

THE ROUTLEDGE HANDBOOK OF SECOND LANGUAGE ACQUISITION AND TECHNOLOGY

Edited by Nicole Ziegler and Marta González-Lloret

First published 2022

ISBN: 978-0-815-36077-3 (hbk)

ISBN: 978-1-032-15031-4 (pbk)

ISBN: 978-1-351-11758-6 (ebk)

25

LEARNING ACROSS THE LIFESPAN

Age, Language Learning, and Technology

Pia Sundqvist

CC BY-NC 4.0

DOI: 10.4324/9781351117586-30

The funder for this chapter is SISCO

LEARNING ACROSS THE LIFESPAN

Age, Language Learning, and Technology

Pia Sundqvist

Introduction

On January 1, 2016, the 17 Sustainable Development Goals (SDGs) of the *2030 Agenda for Sustainable Development* officially came into force thanks to a resolution adopted by world leaders at a UN summit the year before. Amongst these goals, SDG four targets education and reads: “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” (UN, 2015, p. 14; see also UNESCO, 2019). This is truly an important goal, and as regards its mentioning of lifelong learning, this specific aspect of the goal is, in fact, *not* a new topic in the field of language learning. For example, already at the beginning of the 1980s, Holec (1981) proposed the idea of *learner autonomy*, a concept that basically refers to the teaching of L2s in ways that make students/learners equipped to take charge of their own learning. Presumably, teaching in line with learner autonomy would foster learner abilities and agency that make individuals’ language learning extend beyond the classroom and remain throughout life. Later, with the emergence of the Internet in the 1990s and rapid growth in the use of new technologies, the world saw a paradigm shift. This combination of (often) learner self-initiated and self-regulated language learning experiences and improved technology, accessible inside and outside educational settings, has influenced second language acquisition (SLA) research tremendously and influenced at what age language learning should begin. In addition, access to technology has made it easier for learners to maintain an interest in language learning later in life, even after retirement. It is worth noting that many of the *informal activities* commonly investigated in *out-of-school, extramural L_n* studies (i.e., any L2, Sundqvist, 2019) can be regarded as meaning-focused activities in which L2 learning is only a secondary goal. However, these activities are often instrumental to input comprehension or task performance, and frequently carried out in *the digital wilds* (Sauro & Zourou, 2019). Such research is highlighted in this chapter, which will present results from studies including learners of all ages, making age another important variable addressed in the chapter.

The next section offers historical perspectives on age in L2 learning, and then critical issues and topics are addressed, such as the question about when formal L2 instruction should begin. Current important contributions on age, L2 learning, and technology ensue, followed by a brief account of the use of technology as part of the research methodology employed in this line of research. Towards the end, recommendations for practice and suggestions for future research are provided.

Historical Perspectives

The Critical Period Hypothesis

A central theoretical contribution to the discussion of age in language learning, the *Critical Period Hypothesis* (CPH), was proposed in the 1960s by Lenneberg (1964, 1967). However, the CPH has remained controversial in the field and has continued to stir debate (see, e.g., DeKeyser, 2013; Muñoz & Singleton, 2011; Singleton, 2018). Suggested in the CPH is that all human beings are born with a biological capacity for learning language, and this period supposedly ends around the age of 12; however, it ought to be mentioned that many different suggestions have been proposed for the offset of this critical, or sensitive, period (see, e.g., Singleton, 2018). From a scientific point of view, an obvious problem with the CPH is that it cannot be tested, because we simply cannot let children grow up and wait until they are 12 years old before we speak to them for the purpose of finding out whether they, at that point, would be able (or unable) to develop language, as such experiments would be highly unethical. At times, however, so-called feral children have been referred to as evidence of the CPH in that they have been unable to acquire “normal” language skills after puberty, as with the well-known case of Victor of Aveyron, who was found in the late 18th century in France (Ingalls, 1978; Simpson, 2007), and the more modern case of Genie (Curtiss, 1977), a language-deprived child rescued by social workers from isolation and severe child abuse in a Californian home in 1970. Both these cases relate to L1, but the CPH has also been used to explain why learning an L2 may be more difficult with age (see section The introduction of formal L2 instruction—the younger, the better?).

In current research, there seems to be a tendency to prefer to talk about “optimal periods or sensitive periods” for learning languages, and to stay away from “absolutism” (Singleton, 2018, p. 20). In addition, there is evidence from cognitive science that the brain stays plastic beyond puberty and throughout life, which speaks against the CPH (Singleton, 2018). In a recent article, DeKeyser (2020, p. 81) argues for a more nuanced picture, emphasizing that “[i]nput, age, aptitude and structure all interact in complex ways that are slowly leading us toward a much richer understanding of language learning processes.” In sum, it is fair to say that the CPH remains a debatable topic in the field of SLA.

Age of Onset

The term *Age of Onset* (AoO) refers to a learner’s age when s/he is beginning to learn, or acquire, an L2 (Abrahamsson & Hyltenstam, 2009); *Age of Arrival* and *Age of Acquisition* (both AoA), are also used (see, e.g., Abrahamsson & Hyltenstam, 2009; DeKeyser, 2013). In a critical review article of age-related research on L2 ultimate attainment, Muñoz and Singleton (2011) found that AoO is typically viewed as “the crucial variable” and that “other linguistic and contextual variables” often are “insufficiently taken into account” (p. 2). Such contextual variables could be learners’ engagement in extramural language use or their access to technology in L2 learning (see section Current contributions: Technology and L2 learning). Further, the authors found other prominent issues related to age discussed in recent SLA literature to include, for example, the use of native-like performance as the norm/yardstick in assessing L2 attainment, the CPH, and the suggestion that different areas of the brain may be used in late language acquisition compared to in early acquisition (Muñoz & Singleton, 2011).

With regard to the latter issue of late/early acquisition (also talked about as *maturation*), research centering on early L2 learning has shown a rate advantage for late starters over early starters. According to Krashen et al. (1979), this would specifically be the case for morpho-syntactic acquisition. In sum, “older-is-better” for rate of acquisition, but in terms of ultimate attainment, “younger-is-better in the long run” (Krashen et al., 1979, p. 574). Thus, it is important to distinguish between

rate of acquisition and ultimate development. The rate advantage was observed in two studies from Spain (García Mayo & García Lecumberri, 2003; Muñoz, 2006) in limited-input language classroom settings, who found that explicit learning mechanisms are important in L2 classrooms and such a circumstance, then, gives older children an advantage over those who are younger.

In relation to AoO, Schmidt's (1983) seminal case study of an adult L2 English learner (Wes) brought to light the idea that in regards to implicit learning (without explicit attention to form), it remains to be seen whether "any mature adult can actually *acquire* impressive control of the grammar of a second language" (p. 170, italics in the original). Since Schmidt (1983), numerous studies have been carried out with the purpose of finding answers to the central question about AoO (for a review, see, e.g., Muñoz, 2006). In a way, Wes was a predecessor of many (often younger) L2 learners observed in studies three decades later.

Consensus about AoO is yet to be reached, and the role of age in L2 learning remains a controversial topic in the field. Considering this lack of consensus, it is thus difficult, for example, to recommend a certain starting age for formal L2 instruction in school, or what would be "an optimal age" for language learning in general for that matter. In contrast, there is strong agreement among scholars that a great deal of not only *formal* learning, but also *informal* and *incidental* language learning is taking place thanks to technology and the emergence of the Internet—a topic to which we turn next.

Technological Advancements: A Paradigm Shift for L2 Teaching and Learning

As pointed out by Thorne (2008, p. 307), the Internet is "less a technological fact than a social fact," and Internet-mediated communication is not a practice environment, "but is itself the real thing—the medium through which we perform social and professional roles and through which we engage in interpersonal and informational activity." In other words, current technology makes it possible to engage with others in online activities that may promote, among other things, language learning. This exemplifies L2 learning through extramural engagement, where learners simply utilize the L2 as part of their interaction with L2 (most often English) input, and they happen to learn it as a side-effect (i.e., incidental learning). From a language learning perspective, it is also beneficial that users can create their own content in participatory virtual communities—recently referred to as L2 learning in the *digital wilds* (Sauro & Zourou, 2019). Such advanced technology has undoubtedly influenced both informal, self-initiated L2 learning and formal L2 instruction.

Returning to the concept of learner autonomy, this tends to be linked to self-regulated L2 learning (Lai, 2019) (for a more thorough discussion on autonomy and technology, see Chapter 27 in this volume). In fact, a whole new area of L2 learning research opened up as a result of post-millennium technological developments, and it started with English as a target language for two reasons: (i) the status of English in the world, and (ii) the dominance of English on the internet (Graddol, 2006). At present, several terms are used to describe this type of (typically incidental) L2 learning that takes place informally outside of educational institutions, often (but not always) online, generally voluntarily, and on the learner's own initiative. As an umbrella term, *engagement in extramural English* is used (Sundqvist & Sylvén, 2016), or simply *extramural Ln*, indicating any L2 (Sundqvist, 2019). Technology has played a pivotal role in this still emerging area of research, and so has age, as young people in particular—but also older learners—have found new paths to acquiring languages informally in this way, outside of traditional schooling.

Critical Issues and Topics

As should be clear from the previous section, the role of age in L2 learning has received a considerable amount of scholarly attention. In contrast, research that targets both age and technology in L2 learning is less comprehensive. While research on CALL has been around since at least the

1980s (Hubbard, 2008), it was probably not until educational institutions worldwide more or less overnight were forced to start teaching online due to the spread of COVID-19 that the vast majority of teachers realized the inherent potential of technology for all kinds of school subjects and academic disciplines. Technology-mediated L2 learning for students at different ages and levels was no exception in this regard.

Defining Young and Old Learners

In the SLA literature, whenever the age variable is discussed, a majority of studies seem to include participants who are adults, often focusing on immigrants who learn the L2 in natural settings. Conversely, studies targeting young learners are much fewer in comparison—regardless of setting, inside or outside school (cf. Nikolov & Mihaljević Djigunović, 2006). In studies targeting adults, AoA constitutes a frequently examined variable, and it is of course highly relevant in such research on immigrants' language learning. In studies involving young participants, the age variable tends to be connected with questions about what would be an optimal age to start learning an L2 (e.g., Mihaljević Djigunović & Vilke, 2000) and/or when to introduce formal L2 instruction. When researching technology, the age of young L2 learners can also be relevant (see, e.g., Sundqvist & Sylvén, 2016).

Considering how frequently the term *age* has been used in SLA research and how it might cause confusion, the lack of a well-established definition of young learners is surprising. One way is to define young learners as those under the age of 18, which would correspond to the legal definition of a child in the *Convention on the Rights of the Child* (The United Nations, 1990). However, with a growing number of children and adolescents across the globe learning languages incidentally and extramurally, legal definitions may be unsuitable (and outdated) for building SLA knowledge, which can be compared with Ellis (2013, p. 75) who suggests we use terms and age spans in accordance with many educational systems: *Early years/pre-primary* (aged 2–5); *Primary* (aged 6–10/11); *Lower secondary* (aged 11–14); and *Upper secondary* (aged 15–17) *learners*. These definitions may still cause problems, though, especially in comparative studies, as educational systems differ across borders. It is then essential to provide details about the L2 curricula, such as including information about when (and at what age) formal instruction begins and the length of instruction (number of hours).

As for defining old learners, no distinction tends to be made between *adult* and *senior* learning in scholarly literature. Interestingly, the latter “has hardly ever been researched in any systematic way” (Gabryś-Barker, 2018, p. xvi). But, how do we define old learners then? Based solely on age, one suggestion would be to apply Ellis' terminology up until around the age of 20, and then use three age spans, *young adult learners* (aged 20–29), *adult learners* (aged 30–59), and *older* (or possibly *senior*) *adult learners* (60 and older). The division at age 60 for “older” would be in line with the United Nations' general threshold for older age (see Cox, 2017); another option could be to make this “older” division at age 65, which would be in line with the age of retirement in many countries and cultures (see Mackey & Sachs, 2012).

The Introduction of Formal L2 Instruction—the Younger, the Better?

Despite the fact that there is relatively little empirical evidence showing that early implementation is beneficial for L2 learners in the long run (Muñoz & Singleton, 2011; Nikolov, 2013), policy makers seem to be keen on offering L2 instruction (at least of English) early. Early implementation is, therefore, a frequently occurring phenomenon, even though many primary school teachers may lack the appropriate L2 teacher training, and sometimes also adequate L2 skills (DeKeyser, 2012; Nikolov, 2013; Nikolov & Mihaljević Djigunović, 2006). Finally, considering the focus of this handbook and this specific chapter and section, it is worth mentioning that the issue of an optimal

age for formal instruction is rarely examined from a CALL or technology-mediated perspective. That this is the case is not very surprising, however, because in terms of research orientation, L2 researchers interested in teaching and learning tend to “approach a research problem from the perspective of pedagogy, if its answer is to inform instruction and curriculum, or from the perspective of the learner or learning, if it is to inform understandings of SLA more directly” (Reinhardt, 2017, p. 211).

Possible Problems Related to the Use of Technology in Learning

It is worth acknowledging that the use of technology is not entirely without its problems. Aside from pure technological issues (e.g., slow internet connections, hardware breakdowns etc.), teachers should pay attention to when learners signal technologically induced problems that may potentially hinder L2 development (or worse, cause health problems) (Alexander, 2019). For example, teachers may observe behavior bordering on addiction amongst their students, such as when a student just cannot turn off his or her phone due to fear of missing out (FOMO), or falls asleep during a lesson, possibly sleep-deprived due to binge watching or gaming (Exelmans & Van den Bulck, 2017). In such cases, it is necessary to intervene in order to prevent learners from developing possibly harmful habits, even though the main responsibility for such problems should be with the individual (if an adult) or the guardian (if a minor).

A very serious problem relating to technology in L2 learning is the *digital divide*. As pointed out by Ortega (2017, p. 300), technology can be “both a source of empowerment and an instrument for inequality at the individual and societal levels.” In essence, Ortega explains how the digital divide has to do with access to technology (*the first order divide*) and the use of technology (*the second order divide*). Further, she describes how empirical research has revealed that this divide keeps on getting deeper, worldwide as well as domestically, and that it has to do with, for example, unequal broadband speed and whether it is possible to use the internet consistently from the home. To aid L2 teaching and learning and address this problem, González-Lloret (2014) stresses the necessity of conducting a needs analysis of learner needs relating *both* to language learning *and* to digital literacy. In the next section, we take a closer look at recent L2 studies that involve technology focusing on the role of age.

Current Contributions: Technology and L2 Learning

Giving a full overview of the research is unfeasible and beyond the scope of this chapter, leaving the account limited to studies published in the last decade (i.e., 2009–2019) that can be characterized as learning from engagement in extramural L_n , in particular gaming, or as involving variables that mirror typical extramural activities (e.g., watching television). Still, many studies had to be left out (for a scoping review of L2 learning in online gaming, see Jabbari and Eslami, 2018; for an overview of extramural studies, see Chapter 5, Sundqvist & Sylvén, 2016). The studies reported on are briefly presented in the order of the age of the participants, under headings based on Ellis’ (2013) suggested age spans for young learners, with a final section on adult learners.

Primary School Level Learner Participants (6–10/11 Years Old)

Studies within this group underscore the important role involvement in extramural L_n activities plays for learning already at a very young age. As shown by Hannibal Jensen (2017, 2019) in studies from Denmark, most of the time using the L2 was employed gaming, which was significantly related to vocabulary scores, especially for boys. Although according to Lindgren and Muñoz (2013), watching films with subtitles can be a better predictor of reading and listening proficiency than gaming and listening to songs. It seems that the affordances of subtitled films would override

the affordances of songs and games, in line with results by Kuppens (2010) and Puimège and Peters (2019) in Flanders. These studies show that in different contexts, children already know English prior to receiving any English lessons in school, which raises particularly interesting questions not only about when to start formal English instruction in school, but also about what approaches to teaching English primary school teachers may adopt in light of the findings. Clearly, the situation described by research in Denmark and Flanders opens up many possibilities for teachers to build on individual learners' already existing English (and technological) competencies and interests from day one of formal English instruction.

Lower Secondary Level Learner Participants (11–14 Years Old)

In a case study from Saudi Arabia, Al-Nofaie (2018) reports how two learners, Sarah and Omar, were engaged in extramural Japanese, mainly through anime and digital games. They were highly motivated and had learned words and phrases on their own, thanks to access to digital media, not least through television (Arabic television broadcast Japanese anime in Japanese) and their own iPads (used both for anime and games). There was development over time when it came to what they used digital media for. Omar, for example, joined a Facebook group for learning Japanese. Although they did not learn many words, they continued to learn new words over a period of four months. This demonstrates the potential for digital media in L2 learning.

Access to digital media was also important in two studies from Sweden. The first, which focused on extramural gameplay, involved 86 learners and found that frequency of gaming correlated positively with L2 English vocabulary, reading comprehension, and listening comprehension (Sylvén & Sundqvist, 2012a). The second study revealed that the participating boys spent significantly more time on extramural English activities than the girls, to a large extent due to the boys' gaming habits (Sundqvist & Sylvén, 2014). Overall, participants' self-assessed English ability was high ($N = 76$). These studies demonstrate interesting gender differences, and how young learners who have access to the internet expand their opportunities for both intentional and incidental L2 learning based on their personal interests.

Upper Secondary Level Learner Participants (15–17 Years Old)

Studies of learners at this age also show the advantages of extramural activities. In studies from Norway, using secondary data from national readings tests in Norwegian and English, Brevik (2016) and Brevik and Hellekjær (2018) identified learners who were good readers in L2 English but poor readers in their L1—an unusual combination. In-depth interviews revealed that online gaming in English had contributed greatly to their L2 English reading proficiency (Brevik, 2016).

In Sweden, Sundqvist (2009) found positive correlations between extramural English and (i) vocabulary and (ii) oral proficiency. In a follow-up study, Sundqvist and Wikström (2015) compared the results for non-gamers, moderate gamers, and frequent gamers in terms of advanced vocabulary use in essays and scores on vocabulary tests. In essays, frequent gamers used the most advanced vocabulary, followed by non-gamers and moderate gamers. On the tests, however, there was a *linear* relationship between gaming and L2 vocabulary, with frequent gamers (all boys) scoring the highest, followed by moderate gamers, and non-gamers. Moreover, in a recent large-scale study (two samples, total $N = 1,081$), Sundqvist (2019) established a positive correlation between time spent on playing commercial off-the-shelf games and L2 English vocabulary test scores, and that “time played” was related to “types of game played.” However, the effect from the type of game the participants preferred to play (categorized as *single player*, *multiplayer*, or *massively multiplayer online games*) disappeared when entered into the model used, while time remained statistically significant. This study also revealed that gamers had more advanced productive vocabulary than non-gamers.

There are also a number of studies from Belgium (Flanders) that show a positive relation between L2 vocabulary and extramural English (specifically with TV programs/movies without subtitles, the internet, and written print), and which suggest that extramural English has a larger effect of on L2 vocabulary than length of instruction has (e.g., Peters, 2018). Furthermore, while gender seems to influence online activities in English, it does not directly affect vocabulary knowledge (Peters et al., 2019).

A recent study from Taiwan, where English is taught from the first grade as a foreign language, examined the effects of in- and out-of-school input on bilingual Mandarin–English teenagers' English listening comprehension and speech production skills ($N = 97$, aged 16–17) (Huang et al., 2020). The starting ages (AoO) ranged from 2 to 11 years among the participants. The results indicated that out-of-school contact with English seemed more important for the learning outcomes than input from formal instruction, and “current input outweighed early input for long-term L2 outcomes” (Huang et al., 2020, p. 22).

Without a doubt, all these studies demonstrate that extramural English, and specifically gaming, is closely connected with several aspects of L2 proficiency. Different theories have been proposed to explain what it is about gaming that supports L2 learning. For instance, time on task is always important for learning and one obvious and important explanation for why gamers who play using their L2 often score high or stand out in different L2 studies (Sylvén & Sundqvist, 2012b). However, there are many more aspects of gaming that contribute to L2 learning—not least the actual gaming environment. This is (often) set up to encourage active and critical learning and where learners/gamers dare take risks (such as, dare speaking and writing in the L2), since any real-world consequences are low (see Gee, 2007, which provides a useful summary of underlying learning principles connected with gaming).

Adult Learners

As shown, several studies connected to extramural L2 learning and/or technology have been carried out in Europe among young learners. There are also similar studies involving young adult learners (commonly university students, see, e.g., Cox, 2019) and adult learners, but much fewer involving older adult learners. Giving a full overview of research that involves learners aged 20 and beyond is unfeasible, but two recently published studies from South Korea and Indonesia by Lee and colleagues (Lee & Drajadi, 2020; Lee & Dressman, 2018) may serve as examples of extramural L2 learning and technology research for young adult and adult learners. Both studies have a focus on informal digital learning of English (IDLE). In the study from South Korea, results revealed that the more varied IDLE activities the participating university students (aged 19–27) were involved in, the more fluent they were, the better they scored on productive vocabulary knowledge, and the more willing they were to communicate in English online (Lee & Dressman, 2018). In the study from Indonesia, university students (aged 18–36) were found willing to chat with native English speakers on social media sites, such as Facebook, so again there was a link between IDLE and willingness to communicate (even though this study also reports that the students were more hesitant to speak English when in a group of strangers) (Lee & Drajadi, 2020). Both studies show that learners' use of technology in informal contexts can be fertile ground for enhancing willingness to communicate in the L2.

Literature on L2 learning and technology involving older adult learners is much more scant. One of the first studies to focus on this heterogeneous population of L2 learners is Mackey and Sachs (2012). Their study involved nine native speakers of Spanish who were learning L2 English (age 65–89) and had a focus on interaction and working memory, but not on technology. Still, it brought the attention to an under-researched area of SLA. A study that filled this gap in research was published five years later. Cox (2017) investigated 46 old learners (age 60+) who were monolingual English or bilingual English/Spanish speakers (who had learned the L2 late, at least ten years prior to participating in the study) in order to find out how successful they were in learning basic

Latin morphosyntax using a computer program, with or without explicit instruction (EI). Thus, the study took an interest in the effects of ageing on L2 learning and the possible roles of bilingualism and EI, respectively, and incorporated technology. She found that there were no overall effects of explicit instruction, “although bilinguals with EI had advantages when transferring skills” and also “outperformed monolinguals on interpretation regardless of instruction” (p. 29). She concludes that contrary to common beliefs, older learners are “able to adjust processing strategies from their known language(s) to those of a novel language,” indicating that ageing not necessarily has to be linked to inflexibility, and that in L2 learning, bilingual advantages continue throughout life (Cox, 2017, p. 54). In a study from Japan, Murray (2011) reports from research carried out among adult older learners (retirees) who were members of a self-access center. At this center, no formal L2 English instruction was provided. Instead, the members who wanted to learn English were carefully guided towards individual goals, and learning materials included, for example, computer software, films/DVDs, television programs, and print with audio recordings. In essence, the cases described in Murray’s study illustrate how adult older learners can learn from involvement in extramural English activities, many of which were digital. The same phenomenon of an adult older learner learning through self-initiated, voluntary extramural English digital activities is currently observed in Sundqvist (in preparation), but in a different context, that is, in Sweden, and mainly in the learner’s own home.

Altogether, there is ample evidence of autonomous L2 learning thanks to technology amongst learners of all ages—across the lifespan.

Use of Technology as Part of Research Methodology

SLA has a long tradition of experiments in language labs. However, with the social turn, a demand for more ecologically valid studies emerged and many of the studies reported above are indeed examples of such studies. In extramural and gaming studies, most employ traditional methods of collecting data (such as tests, questionnaires, and interviews), but some studies are innovative and incorporate human-human interaction into the design. Hannibal Jensen (2019), for example, employed descriptive ethnographic interviews (Spradley, 1979) in which the young participants “took the interviewer on a guided tour through the English-mediated activities they engaged in on a regular basis *by engaging in the activities while being interviewed*” (p. 77; my emphasis). Further, the need to capture both frequencies related to and the time spent on various types of extramural *Ln* activities (or types of games played, in gaming studies) have led to the use of language diaries (both pen-and-paper and digital) as a complement to more traditional questionnaires and/or interviews (see, e.g., Hannibal Jensen, 2017; Olsson & Sylvén, 2015; Sundqvist, 2009; Sundqvist & Sylvén, 2014; Sylvén & Sundqvist, 2012a). It appears that incidental L2 learning outside school has forced CALL researchers not only to consider new data types, but also new instruments and methods of analysis.

In addition, as regards age, for the purpose of validity, it is crucial to take cognitive maturity into consideration when designing which instruments to use with young research participants and what procedures to use when administering tests. For example, to familiarize children with how a language diary should be filled out, Hannibal Jensen (2017) used a large colorful laminated sample diary page in the classroom and the young participants were given the opportunity to provide personal examples of extramural activities, which were then added to the sample page. With regard to tests, it is necessary to consider whether to administer these individually or in groups (Puimège & Peters, 2019). Likewise, in studies targeting adult old learners, it will also be essential to consider appropriate research procedures and instruments to cater for, for instance, the natural slowing down of processing that is connected with ageing (Singleton, 2018). Finally, while quantitative analysis used to be the dominant approach in SLA, the field has opened up and today multiple methods are employed, as shown in the studies reported on here.

Recommendations for Practice

Based on research addressed in this chapter, it is possible to offer recommendations for practice. Indeed, it has been claimed (and rightly so) that the transfer of acquired skills “between formal and informal contexts is essential,” and that teachers should receive training in supporting such skills in “technology-mediated teaching contexts” (Heift et al., 2019, p. 2). As suggested, an important first step for practice would be to conduct systematic mapping of learners’ extramural L_n habits with the help of logs, language diaries, questionnaires, interviews, and more (see Sundqvist & Sylvén, 2016, for suggestions). Moreover, teachers should encourage learners to explore the target language outside of school, and preferably also demonstrate how this can be done (Peters et al., 2019). An example of a successful way of such exploration is the “30-Day Extramural English Challenge” (which can be adapted to any target language). The basic idea of the challenge is to have learners try out one new extramural activity a day for 30 consecutive days; the idea originates from an English teacher in Sweden (see Sundqvist & Sylvén, 2016).

Other recommendations for practice are to let learners choose texts relevant to themselves (e.g., from digital discourse) and bring them to class for in-depth analysis and for raising learners’ language awareness (“Bridging Activities,” Thorne & Reinhardt, 2008). Sykes (2019) proposes similar ideas, and offers tips on how hashtags and digital games can be used to expand learners’ L2 repertoire. Drawing on her own and Reinhardt’s (Reinhardt & Sykes, 2012) three-pronged approach to investigating games, she adds a fourth element and argues that the following four contexts of digital discourse warrant further attention: interaction *with*, *through*, *around*, and *about* games. She suggests that learners’ ability to critically examine discourses in digital games has a role to play in the L2 classroom and compares interaction *with* digital games to analyzing a novel, a film, or a short story. Other examples of research that can be applied directly to the classroom would be to analyze player interactions in multiplayer games in order to uncover distinct discourse patterns and the lexicon used (Sundqvist & Sylvén, 2019; Thorne, 2008), to examine discourses in game strategy discussion forums (Ryu, 2013), or to enhance learners’ understanding of the real-world consequence of gaming by engaging them in discussions about the societal impact of digital games (Sykes, 2019). Sykes (2019) concludes wisely by saying “it is essential to understand the ways in which learners can develop the language skills needed to find their own digital voice” (p. 143).

Future Directions

For L2 English instruction specifically, in societies where the presence of English is universal and many learners develop their L2 skills incidentally from an early age (see, e.g., Hannibal Jensen, 2017, 2019; Puimège & Peters, 2019), the specific question about starting age raises additional questions, such as what approach(es) to teaching to adopt in the classroom. Here, action research projects involving primary and secondary school L2 learners, where researchers collaborate with school teachers, would be highly valuable. There is also a need for classroom-based studies (all ages) in which teaching and learning practices are examined more closely. Focus could be on the use of information and communication technology, to what extent and how “bridging activities” are used (for example, how students’ extramural L2 experiences are utilized by teachers in instruction and teaching materials), and teachers’ and students’ language use in the classroom (for instance, target language use versus L1 use).

In light of the positive findings from gaming studies, it would be relevant to investigate what gamification of L2 classrooms (for example, by using Kahoot systematically) may yield in terms of learning outcomes. A systematic review of gamification in learning L2 English (including 22 studies published since 2014) concludes that future research should examine gamification under more stringent conditions, stressing the importance of the experimental design (Dehghanzadeh et al., 2019). Among other things, the authors suggest the use of a control group and longer duration

of the gamified tasks in question and recommend large sample sizes. Related to the technology-induced problems discussed earlier (such as sleep deprivation), it is possible that research on the negative effects of technology should be done in parallel with, for example, research on engagement in extramural *L_n*.

As regards extramural *L_n*, English is by far the most commonly examined target language, with Al-Nofaie's (2018) work on extramural Japanese in a Saudi context as a welcome exception. Extramural *L_n* studies are needed to reveal more about learner motivation and agency, and about links between extramural engagement and L2 proficiency (all ages). Further, more studies directed at making comparisons across countries with differing opportunities for engagement in extramural *L_n* are particularly welcome, preferably if starting ages and/or hours of formal instruction can be included as variables. With a robust design, such studies could reveal the relative importance of each variable for L2 learning, in each national setting. If some of these suggestions for future research are realized, they are likely to contribute to lifelong learning for the L2 learners involved.

Further Reading

Benson, P., & Reinders, H. (Eds.). (2011). *Beyond the Language Classroom*. Palgrave Macmillan. This edited volume focuses on L2 learning beyond the classroom and includes a collection of data-based case studies from across the world as well as advice on how teaching materials can be created for the purpose of independent language learning in out-of-school contexts.

Nikolov, M. (Ed.). (2009). *Early learning of modern foreign languages: Processes and outcomes*. Multilingual Matters. This edited volume has a focus on researching young language learners and includes a range of target languages and a great variety of research methods.

Reinders, H. (Ed.). (2012). *Digital games in language learning and teaching*. Palgrave Macmillan. In this edited volume, which includes theoretical, empirical, and practice-oriented chapters, the potential of digital gameplay is examined from a second-language learning and teaching perspective.

Sundqvist, P., & Sylvé, L. K. (2016). *Extramural english in teaching and learning: From theory and research to practice*. Palgrave Macmillan. Connecting practice to theory and research, this book centers on the vast potential of extramural English in L2 English teaching and learning in an increasingly globalized world.

References

- Abrahamsson, N., & Hyltenstam, K. (2009). Age of Onset and nativelikeness in a second language: Listener perception versus linguistic scrutiny. *Language Learning*, 59(2), 249–306. <https://doi.org/10.1111/j.1467-9922.2009.00507.x>
- Al-Nofaie, H. (2018). The attitudes and motivation of children towards learning rarely spoken foreign languages: a case study from Saudi Arabia. *International Journal of Bilingual Education and Bilingualism*, 21(4), 451–464. <https://doi.org/10.1080/13670050.2016.1184612>
- Alexander, P. (2019). Redefining literacy for all in the 21st century: The nexus of text, critical thinking, and technology. *The Helga Eng Lecture*. Retrieved from www.uv.uio.no/forskning/om/helga-eng-forelesning/patriciaalexander_sammendrag.html
- Brevik, L. M. (2016). The gaming outliers: Does out-of-school gaming improve boys' reading skills in English as a second language? In E. Elstad (Ed.), *Educational technology and polycontextual bridging* (pp. 39–61). Sense Publishers.
- Brevik, L. M., & Hellekjær, G. O. (2018). Outliers: Upper secondary school students who read better in the L2 than in L1. *International Journal of Educational Research*, 89, 80–91. <https://doi.org/10.1016/j.ijer.2017.10.001>
- Cox, J. G. (2017). Explicit instruction, bilingualism, and the older adult learner. *Studies in Second Language Acquisition*, 39(1), 29–58. <https://doi.org/10.1017/S0272263115000364>
- Cox, J. G. (2019). Multilingualism in older age: A research agenda from the cognitive perspective. *Language Teaching*, 52(3), 360–373. <https://doi.org/10.1017/S0261444819000193>

- Curtiss, S. (1977). *Genie: a psycholinguistic study of a modern-day "wild child"*. Academic Press.
- Dehghanzadeh, H., Fardanesh, H., Hatami, J., Talae, E., & Noroozi, O. (2019). Using gamification to support learning English as a second language: a systematic review (Early Access). *Computer Assisted Language Learning*. <https://doi.org/10.1080/09588221.2019.1648298>
- DeKeyser, R. M. (2012). Age effects in second language learning. In S. Gass & A. Mackey (Eds.), *The Routledge handbook of second language acquisition* (pp. 442–460). Routledge.
- DeKeyser, R. M. (2013). Age effects in second language learning: stepping stones toward better understanding. *Language Learning*, 63(1), 52–67. <https://doi.org/10.1111/j.1467-9922.2012.00737.x>
- DeKeyser, R. M. (2020). Input is not a panacea. *International Journal of Bilingualism*, 24(1), 79–81. <https://doi.org/10.1177/1367006918768371>
- Ellis, G. (2013). ‘Young learners’: clarifying our terms. *ELT Journal*, 65(1), 75–78. <https://doi.org/10.1093/elt/cct062>
- Exelmans, L., & Van den Bulck, J. (2017). Binge viewing, sleep, and the role of pre-Sleep Arousal. *Journal of Clinical Sleep Medicine*, 13(8), 1001–1008. <https://doi.org/10.5664/jcs.m.6704>
- Gabryś-Barker, D. (2018). Introduction: The background. In D. Gabryś-Barker (Ed.), *Third age learners of foreign languages* (pp. xiii–xxvii). Multilingual Matters.
- García Mayo, M. d. P., & García Lecumberri, M. L. (Eds.). (2003). *Age and the acquisition of English as a foreign language*. Multilingual Matters.
- Gee, J. P. (2007). *What video games have to teach us about learning and literacy. Revised and updated edition*. Palgrave Macmillan.
- González-Lloret, M. (2014). The need for needs analysis in technology-mediated TBLT. In M. González-Lloret & L. Ortega (Eds.), *Technology-mediated TBLT: Researching technology and tasks* (pp. 23–50). John Benjamins.
- Graddol, D. (2006). *English next*. British Council.
- Hannibal Jensen, S. (2017). Gaming as an English language learning resource among young children in Denmark. *CALICO Journal*, 34(1), 1–19. <https://doi.org/10.1558/cj.29519>
- Hannibal Jensen, S. (2019). Language learning in the wild: A young user perspective. *Language Learning & Technology*, 23(1), 72–86. <https://doi.org/10.125/44673>
- Heift, T., Mackey, A., & Smith, B. (2019). History, pedagogy, data and new directions: An introduction to the educational technology issue. *Annual Review of Applied Linguistics*, 39, 1–7. <https://doi.org/10.1017/S026719051900014X>
- Holec, H. (1981). *Autonomy and foreign language learning*. Pergamon.
- Huang, B. H., Chang, Y.-H. S., Zhi, M., & Niu, L. (2020). The effect of input on bilingual adolescents’ long-term language outcomes in a foreign language instruction context. *International Journal of Bilingualism*, 24(1), 8–25. <https://doi.org/10.1177/1367006918768311>
- Hubbard, P. (2008). Twenty-five years of theory in the CALICO Journal. *CALICO Journal*, 25(3), 387–399. <https://doi.org/10.1558/cj.v25i3.387-399>
- Ingalls, R. P. (1978). *Mental retardation: the changing outlook*. Wiley.
- Jabbari, N., & Eslami, Z. R. (2018). Second language learning in the context of massively multiplayer online games: A scoping review. *ReCALL*, 1–22. <https://doi.org/10.1017/S0958344018000058>
- Krashen, S. D., Long, M. H., & Scarcella, R. C. (1979). Age, rate, and eventual attainment in second language acquisition. *TESOL Quarterly*, 13(4), 573–582.
- Kuppens, A. H. (2010). Incidental foreign language acquisition from media exposure. *Learning, Media and Technology*, 35(1), 65–85.
- Lai, C. (2019). Technology and learner autonomy: An argument in favor of the nexus of formal and informal language learning. *Annual Review of Applied Linguistics*, 39, 52–58. <https://doi.org/10.1017/S0267190519000035>
- Lee, J. S., & Draijati, N. A. (2020). Willingness to communicate in digital and non-digital EFL contexts: Scale development and psychometric testing. *Computer Assisted Language Learning*, 33(7), 688–707. <https://doi.org/10.1080/09588221.2019.1588330>
- Lee, J. S., & Dressman, M. (2018). When IDLE hands make an English workshop: Informal digital learning of English and language proficiency. *TESOL Quarterly*, 52(2), 435–445. <https://doi.org/10.1002/tesq.422>
- Lenneberg, E. H. (1964). The capacity for language acquisition. In J. A. Fodor & J. J. Katz (Eds.), *The structure of language: Readings in the philosophy of language* (pp. 579–603). Prentice-Hall.
- Lenneberg, E. H. (1967). *Biological foundations of language*. Wiley.
- Lindgren, E., & Muñoz, C. (2013). The influence of exposure, parents, and linguistic distance on young European learners’ foreign language comprehension. *International Journal of Multilingualism*, 10(1), 105–129. <https://doi.org/10.1080/14790718.2012.679275>
- Mackey, A., & Sachs, R. (2012). Older learners in SLA research: A first look at working memory, feedback, and L2 development. *Language Learning*, 62(3), 704–740. <https://doi.org/10.1111/j.1467-9922.2011.00649.x>

- Mihaljević Djigunović, J., & Vilke, M. (2000). Eight years after: Wishful thinking vs. the facts of life. In J. Moon & M. Nikolov (Eds.), *Research into teaching English to young learners* (pp. 67–86). University Press Pécs.
- Muñoz, C. (Ed.). (2006). *Age and the rate of foreign language learning*. Multilingual Matters.
- Muñoz, C., & Singleton, D. (2011). A critical review of age-related research on L2 ultimate attainment. *Language Teaching*, 44(1), 1–35. <https://doi.org/10.1017/S0261444810000327>
- Murray, G. (2011). Older language learners, social learning spaces and community. In P. Benson & H. Reinders (Eds.), *Beyond the language classroom* (pp. 132–145). Palgrave Macmillan.
- Nikolov, M. (2013). *Early foreign language learning: is it child's play?* Paper presented at the 23rd European Second Language Association conference, EUROSLA 23. The Netherlands.
- Nikolov, M., & Mihaljević Djigunović, J. (2006). Recent research on age, second language acquisition, and early foreign language learning. *Annual Review of Applied Linguistics*, 26, 234–260. <https://doi.org/10.1017/S0267190506000122>
- Olsson, E., & Sylvé, L. K. (2015). Extramural English and academic vocabulary. A longitudinal study of CLIL and non-CLIL students in Sweden. *Apples – Journal of Applied Language Studies*, 9(2), 77–103. <http://dx.doi.org/10.17011/apples/urn.201512234129>
- Ortega, L. (2017). New CALL-SLA research interfaces for the 21st century: Towards equitable multilingualism. *CALICO Journal*, 34(3), 285–316. <https://doi.org/10.1558/cj.33855>
- Peters, E. (2018). The effect of out-of-class exposure to English language media on learners' vocabulary knowledge. *ITL – International Journal of Applied Linguistics*, 169(1), 142–167. <https://doi.org/10.1075/itl.00010.pet>
- Peters, E., Noreillie, A.-S., Heylen, K., Bulté, B., & Desmet, P. (2019). The impact of instruction and out-of-school exposure to foreign language input on learners' vocabulary knowledge in two languages. *Language Learning*, 69(3), 747–782. <https://doi.org/10.1111/lang.12351>
- Puimège, E., & Peters, E. (2019). Learners' English vocabulary knowledge prior to formal instruction: The role of learner-related and word-related factors. *Language Learning*, 69(4), 943–977. <https://doi.org/10.1111/lang.12364>
- Reinhardt, J. (2017). Digital gaming in L2 teaching and learning. In C. A. Chapelle & S. Sauro (Eds.), *The handbook of technology in second language teaching and learning* (pp. 202–216). John Wiley & Sons.
- Reinhardt, J., & Sykes, J. (2012). Conceptualizing digital game-mediated L2 learning and pedagogy: gameenhanced and game-based research and practice. In H. Reinders (Ed.), *Computer games in language learning and teaching* (pp. 32–49). Palgrave Macmillan.
- Ryu, D. (2013). Play to learn, learn to play: Language learning through gaming culture. *ReCALL*, 25(2), 286–301. <https://doi.org/10.1017/S0958344013000050>
- Sauro, S., & Zourou, K. (2019). What are the digital wilds? *Language Learning & Technology*, 23(1), 1–7. <https://doi.org/10125/44666>
- Schmidt, R. W. (1983). Interaction, acculturation and the acquisition of communicative competence: A case study of an adult. In N. Wolfson & E. Judd (Eds.), *Sociolinguistics and language acquisition* (pp. 137–174). Newbury House.
- Simpson, M. K. (2007). From savage to citizen: education, colonialism and idiocy. *British Journal of Sociology of Education*, 28(5), 561–574. <https://doi.org/10.1080/01425690701505326>
- Singleton, D. (2018). Really late learners: Some research contexts and some practical hints. In D. Gabryś-Barker (Ed.), *Third age learners of foreign languages* (pp. 19–30). Multilingual Matters.
- Spradley, J. P. (1979). *The ethnographic interview*. Waveland Press.
- Sundqvist, P. (2009). *Extramural English matters: Out-of-school English and its impact on Swedish ninth graders' oral proficiency and vocabulary*. (Diss.), Karlstad University, Karlstad.
- Sundqvist, P. (2019). Commercial-off-the-shelf games in the digital wild and L2 learner vocabulary. *Language Learning & Technology*, 23(1), 87–113. <https://doi.org/10125/44674>
- Sundqvist, P. (in preparation). Extramural English at the age of eighty-one: A case study.
- Sundqvist, P., & Sylvé, L. K. (2014). Language-related computer use: Focus on young L2 English learners in Sweden. *ReCALL*, 26(1), 3–20. <https://doi.org/10.1017/S0958344013000232>
- Sundqvist, P., & Sylvé, L. K. (2016). *Extramural English in teaching and learning: From theory and research to practice*. Palgrave Macmillan.
- Sundqvist, P., & Sylvé, L. K. (2019). *Creative foreignization or detrimental fossilization? A case study of two teenage L2 English learners' language use when playing League of Legends*. Paper presented at the CALICO 2019 Conference, Montreal.
- Sundqvist, P., & Wikström, P. (2015). Out-of-school digital gameplay and in-school L2 English vocabulary outcomes. *System*, 51, 65–76. <https://doi.org/10.1016/j.system.2015.04.001>

- Sykes, J. M. (2019). Emergent digital discourses: What can we learn from hashtags and digital games to expand learners' second language repertoire? *Annual Review of Applied Linguistics*, 39, 128–145. <https://doi.org/10.1017/S0267190519000138>
- Sylvén, L. K., & Sundqvist, P. (2012a). Gaming as extramural English L2 learning and L2 proficiency among young learners. *ReCALL*, 24(3), 302–321. <https://doi.org/10.1017/S095834401200016X>
- Sylvén, L. K., & Sundqvist, P. (2012b). Similarities between playing *World of Warcraft* and CLIL. *Apples – Journal of Applied Language Studies*, 6(2), 113–130.
- Thorne, S. L. (2008). Transcultural communication in open Internet environments and massively multiplayer online games. In S. S. Magnan (Ed.), *Mediating discourse online* (pp. 305–330). John Benjamins.
- Thorne, S. L., & Reinhardt, J. (2008). “Bridging activities,” new media literacies, and advanced foreign language proficiency. *CALICO Journal*, 25(3), 558–572.
- The United Nations. (1990). *Convention on the rights of the child*. Retrieved from www.ohchr.org/EN/ProfessionalInterest/Pages/CRC.aspx
- The United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development (Resolution 70/1)*. Retrieved from www.un.org/sustainabledevelopment/development-agenda/
- UNESCO. (2019). *UNESCO Collection of lifelong learning policies and strategies*. Retrieved from <http://uil.unesco.org/lifelong-learning/lifelong-learning-policies>