions through virtual exchanges or affinity groups expose students to a much greater variety of pragmatic language use (requests, clarifications, apologies, etc.) than is the case in the typical classroom or language textbook. This kind of language use is culturally determined and is not rule-based and therefore best learned through actual experience using the language. At the same time, language pragmatics offers a valuable insight into the connection between culture and language, an important aspect of intercultural competence. Instructional SLA adds the possibility of explicitly integrating aspects of intercultural awareness into students' L2 learning, including consideration of their own social and economic situations in comparison to those of the target cultures (Siqueira, 2017). That can result in students understanding the symbolic capital associated with learning a new language, as well as their own socio-economic situation (Darvin & Norton, 2016; Hua & Kramsch, 2016). It is increasingly recognized in SLA research that intercultural awareness and understanding need to be part of SLA (O'Dowd, 2019). Some researchers have extended that to the need to recognize and act for social justice (Anwaruddin, 2019; Ortega, 2017; Warner & Dupuy, 2018).

From a social justice perspective, technology-mediated SLA offers a contradictory picture. On the one hand, online resources (social media, streaming video, MOOCs, OER), available for free over mobile devices, offer economically disadvantaged communities valuable opportunities for language learning that may not be available locally. Learning English in this way can be a valuable tool for socio-economic mobility. On the other hand, not all digital resources are free and Internet access itself may be unaffordable or unavailable. Work, family, or community obligations may impinge as well on time or space available for online activities. We should keep in mind as we anticipate new opportunities for SLA through developments such as 5G networks, extended reality technologies, or wearable devices, that these advances will not be universally available but rather accessible only to the privileged few. That applies to classroom integration as well, with many schools for financial, administrative, or curricular reasons not able to use up-to-date technologies. While the chapters of this book demonstrate the many ways in which technology can enhance SLA, for many language learners the most important factor in the learning process is likely to remain the teacher, the human

presence crucial for motivating and mentoring (Kramsch & Zhang, 2018). At the same time, as we have seen, a teacher's effectiveness can be considerably enhanced by the use of appropriate digital resources, as well as by encouraging and modeling technology integration into learners' second language development.

Further Reading

Godwin-Jones, R. (2018). Chasing the butterfly effect: Informal language learning online as a complex system. *Language Learning & Technology*, *22*(2), 8–27.
This study explores the recent trend of independent and informal language learning through online sources, viewing the phenomenon from the perspective of ecological perspectives in SLA.

Lomicka, L., & Lord, G. (2019). Reframing Technology's Role in Language Teaching: A Retrospective Report. *Annual Review of Applied Linguistics*, *39*, 8–23.
This article provides an informed account of the use of technology in language learning with an overview of the field of CALL (computer-assisted language learning)

Ortega, L. (2017). New CALL-SLA Research Interfaces for the 21st Century: Towards Equitable Multilingualism. *CALICO Journal*, *34*(3). 285–316.
The study by one of the foremost scholars in SLA theory discusses technology use from the perspective of current views of SLA with a special emphasis on multilingualism.

Warner, C., & Dupuy, B. (2018). Moving toward multiliteracies in foreign language teaching: Past and present perspectives… and beyond. *Foreign Language Annals*, *51*(1), 116–128.
This article discusses new contexts of language learning from the perspective of multiple literacies and the recent rise of social justice in SLA.

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