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Introduction

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Introduction

Technologies have been used in second-language (L2) teaching and learning in various forms for more than four decades, and as such the discipline has matured into a field that journals from virtually every continent are dedicated to its research and practice. Among others, these include *ReCALL* and *Computer-Assisted Language Learning* from Europe, *Language Learning & Technology*, *IALLT Journal*, and the *CALICO Journal* from the United States, *The JALT CALL Journal* and the *AsiaCALL Online Journal* in Asia, the *Journal for Language, Technology and Entrepreneurship in Africa* (although this has a slightly broader focus) in Africa, and *Technology in Language Teaching and Learning* in Australia. In addition to these, there have been numerous books that cover different aspects of using technology in language teaching and learning, including those with a broader focus such as *Computer-Assisted Language Learning: Context and Conceptualization* (1997, Clarendon Press), *Computer-Assisted Language Learning: Diversity in Research and Practice* (2012, Cambridge University Press), *Contemporary Computer-Assisted Language Learning* (2012, Bloomsbury), and more specific discussions of areas such as teacher education (*Teacher Education in CALL*, 2016, John Benjamins Publishing Company), research (*CALL Research Perspectives*, 2005, Lawrence Erlbaum Associates), online communication (*Online Communication in Language Learning and Teaching*, 2007, Palgrave), and learning through mobile devices (*Mobile Assisted Language Learning across Educational Contexts*, 2021, Routledge), to name a few. While these are useful guides in themselves, they are still necessarily limited in focus, including those that attempt to look at the field more broadly. The range and volume of dialogue on the research and practice that have taken place since the field emerged all those decades ago are a testament to its complexity, and at the same time they accentuate the need for a resource that attempts to bring these multifarious strands together. This is one of the primary objectives of this handbook,

but at the same time trying to include them all into rapidly changing technologies, learning environments, teaching philosophies, and even expectations for language education itself is like hitting a target moving at high speed. Changes have taken place even while this volume was being written, particularly given the COVID-19 pandemic and the explosion of artificial intelligence (AI) technologies such as machine translation and ChatGPT (which will be discussed in the final chapter of this volume).

As a point of departure, however, it is important to clarify the terminology that has been used in this volume. The title of the handbook is *The Cambridge Handbook of Technology in Language Teaching and Learning*, which quite deliberately does not use the established term "computer-assisted language learning" (CALL). While CALL has been – and continues to be – widely used in the field of language education, discourse surrounding the suitability of the term remains ongoing (see Stockwell, 2012, 2022 for discussion on the use of the term). Many researchers have stated that it refers not only to computer but to virtually any digital technology, including desktop, laptop, portable, and mobile devices (see Levy & Hubbard, 2005). There are alternative terms that have been used over the years, such as computer-mediated language learning (CMALL), technology-enhanced language learning (TELL), mobile-assisted language learning (MALL), and network-based language learning (NBLL). Some of these terms remain in use, others have all but disappeared. In saying this, however, we felt it was not practical to use a convoluted term such as "technologies for language teaching and learning" as a phrase throughout the book; so, for convenience, we have opted to use the historically recognized term CALL throughout much of the book, to represent all these variations in the terms that describe technology use in language education, but not any specific application of technologies to language teaching and learning contexts. Nevertheless, there are chapters where alternatives may be seen as well. Those alternatives reflect the preferences of individual authors.

Purpose of the Book

The use of technology in language teaching and learning has become more and more commonplace in recent years, but there is wide variety in the technologies used, the ways in which they are employed in various teaching and learning contexts, and the focus and methodologies that are applied to research and evaluate each of these elements. This has resulted in an enormous range of choice for teachers and researchers in the field, but at the same time it has become increasingly difficult to keep up with these changes, especially for those who are new to using technology in language teaching and researching. On the one hand, there are fresh graduates who may be familiar with technology used for private purposes, or may even have had some experience of it in their own language learning, but may have questions as to how to integrate it into their own language-teaching contexts. On the

other hand, there are experienced teachers who have limited skills in technology, particularly when it comes to using it to teach and learn a language, and may feel daunted by the prospect of making sense of how it may operate in the classroom. Although this is not a major focus of the book, COVID-19 has also had a significant effect, both positive and negative, on attitudes toward the adoption of technology in language education; many readers will approach this book from different perspectives, depending on their experiences during the periods of restriction on face-to-face teaching caused by the pandemic. Considering these diverse backgrounds, the overarching purpose of the present volume is to provide a handbook for a readership that ranges from pre-service and early in-service to experienced in-service teachers, researchers, graduate students, and those who are already investigating other areas of teaching with or without technology. The aim is to offer a balanced overview of the issues associated with the use of technology in a variety of language teaching and learning contexts.

The authors of the chapters in this volume were invited to contribute on the basis of their expertise and academic contribution to the topics they cover. We have strived for a balance of authors with a broad international representation to ensure that the content is not skewed toward any particular language or area. We hope that the book can be a solid reference resource for students, researchers, and pre-service and in-service teachers who are interested in using technology in their current or future teaching and learning environments.

It should be pointed out that at the time this book was written, the recent major developments in AI had yet to take place, in particular, generative AI tools based on large language models (LLM) such as ChatGPT. There is no doubt that these tools have had a profound impact on teaching and learning with technology in a broad range of ways, but at the same time, these developments have caused many to only look at these tools, often at the expense of the groundbreaking work using other technologies. Some of the authors of the chapters in this book have chosen to mention the influence generative AI has had on their respective areas of interest, while others have opted to focus on the existing tools and resources. As described in the conclusion of this book, while keeping up with emerging technologies is important, this should not be at the expense of good pedagogy with established technologies. Finding the balance between the range of tools that are available at any given time and achieving best practice in language teaching and learning is an ongoing struggle for teachers, but one that rests on having a view of the whole picture, and not only of the latest trends and developments.

Key Issues

Complexity of CALL Contexts

It is well established that language learning is a complex process with various cognitive, social, cultural, and linguistic aspects, and these make up the

context in which both teachers and learners find themselves, alongside administrators and decision-makers. This context is not limited to physical settings but encompasses the cultural, linguistic, and social environments in which language learning takes place (see Chapter 2); in fact all these factors create the context through their interaction. As Fleming and Hiple (2004) noted, this context will vary quite dramatically depending on the nature of the learning experience, and technology will take on a very different role in face-to-face, hybrid (Chapter 5), or distance learning environments (Chapter 6). Teachers need to be familiar with their teaching environment but also understand that the learning ecology of each learner will differ and that learners will need guidance if they are to make the most of the variety of resources available to them (see Luckin, 2010 for a discussion). How the complex pieces of the overall learning context potentially impact one another and can lead to success or failure in acquiring an L2 needs to be considered.

Exploring Theory, Research, and Practice

A lot has been written on the interplay between theory, research, and practice in a broad range of fields, and the study of technology in L2 education is no exception (see Chapelle, 2007). Amid the complexity stated above, theory provides a core framework for understanding the relationship between technology and language learning since it helps researchers and practitioners to make better predictions about learning outcomes and also to design studies that can confirm a theory or bring it into question. However, CALL has struggled to find its own voice in relation to theory. As a field, CALL has obvious relevance for theories in different disciplines, and each theory has the potential to provide a different lens for viewing how technology can facilitate language learning. CALL does indeed tend to borrow theories from other fields – most particularly from L2 acquisition – and the absence of a native theory has been noted previously (Hubbard, 2008). The field is certainly not atheoretical and the years since Hubbard's paper was written have seen a massive spread in the range of theories that are used to inform research and practice – from psychology, education, sociology, computer science, and many more. These have been applied to a range of aspects of technology in language teaching and learning, for example the design of materials (Lee, Lo, & Chin, 2019) and learning environments (Hsu, 2016), the exploration of teachers' (Wang, 2021) and learners' (Plummer & Wesely, 2021) attitudes to technology, task engagement (Wang, 2020), motivation for teachers (Fearn, 2022) and learners (Gan & Zhong, 2016), literacy (Hafner, 2014), and social interaction (Wang, Deutschmann, & Steinvall, 2013). An overview of the current and emerging theories is provided in Chapter 3, but theory will naturally be present in most chapters of this volume, sometimes more explicitly, sometimes less.

As alluded to above, theory plays a large role in guiding research, and research feeds back into the creation and validation of theory. Research has

taken a very different shape, both in its focus and in how it has been conducted, as a result of the evolution of theory and technology. The ways in which research has shifted are outlined in Chapter 4, and a further discussion of how this relates to the practice of teaching and learning language skills follows in Part VI (Chapters 24–30). A solid understanding of digital literacies by both teachers and learners is needed if they are to keep up with changes in technology, particularly given the exponential development nowadays of AI technologies, for instance machine translation and Generative Pre-Trained Transformer 3 (GPT-3) tools such as ChatGPT (see Chapter 20), which will naturally affect what happens in actual teaching and learning situations. The learners' cultural background and expectations in these situations can have an impact on what technologies are used and in what capacity (Chapter 19). The ways in which learners engage in learning activities through technology are closely tied not only to their own motivation but also to that of their teachers and other stakeholders who provide the learning resources (Chapter 17). Hence the role that theory plays in deepening our understanding of the relationships between these complex factors is a central one, which can ultimately affect what happens in actual practice.

Technology, Teachers, and Learners

Technological advancements have contributed to a growing interest in providing personalized learning in L2 education, such as giving learners feedback based on their performance, enabling social interaction and collaboration, and creating opportunities for learners to practice and communicate with others in a real-world context (see Colpaert & Stockwell, 2022). One example of personalized learning is adaptive instruction (Chapter 12), where the learners and the technology adapt to each other in a unique learning experience, tailored to the needs of the learner. At the same time, there has been a movement toward less personalized approaches, where much of the responsibility for learning is potentially placed on the learners themselves, for example in flipped classrooms (Chapter 7), where learners are required to spend some time managing their resources outside the class, to prepare for classroom interaction and massive open online courses (MOOCs) (Chapter 11). In these contexts there is the danger of a widening of the *digital divide*, where there are clear gaps between learners who have access to technological resources and those who do not. Being able to cater for learners from varied socioeconomic backgrounds can be a challenge for teachers (Chapter 8), and creative options need to be considered. But mobile devices (Chapter 9) have, to a certain extent, had an equalizing effect, in that there are many less developed regions that provide affordable mobile broadband (see Stockwell, 2022).

Another development in technology that can change the shape of the learning environment is virtual reality (Chapter 13), which has become a more realistic option for teachers and learners as hardware and software become

more affordable. There is evidence to suggest that virtual reality can lead to more embodied experiences that can both provide a deeper level of understanding of learning contexts and foster enhanced motivation and engagement. That being said, there is debate on the lack of empirical evidence to prove whether the technology itself facilitates learners' motivation, or whether the learners already have a certain degree of motivation (see Chapter 17). This brings us to a chicken-and-egg quandary where it is unclear whether learners' motivation increases because of the technology, or their existing motivation makes the technology seem to be a positive facilitator. Focusing on technology for technology's sake can in fact detract from the learning experience, as can be seen in the literature on teaching languages with games (Chapter 10). Over-reliance on technology instead of pedagogy has long been cited as a problem in the field (Felix, 2003) and it is essential that teachers are aware of the appropriate pedagogy using technology rather than attempting to replace good pedagogy with technology.

A recurring theme in this volume is the importance of the social aspects of language teaching and learning. Technology has certainly made it easier to have access to social interactions that would not have been possible without the range of information and communication technologies (ICT) that are available now (Chapter 14). This has resulted in the creation of various forms of collaboration (Chapter 16) and telecollaboration (Chapter 15) that encourage people to work together to achieve specific objectives, and the process, in addition to having language learning purposes, has also been used in teacher training (Üzüm, Akayoglu, & Yazan, 2020). Although technology has the potential to make these interactions and collaborations possible, without a clear understanding of how they can be used to facilitate or support language learning, it is just not possible to take advantage of the affordances that they bring to the language teaching and learning environment. Many teachers have turned to online communities (Chapter 22) as a means of seeking out professional and social support, in order to make the most of the tools that are available to them. Their need for support is often due to a lack of formal training in the use of technologies or an inability to keep up with the new opportunities that have emerged in education as a result of technological evolution, or even with the resurgence of existing pedagogies such as task-based language teaching (TBLT) (Chapter 23), which has been transformed as a result of technological advances.

There is a growing body of literature that has highlighted the importance of having teachers who are trained in using technology in their language teaching and learning contexts (Hubbard & Levy, 2016). According to this literature, teachers play a crucial role in how effectively their learners are able to make decisions about what technologies to use and how to use them. Teacher training should cover topics such as CALL research and theory, selecting and designing CALL materials and activities, integrating technology into the curriculum, and assessing and evaluating the technologies and teaching approaches (Son, 2019) to ensure that they are suited to the environment in

which they are used. For example, training for teachers of distance learning courses (Chapter 6) will be necessarily different from the training of teachers who work in face-to-face situations, even if similar technologies are used. However, most educational institutions do not offer sufficient teacher training, hence the teachers need to learn by themselves how to use various technologies. The lack of training may also cause a risk of teacher resistance, whereby teachers are reluctant to learn new technology or rarely adopt the technology in their teaching practice (see Chapter 21). Such resistance not only hinders teachers' professional development and capacity to effectively implement CALL but can also have a negative impact on their ability to carry out suitable learner training (Chapter 18), and the nexus between these two can significantly shift what is taught and how it is learned (Chapter 31).

Overview of the Book

The book consists of thirty-one chapters, which are organized into six parts. We have aimed to keep a largely consistent pattern across the chapters, with the help of a basic thematic structure. Part I has an introductory character. Part II presents the background and introduces a few historical perspectives. Part III discusses the primary themes of the book. Part IV is dedicated to current research and practice. Part V makes some recommendations for research and practice. Finally, Part VI outlines future directions. Each chapter contains its own references at the end. The structure of the book is outlined below.

Part I: Laying the Foundations

The first part of this volume sets out a comprehensive overview of the foundations of context, theories, and research trends in CALL, which are regarded as the three pillars in any field, providing a solid background knowledge for understanding the theoretical frameworks and research approaches that inform CALL practice. In this introductory chapter we outline several key concepts that are relevant to the overall framing of the volume. In Chapter 2, "Impact of Context," Jozef Colpaert and Astrid Cerpentier present four main contexts in CALL, namely the sociocultural context, the educational context, the geotemporal context, and the learning environment. The definitions and issues of each context are further discussed in the chapter. In Chapter 3, "Current and Emerging Theories for CALL," Regine Hampel and Helen Lee outline the established and emergent theories in the field. The chapter highlights the transdisciplinarity of context, theory, and methodology. In the following Chapter 4, "The Shifting Focus of CALL Research," Yijen Wang discusses the shifting focus of CALL research in terms of design, settings, technology, and teaching approaches, offering a critical review on methodology and common research bias.

Part II: Environments

Part II provides an overview of the underlying themes in CALL environments, highlighting the extensive applicability of technology across diverse educational contexts. In Chapter 5, "Blended Learning," Paul Gruba explores blended (or so-called hybrid) approaches from ecological perspectives. The call for an argument-based evaluation of effectiveness is raised. In Chapter 6, "Distance Learning," Fernando Rosell-Aguilar deals with a variety of topics, from conceptual perspectives to practical implementation, concluding with an inspiring argument about the future transformation of distance learning. Chapter 7, "Flipped Classrooms," written by Hsiu-Ting Hung, focuses on the role of technology in a flipped learning approach – a current area of active research and discussion. On the other hand, in Chapter 8, "CALL in Low-Tech Environments," Francisca M. Ivone and Thomas N. Robb explore how to make the most of environments with less access to technology. They underline the importance of sound language teaching approaches that have creativity and flexibility in their environments.

Part III: Tools

Part III covers the current topics of active research and discussion on existing and emerging technologies, which have been extensively employed as a tool for L2 education. In Chapter 9, "Mobile Devices," Mark Pegrum presents an updated mobile-assisted language-learning (MALL) framework, along with practical examples of how to use mobile devices to support language education. In Chapter 10, "Teaching Languages with Games," Frederik Cornillie and James York deal with the topic of game-based learning through technology, highlighting the role that teachers play in such contexts. In Chapter 11 Agnes Kukulska-Hulme, Fereshte Goshtasbpour, and Barbara Conde-Gafaro discuss the challenges of MOOCs and offer suggestions on research and practice to support learners who engage in MOOCs. Adaptive instruction is the topic explored in Chapter 12 by Mathias Schulze, Catherine Caws, Marie-Josée Hamel, and Trude Heift. The authors address the issues of the development of adaptive instruction in CALL through theocratic approaches, research, and practical instructions. In Chapter 13, "Virtual Reality," Kristi Jauregi-Ondarra, Sabela Melchor-Couto, and Silvia Canto explore the use of virtual reality (VR) in language education, where this is regarded as an emerging technology that holds promise for the future and demands exploration. They touch upon how to integrate low- and high-immersive VR technologies into language classroom practice.

Part IV: Social Aspects

Part IV focuses on the social aspect of CALL. Its four chapters explore various dimensions of social learning through CALL, providing valuable insights into how CALL can facilitate social and collaborative language learning, promote

intercultural communication, and foster motivation among language learners. In Chapter 14, "Social Interaction and Learning," Lara Lomicka and Stacey Benoit emphasize the important role of social interaction in language learning, a field in which technology is seen as a supportive tool. The authors provide an overview of the potential of technology in cross-cultural projects. Another topic of growing interest in the field is developed in Chapter 15, "Virtual Exchange and Telecollaborative Learning," by Begoña F. Gutiérrez and Robert O'Dowd. This chapter looks at how telecollaborative technologies have grown in popularity in recent years, what we have learned about their potential for foreign language learning, and how they should be integrated into educational programmes. In Chapter 16, "Collaborative Learning," Lara Ducate and Nike Arnold explore digital collaboration for L2 learners, with a focus on writing and strategies development. In the final chapter of this part, "Motivation," Richard Pinner discusses the complex relationship between technology and motivation in language learning, including the role of symbolic power in personal and institutional motivations and the lack of empirical evidence about motivation in CALL research. The chapter also presents some motivational techniques for teachers.

Part V: Practice

Part V offers practical insights and strategies for language instruction and professional development through the use of technology. The six chapters in this part provide valuable guidance for language educators seeking to enhance their teaching practices and adopt/adapt technology to improve learning outcomes for their students. In Chapter 18, "Learner Training," Chun Lai highlights the importance of learner training in CALL. The discussion includes the topics of facilitating smooth implementation and enhancing active engagement in informal learning contexts. The chapter argues for more extensive research on learner training in informal language learning environments and calls for a personalized approach to learner training that should consider contextual factors. In Chapter 19, "Digital Media and Interculturality," Julie Choi, Rhett Loban, and Sue Ollerhead explore interculturality in teaching and learning through digital media, showcasing four cultural design approaches. The chapter emphasizes the dynamic and relational nature of culture and the potential of digital technologies to engage learners in intercultural experiences. In Chapter 20, "Literacies for Teaching," Richard Kern stresses the significance of literacy for language education and the teacher's role in enhancing students' language and literacy skills with digital technologies. The chapter covers various topics such as multiliteracies, cultural dimensions, autonomy, mobility, creativity, and communities, as well as the two controversial areas of AI and machine translation. The integration of technology into language teaching and learning has become increasingly important in recent years. However, some teachers may resist this change and feel uncomfortable with using technology in their teaching. In Chapter 21,

"Overcoming Teacher Resistance," Yijen Wang explores the factors that contribute to teacher resistance to technology and provides suggestions for addressing teachers' concerns and fears. This chapter aims to encourage language teachers to embrace technology and to arm them with practical strategies for overcoming resistance to incorporating it in their teaching practices. In line with the statement of this chapter that, as a result of a lack of institutional support, teachers often have to learn about technology on their own, in the following Chapter 22, "Online Communities for Teachers," Yurika Ito demonstrates how online teacher communities can be a source of professional learning for teachers, especially those who use technology in their teaching. The chapter offers a historical overview and explores the benefits and challenges of these communities. It concludes with suggestions for future research and predictions for the future of online teacher communities. In Chapter 23, "Task-Based Language Teaching," Sima Khezrlou looks at the potential of TBLT and technology to enhance language learning. She explores how the two fields can work together to create unique learning opportunities; and she also provides a review of recent research in this area.

Part VI: Language Skills and Areas

Part VI focuses on specific language skills and areas of language learning and teaching where technology is or can be used. Its seven chapters provide insights into how technology can be integrated to enhance the development of language teaching and learning approaches. They offer practical examples and strategies for language educators. In Chapter 24, "Speaking," Gilbert Dizon focuses on L2 speaking and its development through the use of various technologies. The chapter highlights different emerging technologies that have the potential to support the teaching and learning of L2 speaking.

In Chapter 25, "Listening," Glenn Stockwell explores how annotations and captions can be used to lighten the burden of the listening process and suggests that the design of help options can contribute to enhanced comprehension and acquisition of the target language. In Chapter 26, "Reading," Meei-Ling Liaw and Sabrina Priego discuss the challenges of becoming a proficient reader in a new language and how technology can help overcome these challenges. The authors also make suggestions for the effective integration of technology in L2 reading instruction, covering areas such as vocabulary, comprehension, fluency, and motivation. Chapter 27, "Writing," written by Hassan Mohebbi and Ali Panahi, draws attention to the use of technology in L2 writing instruction and discusses various technological tools that have been used in language education, including computer-automated corrective feedback, video impact, and web-based collaborative writing. In the following Chapter 28, "Pronunciation," Tatsuya Kawahara and Masatake Dantsuji introduce the foundations of pronunciation in L2 education, automatic speech recognition (ASR) technology to detect pronunciation errors, and how ASR models can be used for pronunciation grading. In Chapter 29, "Vocabulary,"

Jang Ho Lee and Dongkwang Shin investigate the integration of technology into vocabulary teaching and learning – for instance through online vocabulary tests, hypertext glosses, vocabulary profiler, learning through a vocabulary list, and game-based vocabulary-learning applications. Recommendations for teaching practice and future research on technology-aided vocabulary instruction are also supplied. In Chapter 30, "Grammar," S. Susan Marandi describes various technology-based approaches to grammar instruction that align with grammar-teaching principles and pedagogical practices and concludes with an insightful argument that is relevant to all of the topics in this part: "it is not the technologies themselves that will determine how well we teach grammar but, as always, the way we use them" (p. 507).

In Chapter 31, "Conclusion," as the editors of this volume, we bring together the topics and issues discussed throughout the book, revisiting the concepts of emergent and established CALL and exploring how, over time, research needs to move on from just looking at the technology itself to exploring how to use it effectively. The chapter then considers some of the challenges encountered in using technology in the teaching and learning of an L2 and looks at the interrelationship between teacher training, learner training, and administrative responsibility.

This volume aims to make it clear that there are almost countless approaches to applying technology to language teaching and learning, and these will be very specific to the individual context in which each one is to be used. At the same time, we need to remember that these approaches should be informed by the work of previous research, as a foundation on which to achieve better practice. We hope that readers will be able to benefit from the diverse perspectives of the authors who contributed to this volume and will develop their own pedagogies that will be of most benefit to their learners in the intricate and complex task of learning a second language.

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