

Teachers as Customizers of CALL Resources:  
An approach to teacher developed digital L2 learning materials

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## **Abstract**

### **Teachers as customizers of CALL resources: An approach to teacher developed digital L2 learning materials**

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In second language (L2) teaching, instructors suddenly find themselves in an unprecedented situation where they need to quickly learn to teach with digital resources (Osokoz & Smith, 2020), regardless of their prior experiences with technology. Though COVID-19 has accelerated this process, it had already been well documented that language teachers were struggling with overcoming the anxiety associated with teaching with technology (e.g., Kessler, 2010; Son, 2018). Given the immediate need for L2 teachers to develop computer assisted language learning (CALL) resources for their students to use, they are likely to remain anxious or confused about how to achieve this without an approach to guide them. Therefore, an approach to CALL customization is needed in order to: (1) enable L2 teachers to conceptualize and develop their own technology-enhanced materials, based on their time, resources, and comfort with technology; and (2) afford these teachers' students a variety of ways to use the target language in interactions with and through technology, in digitally-facilitated exchanges. To this end, the three interconnected manuscripts in this dissertation aim to: (1) propose an approach that recognizes teachers as customizers of CALL resources directed at stimulating L2 use, based on their expertise and comfort with technology (manuscript A); (2) investigate the

effect that materials made according to this approach have on the development of L2 pronunciation (manuscript B); and (3) assess the implementation of the proposed approach from a pre-service teacher's perspective (manuscript C). The data from manuscript B support that the customization of CALL resources can contribute to L2 learning, while the data from manuscript C show that teachers can use the proposed approach to become aware of their abilities in CALL, in addition to customizing a wide range of CALL resources.

## Acknowledgements

Jerry Greenfield of Ben and Jerry's Ice-Cream once posed the question, "If it's not fun, why do it?" I first encountered this question as a child when I was on a tour of their factory in Vermont. It went from being a seemingly innocuous question to a personal lifestyle that only ripened over time, often leading me down paths I never knew existed. By breaking life down to its simplest terms— fun— this approach has enabled me to not only navigate, but enjoy the uncertainty associated with writing a dissertation. However, it should be noted that I did not achieve this alone, so I would like to say thank you to some very important people.

I would like to first thank my supervisor, Dr. Walcir Cardoso, for the guidance and support over the course of my studies. Thank you for seeing whatever it was that you saw in me when we first met to discuss the possibility of applying to the Ph.D. program. Your dedication as a researcher, teacher, and friend has continuously encouraged me to achieve beyond my abilities, and I will be forever grateful for your unwavering support. You are truly an inspiration, and I consider myself very fortunate to have trained under one of the best.

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It should be noted that my colleagues and friends have provided me a great amount of support throughout this process. I would like to first recognize Jennica Grimshaw, with whom I worked closely on many projects directly and indirectly related to this dissertation. Thank you

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## **Contribution of Authors and Manuscript-Based Dissertation**

This is a manuscript-based dissertation that consists of three manuscripts, bookended by an introduction (Chapter 1) and the conclusion chapters (Chapter 5). It was conceptualized over the course of several meetings with my supervisor, Walcir Cardoso, and also in tutorials and research-group meetings in the department. Based on my supervisor's feedback and recommendations, I developed the three manuscripts in this dissertation.

In addition to my supervisor, a colleague, Jennica Grimshaw, was second author on manuscript A (Chapter 2). In specific, she contributed by helping me in the development of the literature review and providing feedback about the examples that were provided at each level of customization. My supervisor also edited manuscript A and provided feedback about the key concepts, which explains why he is listed as third author on this publication from 2018.

I developed the two research projects carried out in manuscript B (Chapter 3) and manuscript C (Chapter 4), with the assistance of my supervisor. In manuscript B, I developed the gamified pronunciation course and instruments but received substantial feedback, which is why my supervisor, Walcir Cardoso, is listed as second author on this study. However, because I was the key contributor to the development of manuscript C, I will serve as the single author for this paper when it is submitted to *Computer Assisted Language Learning*, a Tier 1 journal in the field.

As stated in Concordia's 2020 edition of the *Guidelines for Thesis Preparation, Examination Procedures and Regulations* (p. 10-11), because this is a manuscript-based dissertation, the two published articles (in Chapters 2 and 3) will be presented in their entirety. In addition, the three manuscripts will be preceded by "a general introduction [Chapter 1] which clearly states the rationale and objectives of the research [...], and a comprehensive review of the

literature that frames the thesis research area.” Given the nature of this format, it should be noted that “each chapter/manuscript will have some overlap in content.”

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## List of Definitions

**Automated Speech Recognition:** Computer programs that convert human speech to text, thus enabling individuals to speak to computers and receive feedback (Yu & Deng, 2016).

**Computer Assisted Language Learning.** Computer assisted language learning refers to the use of technology for the purposes of language learning, acknowledging the influence of a wide range of modern technologies (e.g., computers, smartphones) and theoretical perspectives on L2 learning (see Levy & Hubbard, 2005 for the rationale behind the decision to use the term CALL instead of its variants; see also *mobile assisted language learning* below).

**Formal CALL Teacher Training.** While CALL teachers can learn about CALL in any setting, formal CALL teacher training typically occurs in accredited university program where learners have access to formal instruction and class structures (Hubbard, 2008). Teachers in such courses are referred to as “in-training teachers” throughout this dissertation.

**Gamification.** The term *gamification* refers to the use of elements of games such levels, points, badges, and leaderboards in non-gaming environments to make an activity more enjoyable (Bell, 2018; Deterding et al., 2011; Hamari et al., 2015).

**Instructional Design.** Procedures and principles that can contribute to the systematic design of instructional materials, which can be developed consistently and reliably (Reigeluth, 1983).

**Interactionist Approaches to Second Language Acquisition.** This approach claims that language learners need to interact with the target language to learn it, which happens primarily via the negotiation for meaning during communication breakdowns (e.g., Gass, 1997, 2003; Long, 1996). This dissertation investigates how teachers can develop their own CALL materials, following the premises of this approach.

**Mobile Assisted Language Learning.** Mobile assisted language learning (MALL) is the use of mobile technology (e.g., tablets, smartphones) to overcome traditional barriers to language learning such as the limitations of time and space (Miangah & Nezarat, 2012). In this dissertation, MALL is subsumed under CALL unless its affordances are otherwise differentiated. This is done in line with Levy and Hubbard's (2005) to use one comprehensive term, CALL, to keep the field intact.

**Socio-Constructivism.** This theory stresses that social interaction is a key aspect of learning, and it takes place between two or more people in zones where they use culturally situated tools to mediate interactions within their social environments (Vygostky, 1978). This theory influenced the development Moodle, a course management system that, due to its customizable nature, is targeted in this dissertation for its usefulness in teacher training and CALL material development.

**Text-to-Speech Synthesis:** Computer programs that convert written text into speech, thus enabling computers to “talk” to the user in different accents and voices (Handley, 2009).

## **Chapter 1: General Introduction**

A common obstacle that second/foreign language (L2) teachers are likely to face when considering the use of computer-assisted language learning (CALL) materials in their courses is determining where to begin. Some may be inclined to incorporate apps or pre-existing online resources, while others may instead consider the possibility of developing their own online learning materials from scratch. As will be seen throughout this dissertation, CALL customization includes working with pre-existing online materials or developing them from scratch; the latter is assumed to be the highest form of customization in this dissertation. Fortunately, both of these can be done with basic computer skills and knowledge of L2 acquisition research, as there is a large pool of online resources that teachers with basic technology skills can use to customize learning materials for their students. Despite this pool of resources, teachers will remain unlikely to use them without developing the ability to transfer their current technological abilities to CALL development (Kessler, 2010).

The goal of this chapter is to introduce the topics and related theories that are central to understanding how teachers can customize their own CALL materials. It begins with a review of approaches to formal teacher-training directed at assisting teachers to conceptualize these materials, based on knowledge in L2 acquisition and CALL research. Because the proposed approach to customization is based on insights from second language acquisition (SLA) research such as the importance of input, output, and negotiation for meaning, these topics are addressed to establish the types of pedagogically-sound interactions available to L2 learners. The final section reviews the ways in which technology can expand learners' opportunities for L2 interaction, including the use of gamified learning environments to further promote the use of the target language. This chapter attempts to establish a conceptual framework for the dissertation by

drawing on formal CALL teacher training literature (e.g., Gruba, 2017; Kessler, 2010), as well as interactionist approaches to L2 learning (e.g., Gass, 1997, 2017; Krashen, 2003; Long, 1996) to establish the ways in which digital technology can be used for L2 teaching and learning, (e.g., Chapelle, 1998, 2003, 2004; Chapelle & Jamieson, 2008).

This chapter details the focus of this dissertation: (1) to address the need for an approach that enables teachers to customize their own CALL materials, considering their time, resources, and comfort with technology (addressed in manuscript A); (2) to test the effect that a teacher-customized CALL resource can have on learning (L2 pronunciation) when implemented in an online setting (manuscript B); and (3) to implement the approach proposed in the first manuscript in a teacher training program to assess how pre-service teachers might use it to customize their own technology-enhanced materials, and to gain insights into their perceived use of the approach (manuscript C). As will be detailed at the end of this chapter, this dissertation aims to answer to overarching research questions:

1. How can teachers work on their own to customize CALL materials directed at stimulating L2 learning?
2. What effect can a customized CALL resource made from widely available materials have on L2 learning?

### **Teachers as Developers of CALL Materials**

Despite decades of attempts to introduce educational technology in teacher training, an issue that persists is that teachers' beliefs about technology dictate whether he or she will use it for teaching (Deng et al., 2014). In a critical review of teacher training literature about educational technology, Tondeur et al. (2017) discovered that providing hands-on opportunities to use educational technology was associated with a higher chance of implementation because

teachers could learn to apply their pedagogical expertise to the resource (see Kessler, 2010 for a similar view in CALL). Based on the assumption that teachers need hands-on opportunities with technology to become comfortable with it, this section will first review the literature that focuses on helping pre-service teachers become comfortable with CALL, and then it highlights how open educational resources such as course management systems can provide teachers an approachable way to develop an array of technology-enhanced materials.

### ***Formal CALL Teacher Training***

Formal CALL teacher training has the capacity to help pre-service teachers overcome negative beliefs about the use of digital materials for L2 teaching (Kessler, 2010; Park & Son, 2009), though teachers who do not view themselves as capable of designing CALL materials will not include technology in their curriculum, even after receiving training (Kuure et al., 2016). One proven way of helping these teachers to view themselves as capable in CALL is by providing them with hands-on opportunities in teacher-training courses, as this equips them with the theoretical and practical tools to develop their own materials (e.g., Gruba, 2017; Kessler, 2010, 2018), and consequently develop their own technology-enhanced materials.

In an analysis of pre-service teacher discourse from course forums, Kessler (2010) found that the participants were skeptical about their role being overshadowed by the use of technology, indicating that they were unaware that their pedagogical experience could be enhanced by its use. Despite being anxious at first, the participants explained that teaching with technology became more approachable only after they had opportunities to work with the digital resources and reflect upon their experiences with other pre-service teachers. In specific, to develop a better understanding of CALL theory and its applications, in-training teachers taught with technology, presented about it, and had forum discussions about CALL resources and

theories. Kessler explains that without these experiences, it is unlikely that the teachers would have been able to apply what they already knew about L2 acquisition and pedagogy to the development of the materials. This finding is in line with Tondeur et al. (2017), who explain that teachers need chances to learn about and work with technology to match their pedagogical beliefs with the affordances of the proposed technology. Therefore, an important need in CALL teacher preparation is to equip trainees with an approach that helps them to become aware of what they can achieve with their current technological abilities and pedagogical expertise (manuscript A).

To train teachers in CALL, Hubbard (2008) describes that teacher-training can be broken into four general categories: (1) breadth first: the traditional survey course; (2) depth first: when it focuses on one specific area to explore in the course; (3) integrated: when technology is introduced across multiple courses; and (4) online: when teachers learn about technology through using technology. A specific approach that affords trainees opportunities to explore teaching with CALL in a single course is the project-based breadth approach, whereby trainees learn about CALL theory while developing the necessary skills to complete a CALL related project (Kessler, 2010). An interesting example of such an approach was explored in a graduate CALL teacher training course by Gruba (2017), who utilized a course management system for the dual purpose of engaging learners in discussions about CALL outside of class and to give them a place to develop digital materials, based on the theories and topics covered in course readings. This approach partially motivated manuscript C (Chapter 4), which examines in-training teachers' perceptions of using the approach proposed in manuscript A (Chapter 2) to design their own online L2 course and materials.

### ***Teacher Abilities with Technology***

To understand how individuals can comfortably work with digital technology, Carliner and Driscoll (2019) propose five levels of skills with the target training technology, describing those who: have no skill with the technology (Level 1); have not used technology but can explain it and its capabilities (Level 2); have the same abilities as the second level but can use the technology (Level 3); have the same abilities as the third level but can personalize the technology and troubleshoot documented problems (Level 4); and have the same abilities as the fourth level but can handle undocumented challenges and create add-ons or extensions to the existing software (Level 5). The proposal put forth in manuscript A (Chapter 2) takes these insights into consideration, but it avoids the use of fixed levels and, instead, positions material customization on an overlapping scale in which teachers can easily move from one form of customization to another, as based on their technological know-how and other constraints such as time, resources, and technological expertise.

It should be acknowledged that building CALL materials is ultimately a discussion about instructional design. Instructional design can best be described as a set of procedures and principles that can contribute to the systematic design of instructional materials, which can be developed both consistently and reliably (Reigeluth, 1983). According to this approach, the focus goes from the teacher presenting information and providing feedback to designing materials that provide instructional support (Dick et al., 2014). One way that Dick et al. (2014) recommend developing materials that take the place of a teacher is through the use of course management systems such as Moodle, which enable students to work at their own pace through teacher-created materials.

### ***Course Management Systems in CALL Development: Moodle***

To develop CALL materials, this dissertation recommends the use of open educational resources - digitized materials that are available freely and openly for teachers and students to use for pedagogical purposes (OECD, 2007). The Modular Object-Oriented Dynamic Learning Environment System, better known by its acronym *Moodle*, is such an example. *Moodle* is an open-source educational resource amenable to customization that emphasizes social interactions— designed to function as a socio-constructivist tool— as described by Dougiamas and Taylor (2003). Note, however, that despite its socio-constructivist roots, *Moodle* is flexible enough to accommodate any pedagogical perspective. According to Dougiamas and Taylor, *Moodle* was designed for students to learn, interact with each other, and even contribute to peer teaching (e.g., via forum posts, wikis) by providing learner-created content for other students. As such, *Moodle* can be seen as a flexible tool that can afford opportunities for learners to mediate their own use of the L2 with each other (between-learner interactions; e.g., via text chats or forum interactions), or enable them to interact with computers to develop a specific skill (learner-computer interactions; e.g., via texts, videos, automated speech recognition). Though seemingly simple, through *Moodle*, L2 teachers can develop CALL materials in ways that have been found to promote L2 learning (Pardoel, 2018).

An important affordance of *Moodle* is that it simplifies the development of CALL materials, and it easily allows for the instructor to, for example, gamify the learning environment (see forthcoming discussion for the rationale behind gamification in L2 learning). According to Pastor-Pina et al. (2015), *Moodle* can be gamified for L2 learning in the following ways: progressive or experiential learning (e.g., via maps, levels), socialization (e.g., via chats and forums), feedback (e.g., instant feedback in quizzes, progress bar), and rewards (e.g., via

experience points). Gamifying a *Moodle* course enables teachers to reward learners for L2 use, including interacting *with* CALL materials created by the teacher (e.g., taking a quiz, reviewing text-to-speech vocabulary cards, practicing pronunciation), or through CALL activities that promote L2 use between learners (e.g., forums, chats, blogs). As will be discussed later, gamified learning environments can benefit L2 learners in multiple ways, including developing consistent study habits.

Despite the stated benefits of using course management systems to develop CALL materials, many teachers note that they are neither qualified nor prepared to use such resources in an effective manner (Kessler, 2010), an issue that has been raised in recent CALL teacher training literature (e.g., Son, 2018). This indicates that an approach is needed to help teachers develop awareness to the types of materials they can develop with their pre-existing abilities. By becoming aware of their abilities in CALL, teachers can provide L2 learners a variety of ways to interact with the target language and consequently increase their opportunities for input and output practice. The importance of interaction in L2 learning is discussed next and addressed directly in manuscript B (Chapter 3).

### **The Role of L2 Interaction in Language Learning**

An important aspect in L2 learning is interaction, as it allows students to notice complex or unknown L2 features in the input, test their hypotheses about the language by producing output, and have opportunities to alter their output based on modified language (e.g., slower speech, elaborations, clarifications) produced by other interlocutors (Gass, 1997, 2003; Long, 1983; Schmidt, 2001). This issue is relevant to the current dissertation because the three manuscripts presuppose that, in order for learning to take place, students need to use the target

language in interactions with others. Therefore, all three manuscripts rely on this concept and explore ways to stimulate it via material development.

Interactionist approaches hypothesize that interaction leads to opportunities to learn a language, as observed in L1-L2 interactions when L1 speakers adjust their utterances so that their output becomes comprehensible to the listener-learner (Hatch, 1978). This type of adjustment is the basis for Krashen's (1980) Input Hypothesis, which assumes that comprehensible input— language that is just above a learner's current ability— is what facilitates acquisition by enabling the learner to notice increasingly complex L2 features that they can then integrate into future interactions (Krashen, 1980, 2003). Krashen emphasizes that comprehensible input occurs incidentally, when the learner is not focused on meaning, which indicates that any measure taken to increase interaction between learners facilitates L2 learning.

One specific issue with Krashen's notion of comprehensible input is that it presupposes that output is not needed for learning (Long, 1983; Swain, 1985). To address this inadequacy, Long (1980) proposed the Interaction Hypothesis, claiming that comprehensible input is the result of interactional modifications that occur during L2 conversations when higher- and lower-level speakers make adjustments to overcome communication breakdowns. During these breakdowns, learners can negotiate for meaning (e.g., when a speaker slows down his or her speech to draw attention to a specific word or sound that the interlocutor misunderstood), allowing the students to process input and produce output (Long, 1996). It is hypothesized that without access to modified speech, learners will not receive the input necessary to advance at noticing specific L2 features so that learning will occur. As will be discussed throughout this dissertation, L2 interactions with computers and mobile devices can afford learners the chance to receive and produce modified input and output without the presence of another human.

Despite the importance of input, L2 output is also necessary for learning. To understand the role of output, Swain's (1985) Output Hypothesis stresses that learners need to produce the language in order to automatize and test their use of target L2 features as they detect the differences between their current ability and the desired goal (Swain, 1995, 2005); this can happen, for example, when students receive explicit feedback about their output attempts. An important issue is that not all learners are willing to produce language, so Swain (1985) emphasizes that they need to be "pushed" (p. 249) into producing output. As will be discussed throughout this dissertation, the use of technology, particularly with digitally gamified learning environments, affords teachers a way to craft resources that encourage learners to produce output, both in interactions with technology and also in digitally facilitated interactions with other L2 learners. Given that a combination of production- and comprehension-based activities are needed for L2 learning (Shintani et al., 2013), the application of interactionist approaches can inform the ways that teachers can use technology to provide learners with opportunities to produce output or receive input.

This dissertation acknowledges that current perspectives on SLA give attention to both the cognitive acquisition of the target language and the context in which it is used, viewing the two as inseparable (e.g., usage-based approaches; Ellis, 2002). Despite the importance of context when it comes to understanding naturally occurring L2 use in CALL environments (e.g., Knight et al., 2020; Sauro & Zouro, 2019), these approaches do not inform design. Similarly, skill Acquisition Theory (DeKeyser, 2007) may be more appropriate for assessing how learners use CALL materials to automatize specific L2 skills, particularly with regard to timing (Li & DeKeyser, 2017). Despite this potential, interactionist approaches are favored in this dissertation because they assume an evaluative stance for *developing* CALL materials based on the ways that

computer-based input and output channels (e.g., videos, audio recordings) can be used for L2 pedagogy (Chapelle, 2004). In support of using this approach to help teachers learn to develop technology-enhanced materials, Chapelle and Jamieson's (2008) textbook "Tips for Teaching with CALL" remains the most comprehensive source to aid L2 teachers develop their materials. Despite more recent perspectives shedding light on how technology can contribute to L2 learning, such approaches have not similarly broken down the ways in which teachers can develop CALL materials—the goal of this dissertation.

Altogether, interactionist approaches to L2 learning stress that the interlocutor plays a crucial role in providing feedback and negotiating for meaning (Philp & Gurzynski-Weiss, 2020). Therefore, the use of CALL seems like a suitable alternative for promoting these types of interactions, particularly when it involves resources that provide feedback, enhanced input, and opportunities for negotiation of meaning.

### **Opportunities for L2 Interaction in CALL Environments**

In an extension of the approaches mentioned above, technology can be used to replace individuals to provide learners opportunities to interact with the target language (Chapelle, 1998), and it can also be used as a way for learners to have digitally mediated L2 interactions with each other (Chapelle, 2003, 2004). On this basis, this section aims first to highlight the types of CALL<sup>1</sup> resources and digital technology that learners can interact with on their own to receive input and produce output. It then provides an overview of the types of online resources that enable learners to have interactions with other interlocutors, and, finally, it investigates the ways in which gamified resources can encourage learners to adopt study habits that may encourage them interact with and through the target language.

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<sup>1</sup> In this dissertation, CALL is operationalized as any digital resource that can be used for language learning, including computers and mobile devices. Unless otherwise differentiated, the acronym "CALL" will be used.

It should be acknowledged that e-training literature uses similar terminology to describe interactions with technology. For example, Driscoll and Carliner (2005) explain that learning can occur in digital interactions *with* technology (e.g., posting in an online forum with other learners), *from* technology (e.g., using a program that acts as a tutor or guide), or *through* technology (e.g., a learner determines how to best use an online resource). Similarly, in CALL, Chapelle (2003) explains that interactions can happen *with* technology (e.g., L2 interactions with digital resources) or *through* it (e.g., L2 chats with other learners), as seen in Table 1. For consistency, and in line with CALL literature, this dissertation utilizes the prepositions *with* (i.e., L2 interactions between a learner and computer) and *through* (digital L2 interactions between-learners) to describe the interactions L2 learners can have in CALL environments.

**Table 1.1**

*L2 interactions that learners can have with and through computers*

| <b>Types of interaction</b> |  | <b>Benefit of interaction</b>                                  |
|-----------------------------|--|--|
| <b>Inter-</b>               | 1. <b>between</b> learner and computer/mobile device standing in place of an instructor or other student | - Receive modified input<br>- Produce modified output          |
|                             | 2. <b>between</b> learners   | - Negotiate for meaning<br>- Receive input<br>- Produce output |
| <b>Intra-</b>               | 3. <b>within</b> a learner's mind  | - Place attention on linguistic form in the available input    |

(adapted from Chapelle, 2003)

### ***Learner-Computer L2 Interactions***

Computers can take the place of another learner, or they can also replace a teacher and provide opportunities for learning. In L2 teaching and learning, learner-computer interactions can contribute to L2 learning by increasing the salience of target features, providing opportunities for input and output practice, creating chances for students to notice errors, and

enabling them to interact *with* computers (Chapelle, 1998, 2003). A key benefit of learner-computer interactions is that they are useful when assisting learners to intra-personally process L2 input within their mind (Chapelle, 2003), which indicates that learners are about to interact with computers for the purposes of practice (see Wagner, 1998 for a full discussion about types of interaction in education). An example of a learner-computer interaction where a learner both receives input and produces output can be seen in van Lieshout and Cardoso's (in press) study about the pedagogical use of *Google Translate*. Participants were asked to practice pronouncing a list of L2 Dutch phrases on their own by using the application's built-in text-to-speech software to listen to the target L2 phrases (input practice) and automated speech recognition to orally produce them (output practice). Learners would initially look up an L2 Dutch phrase via an English-to-Dutch translation, listen to it in Dutch before trying to pronounce it, and then listen to the target pronunciation once again to compare it against their output. Their findings indicate that learners were able to produce intelligible and comprehensible speech in L2 Dutch on post-test recordings, thus serving as evidence that interactions with these types of speech technologies can yield pedagogical benefits. These findings suggest that learners can advance their L2 abilities on their own in interactions with a CALL resource that takes the place of an interlocutor, similar to the approach explored in manuscript B (Chapter 3) in which EFL students interact with a computer (a gamified version of Moodle) to learn about the pronunciation of L2 English /r/-/l/.

Another way in which L2 learners can interact with a computer is in language learning applications (apps) that include a pre-set learning path (apps; Chik, 2020; Dressman, 2020). These apps have a pre-set curriculum that extends opportunities to receive input and produce output, based on a learner's knowledge and skills in the target language. Despite this potential, in a study with 79 EFL learners in Turkey, Tuncay (2020) found that *Duolingo* users stopped using

the app for a multitude of reasons, including a perceived lack of guidance, social isolation, inauthenticity, poor instructional quality, and limited learner control. These reasons were also noted in interviews, where participants indicated that they were bored with a computer voice and the artificiality of the exchanges (e.g., robotic voice, nonsensical phrases). An important implication of these findings is that they highlight the importance of guidance, socialization, authenticity, and learner autonomy. In this dissertation, these factors are taken into consideration in the conceptualization of an approach for CALL customization for L2 teaching and learning, as explored in manuscript A (Chapter 2).

### ***Between-Learner L2 Interactions***

Computers can also connect L2 learners with other users to promote between-learner L2 interactions *through* technology (Chapelle, 2004). These types of interaction stress that the synchronicity and type of the exchange can affect the cognitive development of the target language (Chapelle, 2004; Sotillo, 2000). For example, synchronous webcam exchanges (i.e., real-time interactions) function more like in-person conversations (Yanguas, 2010), though synchronous text-chats offer additional benefits such as the ability to review a conversation after it has ended (Smith, 2003). Conversely, asynchronous exchanges (i.e., not occurring in real-time) such as posting in a forum can give learners additional time to process and produce the target language (Chapelle & Jamieson, 2008; Ene & Upton, 2018). This can also be extended to asynchronous speaking opportunities (Carrio-Pastor, 2019), which can make the act of speaking a more revocable action (e.g., deleting and re-recording a video containing a pronunciation error). Some of these between-learner L2 interactions were employed by the participants (pre-service teachers) in manuscript C (Chapter 4) to provide their learners multiple ways to approach negotiating for meaning with other interlocutors, based on their skills and comfort with the L2.

Despite the noted pedagogical potential of the above-mentioned resources to promote interaction, the mere introduction of CALL technology in L2 education does not guarantee that learners will be motivated to use them (Stockwell, 2013). One way to mitigate this issue is via the pedagogical use of games or creating gamified learning environments.

### ***Gamified Approaches to CALL***

*Gamification* involves the use of elements of games such badges, points, and leaderboards in non-gaming environments to make an activity more enjoyable (Bell, 2018; Deterding et al., 2011; Hamari et al., 2015); for these reasons, it has been explored in a wide range of business and educational settings. Gamified L2 learning is described as the use of game elements in language learning activities that are not typically associated with game-play (Reinhardt, 2019; Reinhardt & Sykes, 2012, 2014). Such approaches aim to make non-gaming activities more enjoyable (Bell, 2018; Deterding et al, 2011), which is done through the use of badges, points, leaderboards, narrative contexts, feedback, ranks, levels, marketplaces, competition under rules that are explicit and enforced, teams, and timed pressure (Bell, 2018; Reeves & Read, 2009). In L2 learning, gamified approaches utilize game affordances to motivate learners to explore the target language and use it (Reinhardt, 2019); for example, by rewarding a learner with a badge or experience points for posting in a forum. From a gamification standpoint, one of the goals of this dissertation is to equip teachers with an approach that enables them to conceptualize and design their own game-informed CALL materials, particularly in activities that reward learners for their attempts to learn about and use the target language (manuscript A – Chapter 2). Another goal is to explore gamification in a teacher-customized CALL resource with badges, points, and leaderboards that rewards learners for their attempts to use the language (manuscript B – Chapter 3). Finally, manuscript C (Chapter 4) explores how pre-service

teachers, influenced by the proposed approach to CALL customization, choose to customize their own learning materials with gamified elements.

Despite the pedagogical benefits of gamified materials that stimulate learner-computer and learner-learner L2 interactions, teachers may not perceive they are prepared to develop their own materials due to a perceived lack of technological abilities (Kessler, 2010). Therefore, it is imperative to introduce an approach that aims to help teachers comfortably develop their own CALL materials, based on their time, resources, and technological expertise.

### **This Dissertation**

The following dissertation aims to understand how teachers, including those who may not believe they are equipped to locate and develop their own CALL materials, can become aware of their capabilities in CALL and work independently to carry out key aspects of customizing digital resources for L2 learning. To achieve this, it proposes a three-tier approach to categorizing potential CALL materials for customization, based on teachers' technological abilities and the way(s) the proposed resource can be tailored for L2 learning: adaptation, modification, and creation.

To better understand this, **manuscript A (Chapter 2)** introduces the proposed approach to categorizing and customizing CALL materials with the goal of positioning teachers as instructional designers of their own (interactive and/or gamified) materials directed at increasing L2 use and interaction. Within a mobile-assisted L2 learning context, it also provides specific examples of how teachers can categorize and customize materials, making consistent connections to instructional design literature within and beyond the fields of CALL. Following this approach, **manuscript B (Chapter 3)** aims to better understand the effect that a gamified online pronunciation resource customized at the *creation level* can have on the acquisition of L2

English /l/-/r/ pronunciation by adolescent Japanese learners. As such, the study features a gamified learning environment that was customized from open-source materials with the goal of making L2 input more salient to learners, and to provide automated feedback without direct instruction from a teacher. Finally, **manuscript C (Chapter 4)** implements the approach proposed in the first manuscript and executed in the second, in a teacher training program in order to better understand how pre-service teachers use it to customize their own interactive and gamified CALL materials, and to gain insights into how they perceive they used the approach.

It is evident that L2 learners can benefit from teachers taking a more active role in developing interactive CALL materials, thus increasing opportunities for learning. To include teachers in the development of materials, some suggest that they work as programmers (e.g., Godwin-Jones, 2015), while others explain that they can work in teams with programmers to develop materials (e.g., Caws & Hamel, 2016). However, these approaches do not consider teachers working to create materials *independently* and within *their own resources*, including time, availability of technology, teaching experience, and comfort with technology.

To this end, this dissertation aims to make a contribution to the literature by showing the ways in which teachers can: (1) work independently to categorize and customize CALL materials to facilitate the acquisition of L2 skills and related features (manuscript A); (2) customize a gamified course management system at the *creation* level to lead learners to notice and consequently learn specific L2 features in a technology-enhanced interactive setting (manuscript B); and (3) categorize and customize their own CALL materials according to the proposed approach, having their students and learning outcomes in mind (manuscript C). To achieve these goals, two general research questions have been developed to guide the dissertation:

1. How can teachers work on their own to customize CALL materials directed at stimulating L2 learning?
  - This question is directly or indirectly addressed in all three manuscripts (Chapters 2, 3, and 4).
2. What effect can a customized CALL resource made from widely available materials have on L2 learning?
  - This question is addressed in manuscripts B and C (Chapters 3 and 4).

The first manuscript (A, Chapter 2) proposes a three-tier approach to customization that enables teachers to categorize potential CALL materials via (1) adaptation, (2) modification, and/or (3) creation. It additionally provides specific examples of how teachers can work as instructional designers to customize materials at each level, with the specific goal of increasing opportunities for L2 input exposure; see Table 2 for an overview of the objectives and outcomes of each manuscript. A unique feature of this chapter is that it combines insights from instructional design and second language acquisition research to propose an approach that enables teachers to work on their own to develop level-appropriate CALL materials to stimulate L2 use *with* and *through* computers.

The second manuscript (B, Chapter 3) explores how gamifying an online Moodle-based resource can enable students to comfortably practice L2 pronunciation while receiving modified input and immediate feedback. The participants, adolescent Japanese learners, do not typically have access to L2 pronunciation instruction and metalinguistic feedback, so the materials were designed for at-home use without direct instruction from a teacher, thus mirroring the nonformal learning environments discussed earlier. Results indicate that the materials (mostly designed at the *creation* level) facilitated the learning of L2 pronunciation and promoted the development of

metalinguistic knowledge; it also revealed that the students perceived the proposed learning environment as an enjoyable, pedagogically beneficial experience. One of the key goals of this chapter is to better understand the effect that customized CALL resources (particularly those that emphasize materials *creation*) can have on learning.

Finally, the third manuscript (C, Chapter 4) explores the implementation of the proposed approach (to which I will occasionally refer as Barcomb et al., 2018) in a pre-service teacher course about teaching with CALL. The seven-week course took place in an accredited university program and was conceptualized to examine how teachers in training used the approach to develop their own CALL materials. Results indicate that the teacher-participants were able to customize a wide range of technology-enhanced materials, often times including gamified elements to stimulate L2 use and interaction. In addition to analyzing the materials built by these participants, a Socratic-Wheel approach to group discussions (Chevalier & Buckles, 2019) was held in order to understand how the in-training teachers perceived they used the approach in the customization of their own materials. Results indicate that the approach encouraged the teacher-participants to reflect on their technological capabilities when selecting and designing CALL materials, and that they plan to use it in their teaching.

**Table 1.2***Overview of manuscripts*

| <b>Manuscript</b> | <b>Objective</b>   | <b>Outcome</b>   | <b>Participants</b>  |
|-------------------|--|--|--|
| A*                | Conceptualize how teachers can work as instructional designers, who categorize and customize gamified CALL materials in order to stimulate L2 vocabulary practice  | N/A: An approach for customizing CALL materials and, consequently, theoretical in scope  | - N/A  |
| B*                | Investigate the effect that a customized CALL resource with gamified elements (following the approach proposed in Chapter 2) has on the development of L2 pronunciation and metalinguistic awareness, in an online setting | - L2 /r/-/l/ pronunciation<br>- L2 metalinguistic knowledge  | - Adolescent L1 Japanese speakers                          |
| C                 | Understand the types of materials pre-service teachers customize in an intensive course and examine how they perceive they used the proposed approach (Chapter 2) to customize their materials                             | - Online courses with customizable materials targeting L2 interaction<br>- An understanding of the factors affecting pre-service teachers' approaches to customization | - Pre-service teachers in an accredited university program |

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\* These peer-reviewed articles have already been published. I am the first and main author in these publications:

**Manuscript A:**

Barcomb, M., Grimshaw, J., & Cardoso, W. (2018). Foreign Language Teachers as Instructional Designers: Customizing mobile assisted language learning technology. In Y. Zhang & D. Cristol (Eds.), *Handbook of Mobile Teaching and Learning* (pp. 1-16). Springer.

A preliminary version of this paper appeared in:

Barcomb, M., Grimshaw, J. & Cardoso, W. (2017). I can't program! Customizable Mobile Language-Learning Resources for Researchers and Practitioners. *Languages*, 2(8), 1-15.

**Manuscript B:**

Barcomb, M., & Cardoso, W. (2020). Rock or Lock? Gamifying an online course management system for pronunciation instruction: Focus on English /r/ and /l/. *Computer Assisted Language Instruction Consortium Journal (CALICO)*, 37(2), 127-147.

## **Chapter 2: Foreign Language Teachers as Instructional Designers: Customizing Mobile Assisted Language Learning Technology (manuscript A)**

The modern foreign language (FL) teacher is often expected to be technologically minded, an expectation that places an added burden on teachers to implement cutting-edge, pedagogically sound language learning activities (Godwin-Jones, 2015). Teachers are also often expected to facilitate out-of-class practice, as FL students require additional access to target language input because the amount of in-class time is usually limited, particularly in the foreign language context (Collins & Muñoz, 2016). To address these two issues by exploring the role of teachers as mobile-assisted language learning (MALL) material designers and “engineers,” Barcomb, Grimshaw, and Cardoso (2017) proposed three levels of teacher involvement with CALL technology, which enable instructors to customize and/or create material for their learners without prior programming experience. These three levels range from adapting pre-made materials at Level 1 to modifying pre-made materials at Level 2 and creating materials at Level 3. The goal of this chapter is to illustrate the implementation of this proposal in a MALL environment. As such, it positions FL teachers as instructional designers with knowledge to help them make appropriate decisions when using MALL resources.

In order to avoid the misallocation of institutional resources on modern technology, it is imperative to understand that instructional design, not technology, is what is most important to help students achieve learning outcomes (e.g., Bernard et al., 2004). Accordingly, this chapter explores how different paradigmatic approaches to L2 teaching may enable instructional designers to approach MALL technology at all three proposed levels, with multiple perspectives and rationales for customizing MALL materials. Due to the focus on pedagogy in this chapter, the proposed customized materials will be explored from a teacher-determined perspective

(Brandl, 2002), which positions the teacher as the individual responsible for pre-screening and implementing material in a mobile-assisted educational setting. To achieve these goals, a specific type of technology and its affordances are explored: text-to-speech (TTS or speech readers), a widely available technology that reads aloud written texts which may serve as a pronunciation model (see also Liakin et al., 2017, for a similar approach). As TTS can be made available at all three levels, this chapter examines how instructors can adapt and/or customize its use for their students and specific contexts.

This chapter begins by discussing the importance of the L2 input for language acquisition, which serves to motivate the argument for teacher-generated resources to extend the FL classroom. Subsequently, the chapter will introduce a proposal (based on Barcomb et al., 2017) for the establishment of three levels of teacher involvement in MALL material customization and, within this approach, discuss the role of the teacher as an instructional designer and/or MALL engineer. Via the implementation of these three levels, the chapter then explores how FL instructors can adapt and/or customize available TTS software in a MALL setting to increase chances for exposure to FL input. The ultimate goal of the chapter is to help FL teachers approach customizable MALL design in a way that enables them to transform student interaction with the target language anytime anywhere, outside of the language classroom.

### **Input and Autonomous Learning in the FL Classroom via Text-to-Speech Synthesizers**

According to Krashen (1985, 2003), exposure to target language (TL) input is essential for language development. In his input hypothesis, the author posits that language acquisition occurs primarily through the processing of the input that learners receive. As a consequence, language learners need a significant amount of exposure to the TL to develop their language

skills. While Swain (2000) argues that language production, or output, is also essential in SLA, the ability to perceive sounds generally precedes the ability to produce them (Baker & Trofimovich, 2001), although some studies suggest both perception and production develop simultaneously (e.g., Thomson, 2012). Therefore, access to comprehensible input remains essential in the language learning process (Krashen 1985, 2003).

Learners in foreign language settings often have limited exposure to the TL in their daily lives (Bione & Cardoso, 2020; Collins & Muñoz, 2016), which leaves students to their own devices to seek out opportunities to practice and develop their language skills. While there are numerous resources freely available online, Lai et al. (2016) found that language students often feel lost when attempting autonomous learning, as they do not know where to begin and where to find the information they need. Due to their unpreparedness for the task, their participants expressed interest in teacher guidance for out-of-class activities, as their teachers would presumably have the expertise to provide them with direction and assistance in choosing effective resources. In a teacher-determined approach to developing language materials online, the role of the instructor is to recommend resources and select activities that they feel their students would benefit from (Brandl, 2002). Such an approach enables teachers to preselect materials for out-of-class interaction with the target language, without placing the burden on students to find or develop the materials themselves.

While teachers have access to an endless supply of applications (apps henceforth) and computer programs for language learning, deciding on which ones to use with their students can be overwhelming. One example of a readily available program and/or feature available on all computer platforms and in many apps is text-to-speech (TTS) software. Also known as text readers, TTS are computer programs that automatically transform written text into speech, thus

enabling the computer to “talk” or “speak” to the user in different accents and voices representing speakers of different genders, age groups, etc. (see Handley, 2009 and Liakin et al., 2017 for a discussion of TTS’s pedagogical affordances). As such, TTS can provide varied and customizable listening practice and pronunciation modelling that is easy for teachers to implement. In daily life, synthetic voices are often used to replace human speakers to automate or facilitate tasks (e.g., announcements in public transit systems, reading online texts to ease eyestrain, GPS systems). While the quality of synthetic voices has been negatively assessed in the past (e.g., Bossemeyer & Hardzinski, 2001; Nusbaum et al., 1995), modern TTS voices have become significantly more natural and intelligible when compared with earlier voices (see Bione & Cardoso, 2020 for a current evaluation of TTS voices). These systems are also increasingly accessible as they are already built into many desktop software applications (e.g., Microsoft Word), apps (e.g., Quizlet), and mobile devices (e.g., smartphones, tablets); importantly, there are many free options available. A popular example of a free and multi-platform TTS system is Google Translate (<https://translate.google.ca>), available online and as a mobile app. Another freely available TTS system is Quizlet (<https://quizlet.com>), an app that offers teachers without programming experience an opportunity to create sets of online vocabulary flashcards that provide pictures and associated TTS-produced voices. By having access to TTS on mobile devices, language learners may gain even more access to the target language outside of the FL classroom.

With mobile technology becoming a permanent fixture in modern society, there are increasing opportunities for teachers to customize MALL experiences for their students. MALL may be particularly effective as it helps learners and teachers overcome the traditional roadblocks to language learning such as the limitations of time and space (Miangah & Nezarat,

2012). As such, MALL materials can enable teachers to provide materials for their students for use on the go, thereby increasing learner's access to input in the TL. However, increasing access to TL input through customizable, mobile TTS technology is contingent upon teachers being able to match their resources and abilities with the available technology to create mobile TL interaction opportunities for their students. The next section introduces three distinct levels of teacher involvement in customizable MALL materials that provide teachers without programming experience with an overview of how they can become involved in the development of mobile materials for their students.

### **Levels of Teacher Involvement in Customizable MALL Materials**

While teachers have endless options for utilizing pre-made MALL software, it is possible that many are reluctant to take advantage of the technology because they are unaware that they can be easily customized, without the need for sophisticated expertise or programming skills. To encourage FL practitioners to work with the ever-expanding pool of customizable MALL materials and resources, Barcomb et al. (2017) proposed three levels of teacher involvement in MALL material creation, starting with adaptable pre-made materials (e.g., Duolingo), and moving toward modifiable materials (e.g., Quizlet flashcards) and, finally, teacher-created materials (e.g., a customized Moodle course; see Table 2.1 for an illustrative overview of the three levels, where the gray cells show the novice-to-expert gradience nature of Barcomb et al.'s proposal)<sup>2</sup>. By introducing instructors to the three levels of teacher involvement in customizing MALL material, we aim to enable new “MALL engineers” to choose the level appropriate to their resources and skills (e.g., time, money, skills in the use of computer and smart devices) and,

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<sup>2</sup> It should be noted that the concepts of adaptation and modification overlap with curation (e.g., Mathieu et al., 2019), while creation serves a different purpose by enabling teachers to develop CALL materials from scratch. Please see Mathieu et al. (2019) for a description of CALL material curation.

indirectly, their students. For example, MALL engineers do not have to work at Level 3 – the most complex level of teacher involvement – to create effective materials for their students. Conversely, although pre-made materials at Level 1 may seem too inflexible for customized learning, they can still offer students a great deal of interaction with the TL both inside and outside the classroom.

**Table 2.1**

*Barcomb et al.'s (2017) three levels of teacher involvement using TTS*

|                              | Level 1   | Level 2                         | Level 2   |
|------------------------------|---|---------------------------------|---|
| Choose from pre-made content | Yes   | Yes (optional)                  | Yes (optional)  |
| Modify pre-made content      | No  | Yes                             | Yes (optional)  |
| Create own content           | No  | No                              | Yes   |
| Create own activities        | No  | No                              | Yes   |
| Example using TTS            | <i>Duolingo, Google Translate, Natural Reader</i> | <i>Quizlet, Tinycards, Anki</i> | TTS embedded in apps (e.g., <i>Quizlet via Moodle</i> ) |

To improve the development of computer-assisted language learning (CALL) materials, Caws and Hamel (2016) called on teachers to work as “CALL engineers,” applying a hard science approach to the development of L2 materials. Following their appeal, Barcomb et al. (2017) based the development of their three levels of teacher involvement on activity theory at the individual activity level (e.g., Engeström, 2014), which enables teachers to isolate and examine different aspects of human-computer interaction to effectively link them together to create MALL resources. According to this theory, each aspect of an activity (e.g., the targeted language skill, the hardware, software, how students interact with the software or the activity) is

vital to understanding how customizable technologies such as mobile TTS can help students achieve the desired learning outcome(s).

As a MALL engineer, the teacher plays a central role in developing materials that their students can use online or via apps, within a spectrum that spans from teacher-determined to student-determined materials (Brandl, 2002). On the teacher-determined end, the teacher selects the materials and bears the responsibility of developing the activity. Conversely, the amount of knowledge and expertise (e.g., developing comprehension assignments; Brandl, 2002) required by students increases as approaches become more student-determined. While students desire guidance to locate worthwhile out-of-class materials (Lai et al., 2016), there are still opportunities for teachers to shift the responsibility of material creation to the students, so “the teacher’s roles vary from being a facilitator, designer, and guide to a resource person” (Brandl, 2002, p. 89). As will be discussed, this approach lends itself to increasing opportunities for TL interactions in a mobile setting, ranging from more behaviorist to more constructivist activities across the three levels. Providing practitioners with a feel for how to approach material development may therefore enable them to apply specific pedagogical techniques to MALL technology at a level that matches their digital literacy, resources, and their student clientele’s needs and technological skills.

FL teachers face an inherent pressure to have advanced technological knowledge; however, for actually building the materials, teachers are likely left to their own devices as they are not typically provided with up-to-date training (Godwin-Jones, 2015). Even when provided with training and resources, teacher trainees do not always view themselves as future developers of CALL tasks (e.g., Kuure et al., 2016), as the role of the teacher as a CALL developer has not yet been clearly established. A teacher-determined approach at Level 1 may still be difficult for

practitioners, as sifting through the available MALL software can be overwhelming; it is therefore essential to examine each element of a chosen software to determine its effectiveness as a learning tool. As teachers work across Barcomb et al.'s (2017) three levels, discussed above, they have more chances to enhance the digital environment around the object, which requires an increased awareness of how to use the available hardware and software to help students interact with TTS technology in an online classroom.

### **FL Teachers as Instructional Designers and Gamifiers**

Instructional design is best described as a problem-solving activity (Carliner, 2015), whereby the goal is to create materials that enhance a learner's ability. While not bound to the use of educational technology, instructional design has an extensive history with technological advancements as, for example, the use of summative and formative assessment stemmed from attempting to make effective materials for World War II pilots (Reiser, 2001). The military attempted to develop and implement complicated technology to gain an advantage, and as a result, effective training methods were a necessity (e.g., training to become a pilot). Educational technology in the form of instructional media during World War II and more recent uses of instructional television, computers, and the Internet are all technological advancements that have advanced the field of instructional design (Reiser 2001). In this way, technology has expanded design possibilities for instructional design, so the ways that learners can increase their abilities has also expanded.

The approach that a teacher takes to educational technology is critical because, where a behaviorist may see an opportunity for operant conditioning, a constructivist may see a chance for students to take ownership in developing their own way to acquire new knowledge (Roblyer, 2003). While a full discussion about paradigms is beyond the scope of this paper, a basic

discussion in relation to the design of effective MALL materials is warranted. Ertmer and Newby (1993) pair behaviorism, cognitivism, and constructivism with three different levels of task knowledge (i.e., high, middle, low). In this way, as students become more proficient with task material, opportunities for more student-created materials become a possibility. This approach also pairs well with Brandl (2002), whose student-determined approach to material development requires students to have a high level of task knowledge. While working within a specific framework is central to helping learners achieve outcomes, paradigms do not need to be viewed as competing approaches to educational technology (e.g., Robinson et al., 2008; Bernard et al., 2004). Accordingly, this chapter focuses on designing mobile TTS activities that are behaviorist in nature but that also lend themselves to constructivist possibilities as students become more proficient with the material. Consequently, the proposed activities fulfill Roblyer's (2003) recommendation in favor of hybrid approaches to technology-enhanced teaching.

Even when teachers gain the ability to develop materials on a clear premise, students may not be motivated to use the materials consistently. One way of addressing this issue is via the use of gamified elements in pedagogy. While there is indeed a great deal of freedom in instructional design, gamification is a design choice that has become so common in educational technology that it can find a place in all of Barcomb et al.'s (2017) three levels. Video game elements have become prevalent in educational technology because they increase the enjoyment of learning experiences and encourage learners to spend extra time with the learning materials (Aldrich, 2005). Bogost (2011) echoes this sentiment by explaining that video games can help learners to gain knowledge by interacting with and deliberately reviewing material to encourage deep learning instead of merely skimming in a unilateral direction. However, without having a clear view of how to develop the learning materials, the use of gamification and modern technology

will at best seem like a gimmick (Sykes, 2013). Consistent with having a clear approach to instructional design, Godwin-Jones (2014) points out that a key advantage to a self-developed game is that it is easier to track data to figure out how the game is being played, which reveals how outcomes correlate with actual game use. Such use of technology is beneficial as instructional designers must measure their results not only during the design process but also by understanding how effective the materials are after implementation, as it is only by following the process through implementation and ongoing maintenance that designers can ensure they have built effective materials (Carliner, 2015).

### **Customizing Mobile Technology to Increase TL Interaction: The Pedagogical Use of TTS**

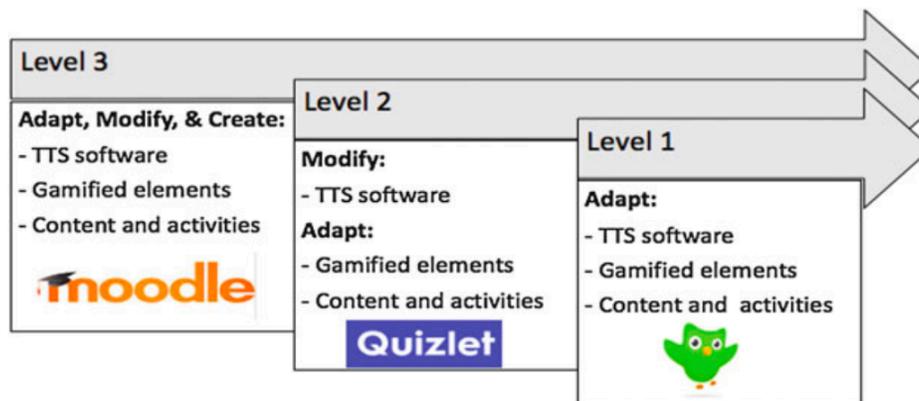
This section demonstrates the implementation of the three levels of teacher involvement in customizing mobile TTS technology for pedagogical use, based on Barcomb et al.'s (2017) proposal. As described earlier, due to the teacher-oriented scope of the chapter, these activities will follow a teacher-determined design to materials development, as described in Brandl (2002). Within this approach, the teacher selects and pre-screens the materials, builds assignments, and then makes them available for students. This section also describes and explains the three levels proposed by Barcomb et al. (2017): Level 1 targets the adaptation of Duolingo, Level 2 targets modifying Quizlet TTS cards, and Level 3 targets the implementation of TTS cards into a Level 3 customized Moodle course with teacher-created content and gamified elements (see Fig. 2.1 for an illustration of the proposed activities using the three levels of teacher involvement in MALL customization). Gamified elements are considered at each level as they have proven to be pedagogically effective in FL research (e.g., Reinders & Wattana 2014; Figueroa Flores 2015).

## *Adapting Mobile TTS Materials: Level 1*

Duolingo (Duolingo, Inc., Pittsburgh, PA, USA, <http://www.duolingo.com>; freely available online as well as for Android and iOS devices) has gained popularity for offering a fun approach to autonomous language learning, particularly due to its pre-defined learning paths, user-friendly interface, and built-in gamified elements. Consistent with MALL software at Level 1, the normal Duolingo user interface does not allow language learners to choose which features to target. This, however, does not mean that Duolingo's resources lack strengths, especially considering that they can introduce new vocabulary, provide comprehension activities, and motivate students with gamified elements within an aesthetically pleasing interface. To create a private learning space, teachers can create their own private Duolingo classroom via Duolingo for Schools (<https://schools.duolingo.com>) and distribute links to students in their class. Duolingo for Schools also enables teachers to keep track of data such as the last login and number of activities completed, all within a user-friendly dashboard for teachers.

### **Figure 2.1**

*TTS, gamified elements, and related activities: three levels of teachers' involvement with MALL resources (Barcomb et al., 2017)*



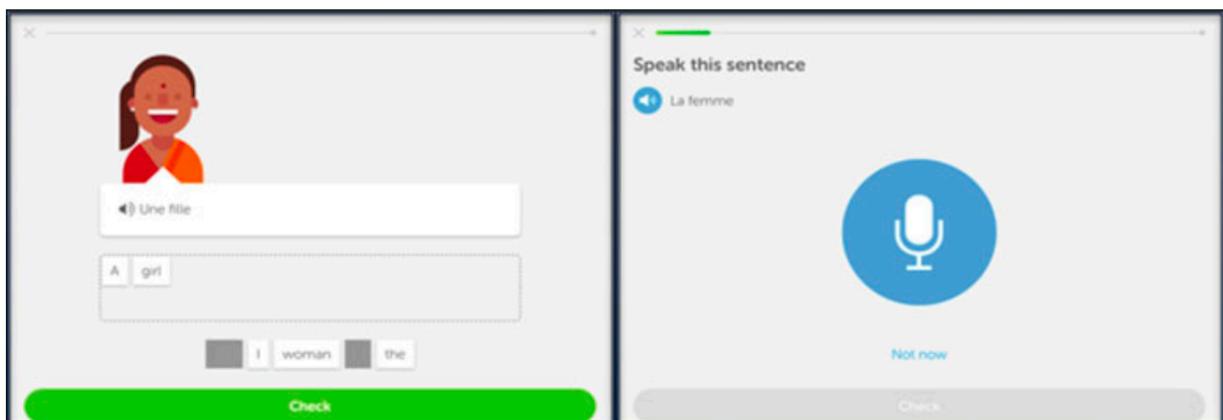
Duolingo offers a wide range of TTS materials that users can interact with outside of class. TTS activities in Duolingo include listening to a sentence and translating it, which affords the student the opportunity to respond to aural input with written output. Users may also be presented with a word or phrase, listen to a TTS pronunciation model, and then record themselves pronouncing the target word or phrase. In both cases, learners are provided with instant feedback on their ability to interact with TL (TTS-based) materials from a range of categories (e.g., adjectives, food vocabulary). The activities are structured in a way that vocabulary-building and comprehension checks occur simultaneously through the use of both speaking and listening assignments (see Fig. 2.2 for the interface of a listening and speaking activity in Duolingo). This enables students to increase their interaction with the TL in the mobile setting, as the software helps learners to set goals, track progress, and interact with gamified elements such as experience points and levels in a way that promotes consistent practice. A full discussion about gamification will be detailed in Level 3, where gamification as a design choice becomes a more relevant topic. Teachers without programming skills, in this instance, can leverage pre-made content so that students can use mobile devices to create opportunities for students to interact with the TL outside of class.

Level 1 was originally conceptualized as a way for the teacher to adapt pre-made materials to enhance out-of-class TL interaction, such as using the TTS voices offered by Google Translate as a pronunciation model. However, Duolingo for Schools contains a feature that encourages reconsideration of what it means to adapt pre-made materials. Duolingo for Schools has a “Classroom Activities” option which automatically generates questions consistent with user proficiency, based on the user logs and data from students in a particular course. While the activities in Duolingo are geared toward beginner language learners and are more behaviorist in

nature (e.g., as defined in Roblyer, 2003), they do provide unique opportunities for TL interaction on the go and, with the assistance of a teacher, could be complemented with more constructivist, in-class activities such as role playing and research projects. The design choices at Level 1 are predetermined, but there is still a variety of possibilities to adapt pre-made MALL technology to help students develop a consistent relationship with the TL outside of class, with activities that target their learning needs and interests.

### **Figure 2.2**

*Duolingo TTS translation activity (left) and a TTS listen and repeat pronunciation activity (right) for French FL speakers*



### ***Modifying Mobile TTS Materials: Level 2***

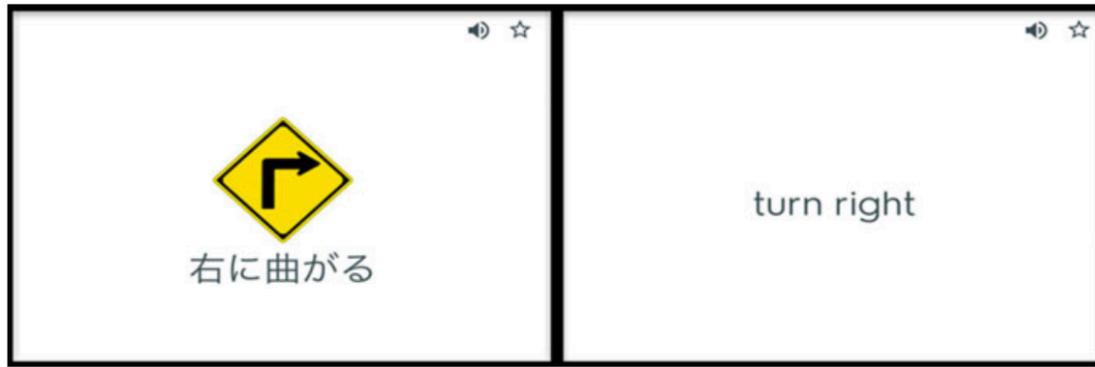
At Level 2, the teacher has the ability to modify TTS cards, but the activity types and gamified elements are still predetermined by the application. Quizlet (Quizlet, Inc., San Francisco, CA, USA, <https://quizlet.com>) is a flashcard-based app that affords teachers the freedom to modify TTS flashcards for their students (Fig. 2.3). Similar to Level 1, the predetermined gamified elements and activities offer the students a wide range of TL vocabulary activities in the mobile setting, which are made available to students via a class link. To make the cards, teachers type a target word in the TL and choose from over 150 languages for TTS

pronunciation modelling. In addition to a database of images readily available to teachers to complement the cards, a paid account affords teachers the opportunity to upload their own images. This enables students to use mobile technology to swipe through cards, flip them to view a relevant image, and listen to target language pronunciation of each word or phrase.

There are a number of predetermined activities that teachers can make available for their students to practice TL vocabulary with Quizlet. In the traditional flashcard mode, for example, students are able to see pictures, flip the card, read the word, and play the TTS model. In the “spell” mode, students can check their comprehension by taking a test that randomly generates questions that require learners to listen to a TTS voice, view the accompanying image, and then spell the word. To increase the level of difficulty, some items in “spell” do not contain an image – only the TTS pronunciation of the word or phrase. Similarly, timed matching games and writing tests are additional predetermined activities that students can play to practice target vocabulary. This offers students a number of ways to interact with TTS cards in the TL and consequently have access to comprehensible input outside of class, as recommended by Krashen (1985, 2003). In addition to the mobile setting, in classrooms where tablets are readily available, Quizlet Live includes competitive, in-class games that students can play against each other by syncing their tablets and working in groups to compete against other groups. A live scoreboard keeps track of student progress to encourage friendly competition between groups. Unfortunately, Quizlet Live is restricted to the in-class setting; nonetheless, it serves as an effective study companion to out-of-class interactions with TTS cards.

**Figure 2.3**

*Quizlet TTS card in Japanese (left) and the English definition on the back of the card (right) for Japanese as a FL learners*



While the differences between Levels 1 and 2 are subtle, the ability that teachers have to modify their own cards at Level 2 opens up a number of pedagogical possibilities. For example, teachers may like the way that their textbook presents grammar but remain dissatisfied with the amount and variety of vocabulary included in the book. In this case, teachers can use Quizlet as a mobile supplement to a traditional textbook to include the vocabulary they deem to be more relevant. For teachers who do not have the time or resources to create their own activities from scratch (such as those found at Level 3) but want to customize material, Level 2 offers modifiable TTS materials with effective predetermined activities and gamified elements. While the activities proposed are mostly behaviorist in nature (or directed, using Roblyer's, 2003 terminology), they provide an interactive way to practice new TL vocabulary. Level 3, as will be seen, gives teachers full control over adapting, modifying and, creating mobile TTS materials, comprehension activities, and gamified elements.

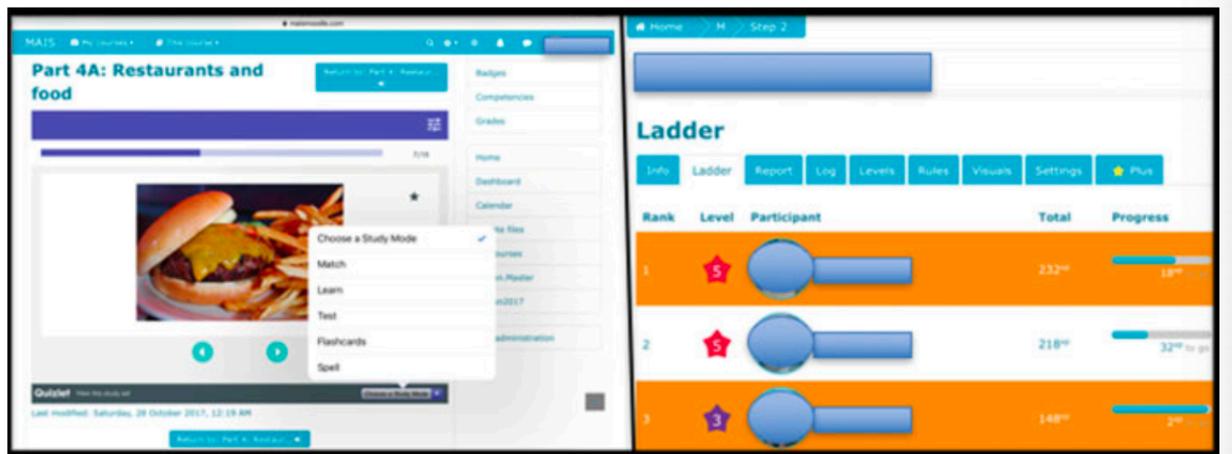
### ***Creating Mobile TTS Materials: Level 3***

At Level 3, teachers can take advantage of the adaptation and modification capabilities found at Levels 1 and 2 while also being able to create content and activities. As previously

mentioned, one should not overlook the importance of learning how to program; however, Level 3 provides teachers with an advanced set of tools and design choices to help students increase interaction with the TL in the mobile setting without having to invest the time to learn advanced programming. Level 3 affords MALL engineers the ability to peruse the robust supply of customizable resources, compile features they deem to increase TL interaction outside of the classroom, and implement those features into a customized course for their students (Barcomb et al., 2017). As such, this level focuses on creating activities and customizing gamified elements to encourage students to study the Quizlet cards created in Level 2 and combines them on a single platform (see Fig. 2.4 for an example using the course management system Moodle). At Level 3, teachers can also shift from behaviorist to more constructivist approaches (e.g., Roblyer, 2003), so that students who are proficient with the material can have opportunities to create their own TTS cards or generate review quizzes for the other students to practice. This is also in line with Brandl (2002), who suggests that a shift from teacher-determined to student-determined material development places material creation in the hands of the students to encourage deeper learning. In short, there are several instructional design choices for practitioners to explore at Level 3.

**Figure 2.4**

*Quizlet TTS food related vocabulary embedded in a Moodle course with predetermined study modes (left) and the associated points distributed to a Level Up! Leaderboard (right)*



Moodle, an open-source course management system, which is commonly used on desktop computers, launched its mobile application in 2015, Moodle Mobile (for Android and iOS). Current versions such as Moodle 3.4 (November 2017) enable teachers to create mobile learning opportunities for tablets or smartphones. One of the strengths of Moodle is that teachers can design their own modules: series of activities that last for a specific duration such as 1 day, week, or month; a course is made up of a series of modules. Within a module, teachers can restrict student access to activities until specific conditions are met (e.g., passing a quiz), which is one of the ways that Moodle can resemble a game with levels (Pastor-Pina et al., 2015). Teacher-created multiple choice, fill-in-the-blank, and listening quizzes are all a possibility for comprehension checks, so pre-screening also becomes a process of creation in this instance. In addition to creating quizzes, there is an abundance of plugins in Moodle that can enable teachers to gamify their courses with badges, leaderboards, and progress bars. One of these plugins is Level Up!, a leaderboard module that rewards students with experience points for attempting

assignments and reviewing material (see Fig. 4 for an illustration of Level Up! and its reward scheme). Teachers can set the amount of experience points students receive for each activity and the amount of points necessary to accumulate the badge for that level (e.g., Level 1 badge = 50 points; Level 2 badge = 100 points). This set of customizable tools gives teachers the ability to create MALL materials, fully equipped with TTS technology, comprehension checks, and motivational affordances.

To create a gamified vocabulary course with activities and features similar to those found at Levels 1 and 2, teachers could start by embedding a set of Quizlet cards into a mobile Moodle course. To begin enhancing the environment around the cards, activity completion can be set up so that, once the student views the cards, the system automatically opens the next activity and distributes points to the user's leaderboard account for attempting that activity. This proposed Level 3 activity is a culmination of all three levels, as adapting Moodle's activity completion and restrict access to mimic gamified elements enables teachers to embed modified TTS cards in an interactive environment they create through customization. To check for comprehension, teachers can create their own listening quizzes by using a combination of the quiz function and the PoodLL language recorder plugin, which enables teachers to create listening questions by making their own recordings; alternatively, students or instructors could make recordings using a TTS voice. Students could take a multiple-choice quiz that requires them to listen to a TL vocabulary word and either fill-in-the-blank or choose the L1 equivalent from a list. If students also receive experience points, badges, and recognitions on the leaderboard for practicing activities, then there is positive reinforcement for students to continue practicing the activities in a module, even after completing all the activities once. At Level 3, it is up to each teacher to

create a course that targets the specific needs of their learners, yet they need to do this within their resources and abilities.

Gamification, in addition to creating more enjoyable learning experiences, offers unique insights into instructional design choices and student usage patterns. One of the strengths of gamification is that it can enable students to work backward to review material (e.g., Bogost, 2011) and focus on specific material that is worth more points. In this way, if a teacher looks at data logs and finds that students did not spend enough time reviewing the vocabulary cards, an appropriate design choice would be to make those cards worth more experience points to encourage students to focus on foundational knowledge before moving on to more difficult activities. As an example of the level of insight that gamification provides as a design choice, Godwin- Jones (2014) points out that a self-developed game is particularly effective for tracking data, a possibility that can also be found in Moodle via its user logs. To explore the pedagogical insights hidden in user logs, Barcomb and Sheepy (2017) applied a data mining algorithm to data logs from a gamified Moodle course targeting foreign language pronunciation. As a result of analyzing the observed patterns, they were able to better understand user tendencies, particularly in regard to how students behaved before communicating in video forums, where they recorded show-and-tells and responded to each other. The opportunities to customize MALL materials without programming skills enable teachers to create unique learning environments based on their own content and reward systems to motivate students to interact with the TL outside of class.

## **Future Directions**

This chapter's main goal was to provide L2 instructors with some guidance on how to implement the use of MALL in their classes, depending on their levels of technological expertise and needs. To achieve these goals, this chapter has demonstrated how the implementation of Barcomb et al.'s (2017) three levels for MALL material development can assist teachers in deciding which strategy or level is most appropriate for their students: adapting (level 1), modifying (level 2), or creating (Level 3) MALL material. Using TTS as a target tool, this chapter has also shown that, depending on teachers' available resources and their technological skills and willingness to use them, they can easily adapt existing technologies in order to increase their students' exposure to the target language input, motivate meaningful interactions with the technology, reduce the place and time restrictions that affect the L2 classroom (Traxler, 2007), and consequently encourage students to learn on their own, anytime, anywhere. It is only by enabling students to have increased interaction with the TL outside of class that students will truly have the input necessary to make gains in the foreign language context. The authors acknowledge, however, that the MALL implementation ideas discussed in this chapter require a long-term dedication to conceptualizing, creating, and revising materials and to understanding how to properly adapt/modify/create MALL materials into a learning experience: it involves a continuous cycle of designing, implementing, and (re-)evaluating (McKenney & Reeves, 2012).

Foreign language teachers are faced with a number of constraints, ranging from time limitations to using materials that are not motivating or relevant to students. The dual need for out-of-class interaction and relevant materials that can provide such interaction is a key reason that, for example, Blake (2013) highlights the potential for web-based language learning materials to replace the use of a static textbook. If paired with TTS technology, customizable

MALL software shows promise in FL education as it affords teachers a feasible way to introduce materials that increase TL interaction outside of class. While there are numerous ways in which mobile technology can transform the amount and types of interactions that learners have with the TL, it is important to remember that instructional design, not the technology itself, is what leads to learning (e.g., Bernard et al., 2004; Reiser, 2001).

## Contributions to the Thesis: Part 1

This thesis examines the customization of CALL materials from three perspectives: it proposes an approach that positions teachers as “instructional designers” of their own CALL materials to stimulate L2 use and interaction *with* and *through* technology, sometimes including the use of gamified elements (manuscript A); it then implements the proposed approach in a study that investigates the effect that a customized CALL resource can have on young Japanese learners’ pronunciation of /r/ and /l/ (manuscript B); and, finally, it assesses the implementation of the proposed approach from a pre-service teacher’s perspective (manuscript C).

In the preceding chapter (manuscript A), I have conceptualized an approach that views teachers as instructional designers to categorize and customize (i.e., adapt, modify, create) CALL materials to stimulate L2 vocabulary practice, within their time, resources, and technical abilities. Two key goals of this approach are to: (1) show teachers the types of L2 interactions that they can target in the design of CALL materials, with basic technological abilities; and (2) increase the opportunities that L2 learners have to acquire specific L2 knowledge (i.e., vocabulary) via the use of gamified elements that reward learners for interacting *with* and *through* the computer. The proposed approach is hypothesized to show language teachers, representing a wide range of educational background and technological abilities, three ways in which they can develop materials for L2 use: adaptation, modification, and creation.

In the next chapter (manuscript B), I will demonstrate how the proposed approach can be explored in an experimental setting. In this study, I test the effect that a customized CALL resource with gamified elements developed at the *creation* level can have on the development of L2 pronunciation and related metalinguistic awareness.

### **Chapter 3: *Rock or Lock?* Gamifying an online course management system for pronunciation instruction: Focus on English /r/ and /l/ (manuscript B)**

Over the past two decades, research in second or foreign language (L2) phonology, particularly within communicative frameworks (e.g., Celce-Murcia et al., 2010), has pushed pronunciation instruction and research forward. The move from achieving native-like pronunciation to a focus on more attainable goals such as the development of intelligibility and comprehensibility (e.g., Derwing & Munro, 2005) has enabled instructors to help learners work towards realistic goals, as opposed to laboring towards unrealistic objectives such as the achievement of native-like pronunciation (Levis, 2005). While many experiments attempt to understand the process of acquiring an L2 phonological system (e.g., Saito, 2013), there is a lack of research that investigates the development of *young* beginning learners' L2 pronunciation — without direct instruction from a teacher— in the foreign language setting (for examples with adult learners in a computer-assisted environment, see Fouz-Gonzalez, 2018; Mompean & Fouz-Gonzalez, 2016; and Thomson, 2011). To this end, this paper investigates the effectiveness of using gamified pronunciation instruction on the development of L2 phonology.

In particular, this pilot study investigates how a gamified learning environment (occasionally referred to as “site”) might contribute to the acquisition of foreign /r/ and /l/ by a group of Japanese junior high school English learners. The open source course management system, *Moodle*, was chosen because it is amenable to gamification via user-designed plugins (e.g., leader boards; Pastor-Pina et al., 2015). As it will be detailed, a gamified *Moodle* site with pronunciation videos has the capacity to persuade learners to study about and practice pronouncing articulatorily difficult L2 segments. In this study, a gamified pronunciation site, titled “English Detective”, rewarded students with points and badges as they worked through a

series of detective themed pronunciation activities. A one-group pretest-posttest quasi-experimental design was employed to investigate the effectiveness of a gamified version of *Moodle* (specifically designed for this study, containing explicit pronunciation videos) on the acquisition of two English segments, /r/ and /l/, and associated metalinguistic knowledge.

## **Background**

### **Second Language Pronunciation Instruction**

As has been confirmed by researchers and practitioners, pronunciation instruction is still neglected in the L2 classroom (Celce-Murcia et al., 2010; Derwing & Munro, 2005), even when teachers understand its importance (Bai & Yuan, 2019). Currently, pronunciation research and pedagogy focus on intelligibility as the ultimate goal of pronunciation instruction (e.g., Huensch, 2019; Jenkins, 2000), within an approach that recognizes the importance of both segmental and suprasegmental aspects of L2 phonology (Celce-Murcia et al., 2010; Jenkins, 2000; Lee et al., 2020). However, in foreign language contexts, access to the target language via exposure or interaction with other L2 speakers is often limited to the classroom, where time and resources are limited (Collins & Munoz, 2016). Accordingly, attention needs to be placed on how to teach pronunciation in a way that expands opportunities for learners to develop intelligible speech without exhausting the allotted time and resources.

One approach to pronunciation instruction is form-focused instruction, which is described as any effort a teacher makes to help learners build implicit or explicit knowledge about language form (Spada, 1997; Tomita & Spada, 2013). Form-focused instruction consists of a sequence of teaching strategies that include noticing, building awareness, and then practicing the target feature (Lyster, 2007). The first step, noticing, is established when learners pay attention to and notice the accurate use of certain L2 features (DeKeyser, 2007). This is of importance to this

study because the instructional pronunciation videos used in the treatment (see forthcoming discussion) are specifically designed to help learners cue in on the mouth to develop explicit knowledge about how to move their articulators to produce the target sounds: /r/ and /l/. The next step, awareness, occurs when students receive corrective feedback as a method of raising awareness during communicative activities. The third step, practice, occurs when they communicate or produce speech, which is the time when it is important for teachers to provide explicit corrective feedback for target features that are particularly difficult to notice (Spada & Lightbown, 2008).

A study about the effect that form-focused instruction and corrective feedback have on Japanese learners' pronunciation of English /r/ was conducted by Saito and Lyster (2012). Sixty-five Japanese university students learning debate skills in English were split into two groups: while one received form-focused instruction before communicative activities, the other received the same form-focused instruction in addition to corrective feedback (via recasts). The results revealed that learners who received corrective feedback in the form of pronunciation-focused recasts outperformed the group who only received form-focused instruction, though it showed only a slight improvement in this instructional setting, and only in familiar lexical contexts.

To explore this finding, Saito (2013) conducted a study where learners in one experimental group received form-focused instruction (as discussed above), and the other experiment group received a combination of explicit phonetic information and form-focused instruction; the control group participated in meaning-oriented activities that did not focus on form. Explicit phonetic information differs from form-focused instruction because learners are specifically drawing their attention to segmental L2 speech instead of lexical units (Saito, 2013), which was hypothesized to magnify the effects of form-focused instruction and to help learners

establish new phonetic categories. Saito's results indicate that learners who receive both explicit phonetic information and form-focused instruction can make improvements at pronouncing /r/ in both familiar and unfamiliar lexical contexts, while learners who only receive form-focused instruction will likely fail to do so.

To deliver explicit phonetic information, Saito (2013) emphasizes providing over-exaggerated exemplars of the pronunciation of key features (e.g., lip rounding, slow speech) to help learners notice the differences between perceptually similar sounds such as /r/ and /l/. The author grounds this decision in research that examines how speech perception contributes to learners developing new phonetic categories to improve L2 pronunciation (e.g., perceptual assimilation model: Best & Tyler, 2007; speech learning model: Flege, 1995). Accordingly, instruction needs to focus on raising perceptual noticing of target sounds both lexically and phonetically in order to help learners create new phonetic categories so that they can differentiate similar sounds (Saito, 2013). In this study, digital technology was used to enhance the delivery of the explicit phonetic information, as students cued in on the instructor's mouth in videos specifically designed to provide explicit information before practicing pronunciation and trying minimal pair listening quizzes.

### **Computer-Assisted Pronunciation Instruction**

Research in computer-assisted L2 learning indicates that it can be effective for providing opportunities to improve both knowledge of target sounds and the pronunciation of those features. In this scenario, learners have access to two channels of feedback— audio and visual (Hardison, 2004), which could enhance the delivery of explicit phonetic information. Tsubota et al. (2004) explored the combination of audio and visual feedback in an experiment that focused on autonomous pronunciation practice in a multi-modal system that provided university students

with a detailed pronunciation report. Specifically, the system identified segmental errors such as /r/ and /l/ and provided written metalinguistic information about how to produce the target sound, which contributed to pronunciation gains. In further evidence for digitally-based autonomous pronunciation practice, Mompean and Fouz-Gonzalez (2016) conducted a study about the pedagogical use of Twitter, wherein participants received daily tweets that featured a target word and information on how to pronounce it. The results indicate that the learners autonomously improved their L2 pronunciation by the end of the treatment. Another recent example of how digital environments can be effective for pronunciation instruction is Fouz-Gonzalez (2018), who provided learners explicit information about L2 pronunciation in class before having them listen to a podcast with examples of the target feature. Students then practiced the features at home on their own before doing a group pronunciation activity in class. These aspects of CALL based pronunciation practice are important because the use of technology in pronunciation instruction should enable learners to practice on their own without time constraints or the pressure associated with speaking in front of other students (Fouz-Gonzalez, 2015).

One possible way of incorporating technology to deliver explicit phonetic information is through Fogg's (2002) captology approach, which is the use of computing technology to persuade individuals in ways human cannot. One specific use, technology as a *medium*, is based on providing digital experiences that make anxiety-inducing activities more approachable. For example, the use of pronunciation videos that zoom in on the teacher's mouth could provide key metalinguistic information about how to produce the target sound. In a digital space, this can be done without the pressure associated with excessive requests by the instructor to repeat sounds, looking closely at the instructor's mouth, or making pronunciation mistakes in front of other. Such an approach could extend the work of Saito (2013), as the delivery of explicit phonetic

information in instructional settings is typically only available in person. The use of digital tools to help students visualize how to pronounce L2 features in this manner contributes to the awareness of the target features (Lord, 2019). In sum, there is evidence that blending explicit pronunciation instruction with digital technology is a promising direction in research about L2 pronunciation instruction, but an equally important aspect of digital environments is that they afford learners opportunities to practice pronunciation in a comfortable setting of their choice.

Of interest to this study is the potential that explicit pronunciation instruction has to reduce language anxiety. L2 metaphonological awareness is a specific type of metalinguistic skill that focuses on L2 pronunciation (e.g., Celce-Murcia, 2010; Saito, 2013) and includes activities such as teaching students how to position their articulators to produce a specific segment. In the process, learners can take a more reflective and playful approach to pronouncing problematic L2 features (Szyszka, 2017). Szyszka stresses that this type of explicit pronunciation strategy enables the learner to take an approach that reduces anxiety by increasing ownership in developing skills that protect them from future embarrassment caused by pronunciation errors. This indicates that providing explicit phonetic information in a digital setting equipped with gamified elements could potentially help learners to practice pronunciation in a more comfortable way.

### **Gamified Learning Environments in L2 Acquisition**

The notion of digital games serving as a space for learning is well documented (e.g., Gee, 2007; Bogost, 2011). Gamification, however, is different from video games because it utilizes video game *elements* (not games) to motivate users to engage in learning activities (Deterding, et al., 2011). Gamification includes elements from games such as avatars, feedback, levels (and consequently competition) under explicit and enforced rules, and teamwork (Reeves & Read,

2009). Hamari, Koivisto, and Sarsa (2014) explain that when motivational affordances such as points are earned, a psychological response is triggered, which, in turn, triggers a specific behavioral outcome such as pronunciation practice.

In L2 learning, Reinhardt (2019) proposes a framework to examine research and practice in digital games, which includes three distinct types: game-enhanced, game-based, and game-informed. The authors explain that game-enhanced materials include off the shelf games not designed for language learning, while game-based materials take advantage of game play for educational purposes. The third type, game-informed materials, includes elements of games that can be used to enhance L2 teaching and learning, which includes gamified approaches. Of importance to this study is that Reinhardt (2019) stresses that it is possible to utilize game-informed materials to investigate a research problem from the perspective of L2 pedagogy and/or the perspective of the learner. In line with this, the present study aims to inform L2 pronunciation research by emphasizing a comfortable and fun environment to develop explicit phonetic knowledge and practice pronunciation.

A popular example of gamification in language learning can be found in the app, *Duolingo*, which enables learners to earn points and badges as they work through levels on their own, completely free of a pedagogical context. To test the effectiveness of the app in a pedagogical setting, Rachels and Rockinson-Szapkiw (2017) investigated how *Duolingo* could be used to contribute to the acquisition of vocabulary and grammar in L2 Spanish. While one group of students completed lessons on the app, the other covered comparable materials in a classroom setting. The results indicated that there was no difference between the two groups in regard to gains, demonstrating that this type of technology is useful for L2 instruction. It is possible that the participants in both groups performed comparably because they both received

grammar-translation style instruction. While this can be effective in some instances (e.g., for learning vocabulary and morphosyntax), we do not believe it would be as beneficial for pronunciation instruction.

For a more comprehensive and inclusive approach to L2 pedagogy, Reinhardt (2019) recommends the use of “smaller, limited games and educational apps that utilize *some game mechanics*” (p. 7) in order to create a more learning-oriented system. We believe that open source course management systems like *Moodle* can be adapted to fulfil this recommendation, as they are easily accessible to and commonly used by L2 teachers. Importantly, *Moodle* can be gamified to trigger responses via the following elements: progressive learning (e.g., via maps, levels); socialization (e.g., when students collaborate on missions, send messages); feedback (e.g., instant feedback, progress bars); and rewards (e.g., coins, badges, leaderboards; Pastor-Pina et al., 2015). In this way, many typical elements of a *Moodle* page (e.g., conditions to access, chats), if combined with user-designed gamified-plugins to create leaderboards and reward systems, may contribute to pronunciation practice. Of further interest is that programming knowledge is not necessary to create such a system, which can instead be created through the customization of open source materials (Barcomb et al., 2017, 2018). This could enable more teachers to explore the use of gamified materials to enable students to practice pronunciation outside of class.

Research on the use of digital games in L2 pedagogy indicates that the role of the teacher and the location in which learners study can take on many different forms. For example, Sauro and Zourou (2019) explain that the “digital wilds” include online language learning environments that are completely independent of a pedagogical institution and can include activities such as using a second language to play a video game online with other users. In line

with this, Sunqvist (2019) reports that Swedish secondary students who played English commercial games on their own online outperformed those who self-identified as infrequent users or non-gamers in recognizing and using L2 English vocabulary. Given that games and gamified learning environments, as discussed above, expand opportunities for language learning on-the-go, teachers may decide to incorporate such environments in pedagogical settings. In specific, *at-home teacher-initiated* materials (Sundqvist & Sylvén, 2016) are teacher-selected online language learning materials that students can use outside of class. An example of this can be seen in Newgarden and Zheng's (2016) study, in which the researchers replaced a semester-long ESL course with the commercial game *World of Warcraft*. Participants completed missions in the game with other classmates and the teacher once per week beyond the walls of an institution by using text-chats and video conferencing software to communicate with each other. Instead of adapting a commercial game to expand language learning opportunities beyond the walls of the language classroom, the current study examines a game-informed/gamified system that could be implemented as an online resource in an at-home teacher-initiated setting.

### **The Present Study**

This study examined the pedagogical use of an online gamified pronunciation site to aid Japanese junior high school students in the production of /r/ and /l/ by enhancing their explicit understanding of these segments. This population was chosen because research indicates that the foreign language classroom in Japan provides limited opportunities for pronunciation practice (e.g., Machida, 2016). This scenario is further complicated by Japan's Ministry of Education's attempt to implement high-level linguistic activities such as debates into all classrooms (MEXT, 2013). This pilot study aims to propose a way to alleviate these constraints by enabling students to study L2 pronunciation online.

The target segments /r/ and /l/ were chosen because Japanese learners have difficulty acquiring them in both perception (e.g., Lively et al., 1993) and production (e.g., Larson-Hall, 2006). Japanese L1 learners also have difficulties differentiating /r/ and /l/ and instead perceive it as the Japanese tap, which is situated in a space between /l/, /r/, and /d/ (Hattori & Iverson, 2009). Finally, these two segments are of interest because they carry a high functional load, as defined by Brown (1988) and Celce-Murcia et al (2010); that is, they are highly productive in English and serve to differentiate many highly frequent words in the language.

The following research questions were designed to address the goals of this mixed-methods study, which explored the use of a gamified online pronunciation environment to facilitate the development of /l/ and /r/ in a foreign language context in Japan. To determine the effectiveness of the proposed approach to teaching pronunciation, we have developed the following research question: What are the effects of the proposed gamified environment on the pronunciation of the /r/-/l/ distinction among Japanese learners of English? The question can be subdivided into three sub-components:

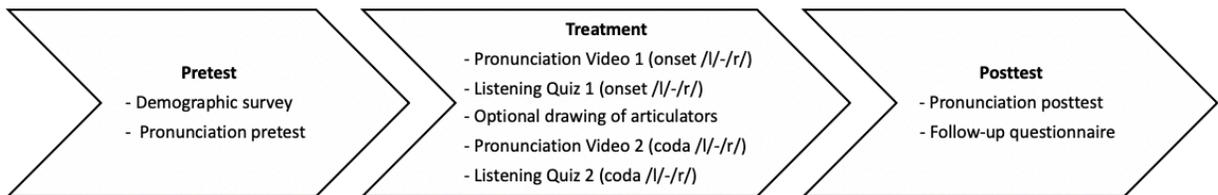
- Does the proposed gamified environment contribute to improved pronunciation of /r/ and /l/?
- Does the proposed gamified environment facilitate increased awareness of the /r/-/l/ distinction?
- What are users' perceptions of learning pronunciation in the proposed gamified environment?

## Method

This one-group pre-test post-test study took place in a gamified *Moodle* site and lasted for two weeks. It aimed to answer the first component of the overarching research question quantitatively with tests to determine if our proposal can improve learners' production of /r/ and /l/. After participants finished their final pronunciation test, they completed a posttest follow-up questionnaire that gathered qualitative data in the form of written responses to better understand the second and third components of the research question. The data include responses related to how they perceived their explicit phonetic awareness was facilitated by pronunciation videos, how they perceived gamification (in general), and how they perceived the gamified site, including its ability to reduce anxiety and promote learning. The research design is illustrated in Figure 3.1.

**Figure 3.1**

### *Research design*



### **Participants**

The study included 11 Japanese junior high school students living in Japan (female: 7; male: 4) with a mean age of 13.7 ( $SD=1.7$ ), all participating from home and interacting with the main researcher via a popular videoconferencing application; they were told that they would participate in a video game-like class to practice English using the video and audio functions of their iPads or laptop computers. Participants were recruited through learning centers, blogs, and online groups dedicated to learning English (i.e., they were not in an intact class). All 11 students

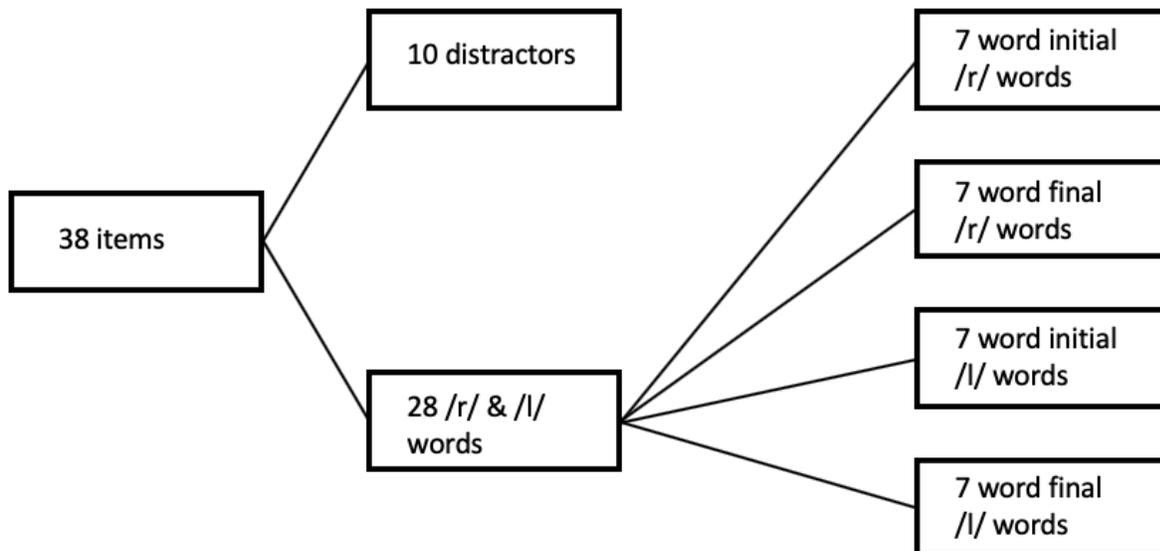
who started the study completed it through the posttests, although participation was voluntary, and they were not compensated for their participation. The entire study was conducted online.

### Instruments

To determine whether the proposed gamified environment contributed to improved pronunciation of /r/ and /l/, students took a 38-item pronunciation pretest and posttest that included 28 target simple /r/ and /l/ words distributed in onset (word-initial; e.g., /r/ice, /l/ate) and coda positions (word-final; e.g., poo/r/, mai/l/). The remaining 10 items were distractors that contained neither /r/ nor /l/ (e.g., big). A breakdown of the items used in the study is shown in Figure 3.2.

**Figure 3.2**

*Pronunciation materials*



The participants were asked to produce the target words in both isolation (e.g., /r/ain) and inserted at the beginning of short pause-initial sentences (e.g., /r/ain, I like that!). They completed a listen-and-repeat test that involved watching video recordings of either words or

brief sentences before recording themselves saying the word or phrase that they heard. The pretests and posttests were both done at home via *Moodle*, which was designed to provide learners a comfortable place to do the assignments and reduce the observer's paradox (i.e., the participants' discomfort in being observed, which may affect their linguistic output; Labov, 1972). The accuracy of /r/ and /l/ pronunciation was assessed as accurate or inaccurate by one of the researchers (a native English speaker) and one assistant (a fluent English speaker of Japanese origin). When the raters disagreed on an item (which rarely happened), a third researcher was asked to make a determination. If students produced /l/ instead of /r/, or instead produced the Japanese tap (i.e., /ɾ/), then the item was deemed to be inaccurate. There were 28 /r/ and /l/ items (14 of each) on the pre- and post-test.

Qualitative data were collected to understand how learners perceived the pronunciation videos affected their awareness of the target features, and how the proposed gamified environment (including its anxiety-reducing benefits) contributed to learning. These data were collected in the form of an eight-item written follow-up questionnaire that asked open-ended questions in Japanese: (1) What was the strength of the site to learn English? (2) What do you like about this site? (3) What was the weakness of this site to learn English? (4) What would you change about this site? (5) After learning with the site, do you feel that you are more comfortable speaking English in front of your class? (6) Do you feel that you learned English from the site? (7) Would you like this site if it was part of your school curriculum? And (8) How do you feel about learning English from videos? These eight questions required open-ended responses about how the participants perceived learning pronunciation on the site and what they liked or did not like about the pedagogical experience. The questionnaire was completed online and was located in a link found in *English Detective*. The written responses (completed in Japanese but translated into

English for analysis) were coded according to the themes that informed the qualitative analysis: the development of an explicit phonetic understanding of target features in a digital context, and participants' perceptions of the gamified site, including its ability to reduce anxiety and promote learning.

### **English Detective: A gamified Moodle site**

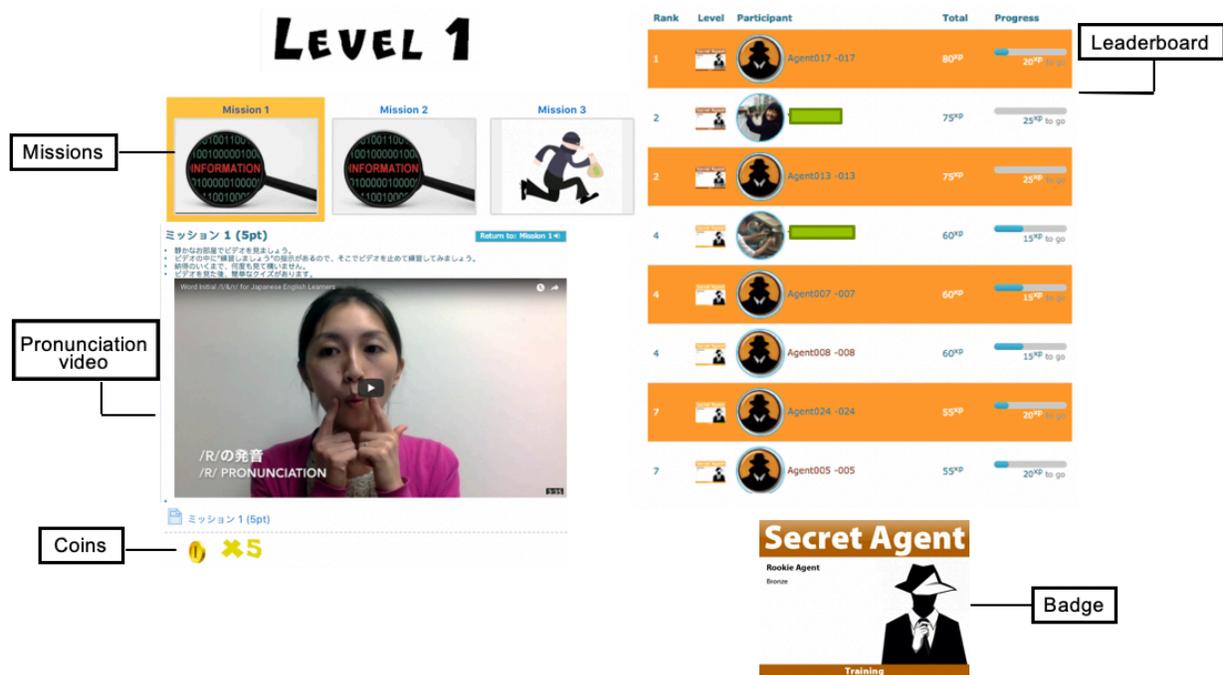
*English Detective* is a gamified *Moodle* site that was built specifically for this study. To encourage learners to practice L2 pronunciation in an environment less likely to trigger anxiety, activities were completed in the form of gamified missions. Participants received experience points for each mission they attempted, which automatically went to a leaderboard and subsequently opened the next mission. This was done through a leaderboard plugin in *Moodle*, *Level Up!*, which housed many of the gamified elements in this treatment. The leaderboard, which can be seen with other elements in Figure 3.3, was orchestrated to provide experience points in the form of coins for each activity, show each participant's avatar, display the total number of coins, update badges, and inform the students of the number of coins necessary for the next badge.

As a strategy to compete, participants were instructed to review materials in order to receive additional coins and, thus, higher ranking badges. For every 20 coins, participants earned a new badge, ranging from *Rookie Agent* to *Super Agent*. To deemphasize failure, the coins and leaderboard represented "experience points", which means the coins reflected attempts, not mastery. Because the target feature was a hard-to-acquire segment and therefore beyond the learner's immediate control, the goal was to deemphasize failure and instead reward learners for their effort and continued practice (e.g., Bell, 2018). Each student used the site for approximately one hour by the end of the study. To prevent participants from receiving coins for constantly

doing the same mission, a filter required 20 minutes to pass before earning points for the same activity.

**Figure 3.3**

*Overview of the gamified pronunciation site*



Mission 1 consisted of videos that provided learners with explicit instruction and multiple opportunities to practice the pronunciation of /r/ and /l/ in *onset* position. In line with Saito (2013), the videos provided metalinguistic cues to visually draw the learner’s attention to the relevant articulators (e.g., the positioning of the tongue tip against the alveolar ridge to produce /l/). To relax, students were instructed to massage their faces to prepare themselves to make foreign sounds. To deliver information about how to produce these sounds, an L1 speaker of Japanese with experience teaching EFL served as the teacher in the videos and delivered relevant metalinguistic information about the features before pronouncing a few words; a native English speaker also provided examples of how to pronounce each sound. In the /l/-related videos,

students were instructed to touch their tongue to the alveolar ridge (i.e., “the hard bump on the roof of the mouth”), while for /r/ production, the videos focused on lip rounding and preventing the tongue from touching the alveolar ridge, according to Celce-Murcia et al.’s (2010) recommendations.

As a pedagogical strategy, participants were instructed that, if they saw the teacher’s tongue in the video, that meant /l/ was produced. For the pronunciation of /r/, learners were instructed to focus on lip rounding and to avoid touching their tongue to the alveolar ridge. Per Fogg’s (2002) recommendations, the video instructed learners to rewind and pause the video to practice pronouncing the words and to study the instructor’s articulators for each segment. The activity was designed to provide access to a form of explicit phonetic information not available in classroom instruction. Students were also instructed to pause the video to review wordlists with the target feature before pressing play to listen to the instructor’s pronunciation. An optional activity in Mission 1 gave participants the opportunity to use tablets to draw a picture of what a person’s mouth looks like when pronouncing /l/ or /r/ (see Figure 4).

Mission 2 followed the same format as Mission 1, except that it focused on the production of /l/ and /r/ in *coda* position (e.g., poo/r/, mai/l/).

Mission 3 gave learners an opportunity to practice the skills learned in the first two missions by completing a minimal-pair listening quiz. The rationale for including a listening quiz comes from findings that suggest that these tasks can improve oral production (Bradlow et al., 1997) and may even reduce anxiety by giving learners an opportunity to focus on target sounds without the pressures associated with language production (Celce-Murcia et al., 2010). Perception activities also serve as an opportunity for learners to exercise their explicit phonetic understanding of the target features, which can contribute to pronunciation gains (Saito, 2013).

Six questions quizzed learners on their ability to differentiate minimal pairs (e.g., “lip” and “rip”). Half of the questions showed a video of the researcher pronouncing the word so that participants could visually notice the target feature, and the other half were audio only. After viewing and/or listening to each item, participants selected /r/ or /l/ based on which sound they heard.

### **Analysis of Results**

The data from the pronunciation tests were analyzed using descriptive statistics. Initially, a composite score for /l/-/r/ pronunciation was calculated in order to determine the effectiveness of the treatment on the pronunciation of perceptually similar segments. To better understand the effect of the treatment on each individual segment, a separate set of analyses was conducted.

The short-answer follow-up questionnaire data were analyzed with the help of one research assistant, according to the coding methods proposed by Saldaña (2009): the participants’ responses were first categorized based on learners’ reported experiences, that is, their perception of learning pronunciation in a gamified site with respect to its strengths and weaknesses as a pedagogical tool. These were then broken into subcomponents according to the themes that informed the analysis: the effects of the proposed site on (1) developing an explicit phonetic understanding of /r/-/l/, (2) reducing anxiety, and (3) promoting learning. In vivo coding was chosen as the coding method to represent participants' intended meanings (i.e., sections of data were assigned a label such as “developing explicit phonetic awareness”). These data were extracted verbatim from the data set and inserted into columns in a spreadsheet to create themes, categories, and sub-categories for the qualitative analysis.

## Results

### Quantitative

All participants began and completed the study through the posttests and, by the end, completed all proposed activities at least once and spent a mean total of 63.23 minutes in the gamified site, SD= 24.82, 95% CI [46.72, 80.22]. To first determine the effectiveness of the gamified environment on the production of /r/ and /l/ as a composite score, a Wilcoxon Signed-Rank test was used to measure the accuracy of their pronunciations. The key assumption for the test, the distributional assumption, was not violated, as assessed by a histogram with a superimposed normal curve on the distribution of scores. The results in Table 3.1 indicate that there was a statistically significant increase in /r/ and /l/ accuracy (Mdn = 8) on the posttest (Mdn = 19) when compared to the pretest (Mdn = 11),  $z = 2.97$ ,  $p = .003$ .

**Table 3.1**

*Composite /r/ and /l/ Results (z-scores)*

|                 | Pretest | Post  |    |       |
|-----------------|---------|-------|----|-------|
| Outcome         | Mdn     | Mdn   | n  | z     |
| /r/ & /l/ items | 11.0    | 19.00 | 11 | 2.97* |

\*  $p < .05$ . Mdn = Median

To better understand the effect of the treatment on the pronunciation of /r/ and /l/, each segment was analyzed separately by conducting a pair of related-samples Wilcoxon signed-rank tests (Table 3.2). The key assumption for the test, the distributional assumption, was not violated, as assessed by a histogram with a superimposed normal curve on both /r/ and /l/ distributions.

**Table 3.2***Individual /r/ and /l/ Results (z-scores)*

|           | Pretest | Post  |    |       |
|-----------|---------|-------|----|-------|
| Outcome   | Mdn     | Mdn   | n  | z     |
| /l/ items | 5.00    | 10.00 | 11 | 2.94* |
| /r/ items | 6.00    | 10.00 | 11 | 2.81* |

\*p &lt; .05. Mdn = Median

Regarding the pronunciation of /l/, a Wilcoxon signed-rank test determined that there was a statistically significant median increase in the number of correct /l/ items from the pretest (Mdn = 5 correct /l/ items) to the posttest (Mdn = 10 correct /l/ items),  $z = 2.94$ ,  $p < .05$ . Similar to the composite score, a Wilcoxon signed-rank test for /r/ pronunciation determined that there was a statistically significant median increase in the number of correct /r/ items from the pretest (Mdn = 6 correct /r/ items) to the posttest (Mdn = 10 correct /r/ items),  $z = 2.81$ ,  $p < .05$ . Altogether, these findings indicate that the participants benefited from the gamified Moodle site, as learners appear to have equally improved in their production of English /r/ and /l/.

### Qualitative

To answer the second and third subcomponents of the research question, which examined (1) whether the proposed learning environment led to an increase in phonetic awareness of the /r/-/l/- distinction and (2) the participants' perceptions of the gamified learning environment, participants completed a posttest written questionnaire consisting of eight open-ended questions, as described earlier.

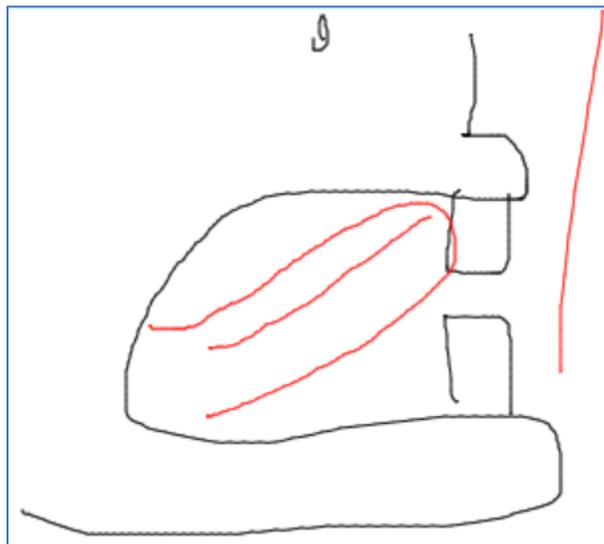
The analysis of the participants' responses suggests they developed explicit knowledge of /r/ and /l/ by: (1) noticing segments that do not exist in their L1 (e.g., "I could learn about sounds that do not exist in Japanese"); (2) learning how to manipulate their articulators (e.g., "I can

pronounce sounds correctly by focusing on my tongue, mouth, and lips”); (3) differentiating contrasting sounds (e.g., “I feel that I learned the /r/ and /l/ difference”); and (4) developing explicit phonetic knowledge in both perception and production (e.g., “I can hear and practice correct pronunciation”).

To further understand the development of explicit phonetic awareness from a qualitative perspective, the drawing activity provides key insights. Of the seven students who completed the activity, all focused on ensuring their drawing showed the tongue tip touching the alveolar ridge for /l/ and a low and drawn back tongue for /r/. Figure 3.4 illustrates an example of a typical drawing produced by the participants, indicating their awareness of the tongue positioning for /l/.

**Figure 3.4**

*An example of a student’s depiction of one’s articulators when producing /l/*



An interview question about how participants perceived learning from videos yielded responses that were directly related to the affordances of persuasive technology (Fogg, 2002), which indicates that this strategy may have been effective for delivering explicit phonetic information. For instance, six learners stated that they were comfortable with closely analyzing the teacher’s mouth in the video to build explicit knowledge about the target L2 pronunciation

(e.g., “I can see the shape of the mouth”; “videos allowed me to watch the movement of the tongue and mouth”). Furthermore, six responses indicated that, in line with the affordances of persuasive technology, learners paused and replayed the videos to study each feature (e.g., “I can hear native speaker sounds as many times as I want and still be able to repeat to practice”). An analysis of the log data supports that students viewed the videos several times: those related to /l-/r/ in onset position were watched 70 times, and those involving the coda were viewed 59 times.

Based on the assertion that metalinguistic approaches to pronunciation instruction can reduce anxiety (Szyszka, 2017), and that pronunciation anxiety in the L2 classroom is negatively correlated with WTC (Baran-Łucarz, 2014), one of the interview questions asked the students: “After learning with the site, do you feel that you are more comfortable speaking English in front of your class?” Seven participants responded that they felt more relaxed about speaking English in front of their classmates (e.g., “I am more relaxed because I understand the pronunciation a little more”; “I am more relaxed because I can pronounce a little better”). Interestingly, these quotes provide some preliminary evidence that participants experienced at least some sense of relaxation as a result of having a better understanding of L2 pronunciation.

Overall, participants reported that they enjoyed the site, particularly because it involved the assignment of coins and intrinsic competition (n=3), or watching videos to gain points to compete (n=7). In response to the question about the perceived weaknesses, five of the responses were related to the interface being in English. The other most common issue reported was that the videos did not always load properly (n=3).

## Discussion and Concluding Remarks

The goal of this study was to examine the pedagogical effectiveness of a gamified online site with pronunciation videos to aid the development of the L2 segments /r/ and /l/ and related explicit phonetic awareness by a group of Japanese EFL learners. Our findings provide quantitative evidence that the proposed pedagogical approach contributed to the development of English /l/ and /r/ over the treatment period. This finding conforms with Saito (2013), who reported pronunciation improvements in /r/-/l/ production when participants received a combination of form-focused instruction and explicit phonetic information. The results also conform with Saito (2013) with regard to explicit phonetic information aiding the production of /l/ and /r/, as the instructional videos provided an explicit (often exaggerated) pronunciation of the target features.

In addition to the quantitative evidence offered, the qualitative data suggest that some students developed explicit phonetic awareness, likely aided by the pronunciation videos; consequently, they felt less anxious after completing the experiment, thus confirming Fogg's (2002) assumption that using technology as a medium can make anxiety-inducing activities more approachable—developing explicit phonetic information and practicing pronunciation in the case of this study. Furthermore, unlike the classroom learners in Baran-Łucarz (2014) who experienced pronunciation anxiety, it appears that the digital environment in this study enabled some participants to practice pronunciation in a more comfortable way.

Practicing pronunciation while being rewarded with experience points in a gamified environment may have also contributed to helping learners detect progress and persevere at learning about and pronouncing the target segments, as evidenced by the fact that all participants completed the assigned quizzes at least once and watched the pronunciation videos for a total of

129 times. This finding is consistent with Hitosugi et al. (2014), who reported instances of deep cognitive development by participants learning L2 vocabulary in a game-based system that also afforded them chances to replay “learning missions” as frequently as necessary. Altogether, the evidence from this pilot study indicates that it is possible to apply the concepts of gamification and persuasive technology to the development of CALL pronunciation materials.

Despite the promise that this study shows in regard to facilitating the acquisition of L2 phonology, there are a number of limitations that should be acknowledged. The first relates to the lack of a control group, which prevents us from drawing specific conclusions regarding the optimistic results obtained. Two other methodological limitations are the short duration of the experiment (participants spent roughly one hour in the course), and the absence of delayed posttests, which would allow us to determine if the observed improvements affected learners’ long-term phonological inventory. Furthermore, the study employed a written questionnaire to examine metalinguistic knowledge. Although this instrument provided invaluable information about the participants’ awareness to the articulation of /r/-/l/, a more refined qualitative approach is necessary. In future studies, the development of qualitative instruments should be guided by the literature on explicit phonetic awareness and pronunciation anxiety to appropriately probe into responses related to the development of explicit knowledge of the target features. Finally, the analysis of the qualitative data was directed by the research questions, which means that the themes were pre-determined and did not emerge as part of the data analysis. Future versions of the study require more refined qualitative measures such as interviews and focus group discussions.

In terms of phonological gains, measuring the mere accuracy of /r/ or /l/ production in all prosodic contexts does not provide a full picture of its acquisition. Whether participants

improved more on onsets or codas is valuable information because, as based on the syllable structure of L1 Japanese, which only allows CV (coda-less) sequences, it is likely that word-final consonants will prove to be more difficult and, therefore, possibly more anxiety inducing than onsets. Finally, for reliability in pronunciation rating, future versions of this study will need multiple raters and the subsequent calculation of interrater reliability.

Although pilot studies do not guarantee the success of a future experiment, they are a critical first step toward understanding which aspects of a treatment to include in future iterations; this study does make a compelling case to include many of its features in a follow-up study, especially with the inclusion of a control group and more comprehensive methods that can shed light on the effectiveness of digital gamification in the acquisition of hard-to acquire L2 phonological features. This study is a first step toward determining that L2 pronunciation techniques within a gamified setting is not only feasible in terms of design and implementation, but also potentially facilitative of L2 pronunciation.

## Contributions to the Thesis: Part 2

As mentioned earlier, this thesis examines the customization of CALL materials from three perspectives: it proposes an approach that positions teachers as “instructional designers” of their own CALL materials to stimulate L2 use and interaction with and through technology, sometimes including the use of gamified elements (manuscript A); it then implements the proposed approach in a study that investigates the effect that a customized CALL resource can have on young Japanese learners’ pronunciation of /r/ and /l/ (manuscript B); and, finally, it assesses the implementation of the proposed approach from a pre-service teacher’s perspective (manuscript C).

In the previous chapter (manuscript B), I provided some preliminary evidence regarding the effect that a customized online resource with gamified elements can have on L2 learners’ pronunciation and metalinguistic awareness. In line with interactionist approaches to CALL, the materials created in manuscript B offered learners multiple opportunities to interact *with* the computer to learn the target pronunciation feature, including simulated pronunciation lessons and listening quizzes. The resource under investigation was customized at the *creation* level and was found to contribute to the oral development of English /r/-/l/ and related metalinguistic awareness. Altogether, the young learners in the study independently completed and reviewed the activities and, overall, perceived the experience as pedagogically rewarding. Would similar positive perceptions be observed from a teacher’s standpoint?

To address this question, Chapter 4 (manuscript C) examines the implementation of Barcomb et al (2018) in a teacher training course to find out: (1) what types of customization these teachers engage in when developing their own CALL materials: adaptation, modification,

and/or creation; and (2) how the same teachers perceive their use of the proposed approach when customizing their own technology-enhanced materials.

## **Chapter 4: Teachers as CALL Designers: Exploring perceptions of customization and approaches to designing materials (manuscript C)**

One barrier that may prevent second and foreign language (L2) instructors from utilizing technology for teaching is that they might not be aware that they can develop materials with their pre-existing technological expertise. To help teachers match their pre-existing skills with an ever-expanding pool of technology that can be customized to stimulate L2 interaction, Barcomb et al. (2018) (manuscript A) propose a three-level approach to show how teachers can categorize and customize potential CALL materials. The approach is directed at teachers adapting, modifying, and/or creating materials that can expand learner opportunities for L2 use in interactions with their devices and other L2 users (e.g., in shared online spaces such as blogs and forums). Given that the approach proposed in Barcomb et al. (2018) (manuscript A) and implemented in Barcomb and Cardoso (2020) (manuscript B) shows some pedagogical promise (e.g., it can assist teachers in conceptualizing and using pedagogically effective learning materials, as shown in manuscript B), an important next step is to test the implementation of the approach from the perspective of the target users: language teachers. Therefore, this study (manuscript C) examines the adoption of Barcomb et al.'s (2018 – manuscript A) approach to customization involving in-training teachers, representing a population with a wide range of abilities and experiences with CALL.

The objectives of the current study are twofold: (1) to determine the types of CALL materials teachers in training can customize (i.e., adapt, modify, create) to stimulate L2 interaction, using Barcomb et al.'s (2018) approach (manuscript A); and (2) to examine these student-teachers' perceptions of the ways in which they used the approach. To address these objectives, mixed-methods data were collected in the form of: (1) an online ESL course built by

the student-teachers and a design-choice log where participants recorded details about each resource they customized (e.g., type of L2 use targeted, form of customization, use of gamification); and (2) a reflective discussion led by the Socratic-Wheel technique (Chevalier & Buckles, 2019). The latter was selected in order to understand the ways participants perceived they used the proposed approach to customize their CALL materials. Understanding pre-service teachers' perceptions of customizing digital language teaching and learning materials—based on Barcomb et al.'s (2018) approach (manuscript A)— may shed light on the suitability of this approach with regard to how in-training teachers can tap into pre-existing skills and knowledge to craft stimulating materials for their own pedagogical use.

### **Literature Review**

This literature review introduces the topics and related theories that are central to understanding the types of CALL materials that teachers can customize, based on Barcomb et al.'s (2018) approach outlined in Chapter 2 (manuscript A). The first section (re-)introduces the approach and explores the ways in which formal teacher training can contribute to enhancing L2 teachers' knowledge about CALL and the customization of materials that target a wide range of learner interactions. The following section investigates the ways in which common online resources can contribute to L2 learning, emphasizing interactionist perspectives (e.g., Chapelle, 1998, 2003, 2004). The literature review ends by making recommendations for testing the implementation of the proposed approach in a teacher training context, the goal of this study.

## **Teachers as Customizers of CALL Resources**

If L2 teachers would like to conceptualize and develop their own CALL materials to promote learning, they need an approach to guide them in this process, particularly one that considers their available resources and technological expertise. To meet this need, Barcomb et al. (2018) (manuscript A) propose three ways of customizing CALL materials in which teachers can fulfil the role of adapter, modifier, and/or creator. The main goals of this section are to introduce this approach and to establish how a formal teacher training context can serve as a space to test its implementation and pedagogical suitability (a step in CALL research that, as Cardoso, in press explains, typically occurs after the development of a tool, resource, or approach - manuscript A, and an examination of its pedagogical effectiveness - manuscript B).

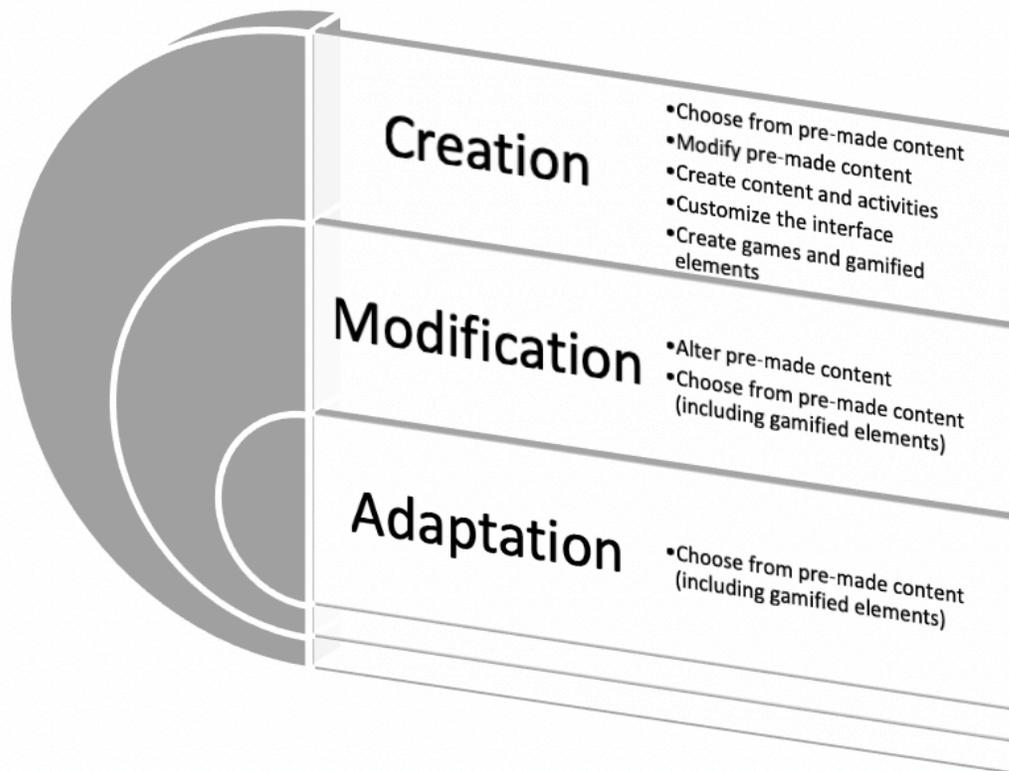
### ***The Three Levels of Customization***

Barcomb et al. (2018) (manuscript A) suggest that teachers can work independently to develop CALL materials without advanced technological knowledge. For instance, to stimulate L2 interaction with and through computers, as will be discussed later, teachers can work with user-friendly online resources that utilize drag-and-drop material creation. To customize these resources, the authors suggest that teachers consider insights from cognitive-interactionist approaches to determine what type(s) of L2 interaction they wish to target (i.e., learner-computer, between-learner) and if/how the use of the resource can support this goal. This enables teachers to apply SLA knowledge to the process of locating and developing CALL materials.

Figure 4.1 illustrates the possibilities for customization at each level, beginning with one option at the adaptation level and at least five at the creation level. It should be noted that the levels contain overlap, and depending on technological expertise and available time and resources, teachers can customize basic or complex CALL materials within or across levels.

**Figure 4.1**

*The three levels of customization and the associated design choices that teachers can make at each level (adapted from Barcomb et al., 2018 – Chapter 2)*



**Adaptation.** This level enables teachers to utilize pre-existing online materials for L2 teaching. Manuscript A (Chapter 2), for example, details how L2 teachers can adapt *Duolingo for Schools* by creating a class account and making it available to students, thus encouraging learners to interact with content in which they can receive and produce L2 input and output in interactions with computers. Teachers working at this level would use *Duolingo*'s pre-set content (including gamified elements) without making any changes. This is the simplest form of *adaptation*, as teachers merely assign a pre-existing resource for their students.

Not all adaptable content is intended for L2 teaching (e.g., search engines, text-to-speech synthesis), so teachers may need to take extra steps to make it useful for that purpose. For

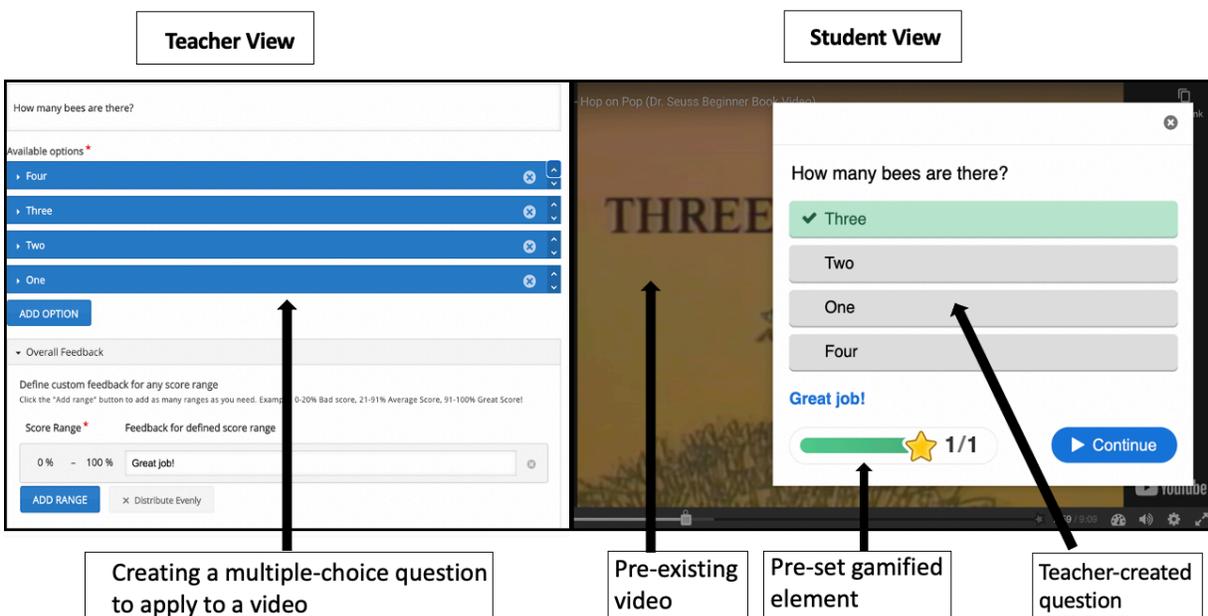
example, Van Lieshout and Cardoso (in press) found that *Google Translate* and its speech technologies (ASR and TTS) could be adapted so that L2 Dutch students could learn the language in a self-directed manner (e.g., by listening to the target Dutch words using TTS, and practicing their pronunciation via speech recognition). Although *Google Translate* is not a pedagogical tool on its own, it can become one if teachers adapt some of its pedagogically-relevant features (ASR and TTS in this case). In this example, *Google Translate* became pedagogically useful without being altered in any way.

**Modification.** To exert more control over CALL resources, teachers can *modify* pre-made online content. Modification is the stage at which a teacher can alter or tailor a pre-existing resource to make it more appropriate for a specific group of L2 learners.

The parameters of the available design choices at this level can be seen, for example, when teachers *modify* a pre-existing video. As shown in Figure 4.2, the use of *H5P!* ([www.h5p.org](http://www.h5p.org)) enables teachers to create their own comprehension questions and then superimpose them over a *YouTube* video, thus making a resource unintended for L2 learning more useful for that purpose. To encourage students to answer questions, teachers can choose to include gamified elements such as experience points and progress bars that instantly reward learners and show their progress when answering questions correctly. Similar to adaptation, at this level of customization, the chosen CALL resource is pre-existing, but teachers have the ability to directly modify content (e.g., by superimposing comprehension questions over a pre-existing video, as shown in Figure 4.2).

**Figure 4.2**

*Use of H5P! to modify a YouTube video*



At this level of customization, teachers can also locate pre-existing language-learning materials such as customizable L2 vocabulary cards online (e.g., about food) and then ask their students to add items that they deem to be important, thus establishing a constructivist approach to teaching that includes learners in material development (Brandl, 2002). For example, the use of *Quizlet*, a popular online app with study resources in the form of text-to-speech vocabulary cards, has been found to be effective in foreign language vocabulary acquisition (e.g., Dizon, 2016). *Quizlet* contains pre-existing sets that teachers can locate and then add their own items, based on their students' needs and interests. Such an approach provides teachers alternative ways to improve learner fit - the appropriateness of a CALL resource for a specific group of learners (Chapelle, 2001).

**Creation.** To gain control over how a resource's interface, content, and activities can contribute to L2 learning, teachers can choose to *create* customizable CALL materials. Creation

enables teachers to take advantage of the design possibilities presented by adaptation and modification but with the added ability to conceptualize and develop materials without relying on pre-existing content.

An example of *creation* was illustrated in manuscript B (Chapter 3), wherein a course management system was designed to improve learners' pronunciation of English /r/ and /l/ (e.g., via pronunciation videos, listening quizzes, gamified elements). The system enabled participants to independently work through different activities in the form of missions as they collected points and badges for practicing English /r/-/l/ pronunciation and related listening activities in interactions with the computer. A gamified *Moodle* extension/plugin, *Level Up!* ([https://moodle.org/plugins/block\\_xp](https://moodle.org/plugins/block_xp)), was used to create the gamified system in the course, including the appearance of rewards, the value of each activity, and how much time was needed to complete the assigned task and receive points.

Customizing materials to stimulate between-learner interaction (through the computer) is a common design choice at the *creation* level, particularly when working within a course management system. For example, teachers can create asynchronous speaking forums in which learners complete a jig-saw activity by listening to their peers and producing their own speech recordings without the pressure of time (Cong-Lem, 2018). Creating such a forum in a course management system may seem like a straightforward task, but its effectiveness hinges upon providing clear directions, determining where to situate the forum among other activities, and setting its value in regard to experience points. In this type of customization, teachers have substantially more control over the development of a resource and the ways in which it can promote interaction in the L2.

As evident in the above examples, teachers can develop theoretically and pedagogically sound materials without advanced knowledge of technology. This is a necessary direction in CALL because many L2 teachers are anxious about using technology and perceive it to be beyond their abilities (e.g., Kessler, 2010), indicating that they can benefit from formal training.

### ***Formal Teacher Training and Comfort with CALL***

Teachers who have not had opportunities to learn about CALL theory and its pedagogical application are likely to remain anxious about using technology in their courses (Kessler, 2010). To address this issue, teachers need formal training to experiment with the many possibilities afforded by technology and be given opportunities and reflect on their learning (Gruba, 2017; Kessler, 2010, 2018). The benefits of such a learning-reflection approach can be seen in a graduate CALL teacher training study by Gruba (2017), who utilized a course management system to engage learners in discussions about CALL theory outside of class and give them a place to develop materials. A key aspect of Gruba's approach to teacher training is its alignment with constructivist approaches, which rely upon the views of participants to interpret their understanding and experiences about a specific situation (Creswell & Poth, 2018). As such, it is relevant to this study because, as will be discussed in the methodology, the in-training teachers (participants) consistently used the available course structures to reflect upon CALL theory and discuss how they customized their resources with other teachers.

It is not yet known what types of CALL materials teachers can customize, so this study aims to determine whether teachers can customize common online resources to stimulate L2 learning, emphasizing interactionist perspectives (e.g., Chapelle, 1998, 2003, 2004).

## **Types of CALL Materials Available for Customization**

### ***CALL Materials that Promote Learner-Computer L2 Interaction***

Interactionist approaches to learner-computer L2 interactions emphasize that technology can enable learners to intra-personally process the target language, direct attention to linguistic form, and produce modified output without interacting with another interlocutor (Chapelle, 1998, 2003, 2004). In this way, digital devices can enable L2 learners to have opportunities to produce output and receive immediate feedback (Chapelle, 2004), thus increasing the opportunities for learners to assess their ability to use the target language.

One way in which learners can interact with technology is by self-assessing their ability to understand L2 words or phrases that are produced by text-to-speech (TTS) synthesizers. For example, in a study by Bione and Cardoso (2020), the authors determined that digitally synthesized TTS voices offered learners a way to listen to and interact with comprehensible and intelligible L2 speech. To do this, a learner could listen to a target L2 phrase (e.g., via the use of *Google Translate* - GT) and self-assess their ability to understand it. A learner could then use GT's built-in automatic speech recognizer (ASR) to practice saying the target word and receive immediate feedback about the accuracy of their pronunciation, via orthography.

Consistent with this, Liakin et al. (2015) found that independent pronunciation practice using another ASR application (Dragon Dictate) enabled learners to improve their L2 pronunciation of French /y/, as compared to a control group. An interesting aspect of this study was that not only did technology take the place of another interlocutor (a teacher), but it did so in a manner that had a statistically significant effect on the acquisition of the target feature.

Similarly, in van Lieshout and Cardoso (in press), participants tested how Dutch L2 learners used *Google Translate* to practice pronouncing a list of phrases in the target language.

Results indicate that the participants learned the target Dutch words/phrases and associated pronunciation by developing strategies that involved listening to the target pronunciation via TTS synthesis. They then tested their pronunciation by orally producing the newly-acquired Dutch phrases and comparing them against the ASR output (via orthography). Such use of CALL technology is needed because learners commonly experience anxiety in the L2 classroom (Horwitz et al., 1986; Horwitz, 1986, Horwitz, 2016), particularly concerning their pronunciation (Baran-Lucarz, 2014).

These findings suggest that the types of learner-computer interactions afforded by speech-based technologies can contribute to reducing anxiety by encouraging learners to produce speech in private interactions with a digital device (e.g., Barcomb & Cardoso, 2020; Egbert & Shahrokni, 2018), not in a classroom where learners risk losing face in front of their peers.

### ***CALL Materials that Promote Between-Learner L2 Interaction***

Although there are clear benefits in using technology to replace an interlocutor, as discussed above, learners still need chances to have L2 interactions with others (Chapelle, 2004) to enhance their language development (Chapelle, 2004; Sotillo, 2000) and increase their chances of L2 practice.

One common example of digitally-mediated between-learner interaction can be found in web-based conferencing (e.g., those conducted via Skype, Zoom), a platform that closely resembles in-person discussions in which L2 learners process (input) and produce (output) language in real-time (Yanguas, 2010). Such conversations, however, may not be a possibility for some students (e.g., those with low speaking/listening proficiency), a limitation that can be circumvented via the use of text-chats (e.g., online messengers). *Synchronous* text-chats enable

students to quickly conceptualize and review a conversation before publication (Smith, 2003), thus allowing them to have additional time to process the L2 before producing a response.

Learners whose proficiency is not yet sufficient for synchronous communication may instead benefit from *asynchronous* exchanges (e.g., posting comments in a forum). This type of interaction provides learners with as much time as they need to process and produce language, making the interaction more approachable (Chapelle & Jamieson, 2008; Ene & Upton, 2018). Similarly, for speaking, asynchronous interactions give learners more time to receive, process, and produce the target language (Carrio-Pastor, 2019), encouraging them to deliver more complex syntax and grammar, and more accurate speech (Guillén & Blake, 2017), without the pressure of a real-time exchange (Carrio-Pastor, 2019).

Although it is important for learners to use the target language in exchanges with other L2 users, making the appropriate resources available to learners does not always guarantee that they will in fact interact with others (Stockewell, 2013). One way of encouraging learners to practice and use the language is via gamification, discussed next.

### ***CALL Materials with Gamified Elements***

Gamified approaches to L2 education utilize elements of games but in a language learning context (Reinhardt, 2019; Reinhardt & Sykes, 2012, 2014); for example, the use of badges, leaderboards, and progress bars to make an activity not typically associated with games (e.g., L2 learning) more enjoyable (Deterding et al., 2011). Such an approach was applied in Barcomb and Cardoso (2020) (manuscript B), in which a course management system was customized with gamified elements (i.e., levels, competition, and rewards such as badges and points) to encourage L2 learners to practice pronunciation. The results indicate that learners improved their pronunciation and phonological awareness of the target L2 feature (English /l/-

/r/), and that they enjoyed the pedagogical experience, particularly its competitive, game-like nature. Such approaches to gamification have the potential to encourage learners to complete activities more than once and continuously engage in L2 interactions (Bell, 2018; Bogost, 2011).

To summarize, the literature indicates that L2 learners benefit from types of interactions afforded by technology. However, to implement these ideas in a language classroom, teachers need to be trained in a manner that enables them to make sound pedagogical decisions based on their technological abilities, teaching experiences, and available resources.

### **This Study and Research Questions**

The approach to customization introduced in Barcomb et al. (2018) (manuscript A) has been found to be beneficial in guiding teachers in the development of an online course and aiding their students to improve aspects of their pronunciation (manuscript B). However, it is not yet known what kinds of CALL materials teachers will customize, nor is there any data to support how they perceive the proposed approach to conceptualize their learning materials. Therefore, the goals of this study are twofold: (1) to find out what kinds of CALL materials teachers customize based on the proposed approach to customization, and (2) to uncover the users' perceptions of how they perceive they used the approach to customize their own materials. In this paper, perception is operationalized as the ways in which participants perceive they *used* the approach, not whether they enjoyed its use. To address these two goals, the following two research questions have been developed:

1. Based on Barcomb et al. (2018 - manuscript A), what types of customization do pre-service teachers engage in when developing their own CALL materials within the context of a formal CALL training course: adaptation, modification, and/or creation?

2. How do pre-service teachers perceive they used the proposed approach when customizing their own CALL materials?

Answers to the first question derived from online L2 courses and materials that pre-service teachers customized (see Appendix A for an example), as well as from a design-log where they recorded design choices (shown in Appendix B). Answers to the second question derived from an analysis of a Socratic Wheel approach to stimulating reflective group dialogue via the negotiation of ratings (Buckles, 2013). This approach aimed to enable the participants to work together to create a simple visual rating tool that they could then use to have a conversation to assess progress and final results (Chevalier & Buckles, 2019); see Appendix C for a screen shot of the Socratic Wheel constructed as part of this study.

### **Methodology**

This mixed-methods study took place in an intensive TESL training course about computers and language learning for eight weeks (13 total meetings in the form of lectures and lab sessions). In the course, students learned about the proposed approach to customizing technology-enhanced language learning materials and applied it to customize their own CALL activities. The course also featured weekly readings about CALL that provided participants a base of knowledge to consider when working as instructional designers to customize materials. It should be noted that the first author of this paper was the instructor for the course, and ethics approval was granted to conduct this study.

### **Participants**

Participants were university students in an accredited ESL teacher training course. They ranged in technological abilities and experiences in regard to working with digital language learning materials. Because participation was optional and, more importantly, the data collection

coincided with the students' internships, 18 out of 25 student-teachers enrolled in the course agreed to participate. Students participated in the first part (i.e., the design-log), and only six participated in the second part (i.e., Socratic Wheel discussion). Of the six participants who participated in the second part, two identified as being highly anxious and lacking experience with technology at the beginning of the course, whereas the other four participants identified as being generally comfortable with technology but inexperienced in CALL. The six student-teachers were compensated \$20.00 for their participation. Participants were recruited in the last class by a teaching assistant who explained the study, collected consent forms, and possessed the completed forms until final grades for the course were submitted.

### **The Course and Learning Materials**

The name of the course was "Computers in Language Learning", which included second- and third-year students in the TESL program. The course description explains that the course serves as an introduction to the use of computers in the ESL classroom, and students in the course learn how to incorporate this knowledge into their instruction. Course attendance and participation in online activities were both mandatory. It took place in person and on *Moodle*, an open-source, socio-constructivist educational resource amenable to customization in the form of drag and drop activities, designed for students to interact with each other while learning (Dougiamas & Taylor, 2003). The pedagogical materials were conceptualized and designed to encourage pre-service teachers to reflect on CALL as they used and became familiar with this dynamic and customizable learning environment. To customize materials, participants worked with digital open-source learning resources (e.g., *ARIS*), text-to-speech software (e.g., *Quizlet*), automated speech recognition software (e.g., *Read Aloud*), and a range of other widely (and freely)

available programs with the goal of encouraging their future students to interact *with* and *through* computers to practice the target language.

The final assignment required students to utilize *Moodle* to build their language courses and design some of their pedagogical activities using built-in or external features.

### ***Course Readings***

To customize their learning materials, participants acquainted themselves with CALL literature that could help guide their decisions. The knowledge from the readings was hypothesized to directly inform their decisions, so a weekly reading quiz tested participants' knowledge of key concepts and findings from the readings. They were also required to discuss the readings in online forums and after-class group discussions. The course textbook was Chappelle and Jamieson's (2008) "Tips for Teaching with CALL", in which the authors emphasize the teaching of L2 grammar, vocabulary, and the four language skills (speaking, reading, writing, and listening).

### ***Lectures***

To help participants reinforce their understanding of the course readings, weekly lectures began by synthesizing the reading materials in a full-class discussion. In addition to the review and initial discussion, there were concrete examples of popular digital language learning resources that utilize the theory or pedagogy discussed in the reading. In addition to providing examples, when time allowed, there was an emphasis on activities where participants briefly conceptualized and discussed how they could customize potential CALL resources to stimulate a specific type of L2 use— all with support from the course readings. This cyclical nature of re-visiting readings and exercising recently-acquired knowledge in group-work persisted

throughout the course and was designed to encourage students to become aware of and adopt multiple approaches to categorizing and customizing CALL materials.

### ***Lab Sessions***

Once per week during the course, students attended a lab session where they had nearly three hours to learn step-by-step how to customize a new resource. In specific, the lab sessions introduced participants to a new piece of software and/or hardware that could be customized (i.e., adapted, modified, or created) for use in L2 pedagogy. The goal of the lab was to provide pre-service teachers the support necessary to tap into their knowledge and experiences to create their own technology-enhanced materials.

### ***Design-Log***

To help participants situate their ideas within the range of available design choices, students recorded their choices in a log. In line with the aims of Chapter 2 and other key readings in the course, including the required textbook (Chapelle & Jamieson, 2008), the log focused on form of customization (i.e., adaptation, modification, and/or creation), type of L2 use (e.g., listening, speaking), and whether the interaction took place with or through a computer (see Appendix B for an example). The log consolidated several design choices in one space so that pre-service teachers could explore the resources available and then determine the feasibility of customizing them. The complete log was submitted at the end of the course when participants completed their ESL course for the final project in the class.

### ***Final Project***

The final project required participants to develop their own customized language learning resources in one space (i.e., their *Moodle* course) in the form of a fictitious but fully functional ESL course. Based on the approach presented in Barcomb et al. (2018) (Chapter 2), participants

were required to adapt, modify, and/or create language learning materials for use in an actual L2 class (e.g., during their upcoming internships). Examples of such materials included chats, forums, blogs, and gamified systems with points and leaderboards. In addition to developing materials within *Moodle*, students also learned how to embed and include external resources into their courses (e.g., *YouTube* videos, *Quizlet* flashcards, websites). In this course, students were graded on their ability to apply the acquired knowledge about the pedagogical use of technology in their own course (e.g., by creating pedagogically-sound materials that emphasize the materials discussed in class and the required readings).

## **Quantitative Instruments**

### ***Design-Log***

To answer the first research question, data from the design-log was analyzed quantitatively to understand the different approaches that participants took to develop their materials. Because the entries are nominal (e.g., customization type, game type), the choices were analyzed quantitatively, as will be discussed later. In specific, teacher-produced materials were assigned a code based on criteria such as customization type, interaction type, and the use of gamification. To further substantiate the design choices and the intended use of each customized material detailed in the design-log, each student's course was accessed and reviewed.

## **Qualitative Instruments**

### ***Socratic Wheel***

To answer research question two, this study utilized a Socratic-Wheel led discussion to better understand pre-service teacher perspectives of how they used the approach in manuscript A to customize their materials. A unique feature of Socratic-Wheels is that they enable the researcher to collect data that result from interactions between participants while they discuss

topics that are important to them, in their own words (Chevalier, 2013). Chevalier and Buckles (2019) explain that Socratic Wheels are best suited for stimulating interaction about specific topics, customization in this case, when the group is comprised of homogenous members in relation to the topic of interest. The participants in this study meet this goal, as it included participants from the same teacher training course. The participants used tape to construct their wheel on a table, and then used colored post-it notes to negotiate rankings for each topic/spoke for three different points in time: at the beginning of the course, the end of the course, and in the future (see the following section for the qualitative data collection procedures and analysis).

In particular, the constructivist paradigm is central to the conceptualization of the qualitative procedures because they are geared towards producing reconstructed views of the social world (Lincoln et al., 2011). Lincoln et al. (2011) specify that, within this paradigm and the related methodology, individuals self-create their own reality and the role they play within that reality, which enables them to express themselves in ways that represents their reality (Guba, 1990). This cooperative aim is a key aspect of answering the second research question because CALL teacher training literature emphasizes the importance of collaboration with other in-training teachers to learn about and develop CALL resources (e.g., Gruba, 2017; Hubbard, 2008; Kessler, 2010). Given that the teacher-participants were accustomed to collaborating in small groups throughout the course, the use of the Socratic Wheel matched these aims because it was directed at enabling small, homogenous groups to discuss and negotiate ratings about topics that they deem to be relevant (Chevalier & Buckles, 2019).

## **Quantitative Data Collection and Analysis**

### ***Design-Log***

Each participant completed at least 10 log-entries as part of the course requirements, which provided an overview of how the materials were conceptualized and created. Altogether, the choices in the log represent a range of design choices that are ultimately directed towards increasing student interactions with and through computers.

**Administration.** The design log was first made available to the students at the beginning of the semester so that they could familiarize themselves with it when conceptualizing materials. In order to ensure students knew how to use it, the class completed logs together as part of in-class activities. For example, when students customized a CALL resource as part of a lab, they would be asked to fill out a log in order to: (1) guide their development of the material, and (2) enable the researcher/teacher to quickly review the resource on paper before accessing it.

**Analysis.** To analyze the design-choices quantitatively, a bottom-up approach was adopted to explore the choices made by each participant for each of the resources they built. Every choice in the design log was assigned a numeric value in a statistical program (SPSS) and treated as a nominal variable. This enabled the researcher to analyze the data based on the choices present in each participant's design log. To analyze the data, the frequencies of design choices for each category were calculated; for example, the total number of resources that were adapted, modified, and/or created by the participants. Following the topics and themes that guided this study (discussed in the literature review), the report of the results emphasize CALL materials that facilitate L2 use in learner-computer and between-learner interactions (*with* and *through* the computer, respectively), with some emphasis on the use of gamification (deemed important to motivate interaction and practice).

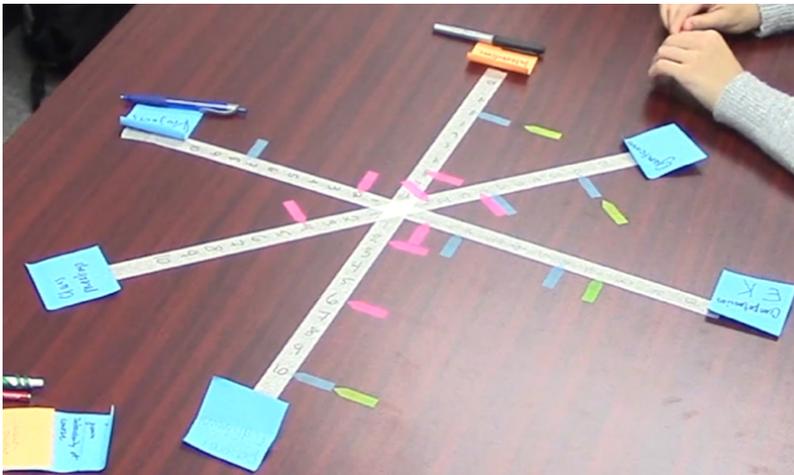
## **Qualitative Data Collection and Analysis**

### ***Socratic Wheel***

**Socratic-Wheel Administration.** The discussion took place in one session that lasted for approximately 75 minutes. It was guided by a socio-constructivist instrument designed to help students co-construct an answer to research question two, which asked how they perceive they used the proposed approach to customization. Participants constructed and taped their Socratic Wheel to a flat surface (see Figure 4.3), which was designed to invite the participants to become active in the construction of the instrument that guided their discussion. A research assistant oversaw audio and video recordings while the main researcher worked together with the participants to create the wheel.

**Figure 4.3**

*An example of a completed Socratic Wheel*



In specific, a Socratic Wheel can be used to evaluate final results or the effectiveness of an activity by using multiple criteria (Chevalier & Buckles, 2019). Each wheel contains roughly six to eight spokes that represent the criteria relevant to the topic, such as the ways in which the participants perceive they used the proposed approach to customize materials (e.g., to develop materials that stimulated L2 interaction). The topics for the spokes were determined by the participants, which were numbered one through ten, thus enabling them to negotiate a rank for

the importance of each specific criterion in relation to answering the research question (for more details about this procedure, see Chevalier & Buckles, 2019). Though numbers are used to facilitate conversation, the qualitative data of interest is gathered primarily when participants negotiate and justify a rank with other participants, as well as when they describe their progress between two points.

To determine the criteria for how the participants perceived the use of the proposed approach to customizing materials, they started with an activity called *Free List and Pile Sort* (Chevalier & Buckles, 2019): after defining the topic (i.e., how the participants used the approach in proposed in manuscript A), each student was handed three index cards and a pen to write down three ways in which they used the proposed approach to customize their materials. Next, the participants sorted all their cards on a table and combined cards that represented a similar topic. At this point, students also considered what other criteria to add, based on gaps they may have noticed when working with other participants to create categories. Once students decided on approximately six criteria, the spokes for the Socratic Wheel were formed.

**Data Analysis.** After the audio/video-recorded discussion completed, an audio file was generated into a transcript of spoken interactions and then coded according to the methods proposed by Saldaña (2009): the participants' responses were first categorized based on the pre-service teachers' reported experiences, that is, their perception of how they used the proposed approach to achieve a range of outcomes related to customizing CALL materials. These were then broken into subcomponents according to the themes raised by the participants, but which complied with the aims of the study which, via material customization, aimed to promote a learning environment that stimulates L2 interactions. In vivo coding was chosen as the coding method to represent participants' intended meanings (i.e., sections of data were assigned a label

such as “active CALL design”). These data were extracted verbatim from the data set and inserted into columns in a spreadsheet to create themes, categories, and sub-categories for the qualitative analysis. To check inter-rater reliability, two raters were asked to match the codes identified with accompanying quotes from the participants; the two raters matched the codes to the same quotes, thus agreeing with the codes identified. The data from the discussion were then analyzed according to the four themes identified above.

## **Results**

### **Types of Adapted, Modified, and Created CALL Materials: Quantitative (RQ #1)**

The results presented here provide answers to the first research question, which aimed to determine the types of customization that pre-service teachers engaged in when developing their own CALL materials, according to Barcomb et al.’s (2018) proposal (manuscript A); i.e., adaptation, modification, and creation. As indicated in Table 4.1, of the 179 CALL materials that the participants designed and implemented in their L2 courses, all 18 participants chose to adapt (15.64%), modify (20.11%), and create (64.25%) their materials.

**Table 4.1**

*Frequency of Customization Types*

| Type         | N/179 | %      |
|--------------|-------|--------|
| Creation     | 115   | 64.25  |
| Modification | 36    | 20.11  |
| Adaptation   | 28    | 15.64  |
| Total        | 179   | 100.00 |

### ***Created Materials***

Participants chose to *create* (64.25%; 115/179) materials more often than modify or adapt pre-existing content. Unlike the prior two types of customization, the created resources promoted both learner-computer (27.37%; 49/179) and between-learner (36.88%; 66/179) L2 interactions

in CALL settings. In an extension of modification, creation enabled participants to not only alter pre-existing digital content, but also to develop it from scratch, including the design of the layout, interface, and content.

To give language learners chances to produce speech and receive feedback in with-computer interactions, three resources created by participants utilized an (external) automated speech recognition plugin in *Moodle* called *ReadAloud* (<https://poodll.com/plugin-poodll-readloud>) to target reading, speaking, and pronunciation practice. These resources enabled learners to record themselves reading a passage provided by the teacher and then immediately have their words per minute and accuracy calculated (according to Segalowitz, 2010, words per minute and accuracy are two measures for determining oral fluency). Learners could then review mispronounced words, underlined in red, and attempt to read the passage again to improve their score. To practice writing in learner-computer L2 interactions, a common activity adopted was fill-in-the-blank (n = 8). Upon completing the fill in the blank assignments, learners would immediately receive automated feedback about their responses and have a chance to try again. Six other activities utilized a free speech recorder, *PoodLL* ([www.poodll.net](http://www.poodll.net)), which enable learners to record themselves pronouncing words or phrases for later assessment by the instructor. All of the content found in these materials was created by the teacher-participants, which, unlike adaptation and modification, gave them more control over the content used by their students.

All of the participants chose to create materials with the intent of promoting between-learner L2 interactions and practice. Of the 66 between-learner resources, 41 targeted asynchronous exchanges between learners, including 32 forums and nine blogs. Of the 32 forums, 20 were conceptualized as asynchronous speaking forums, where learners could listen to

and send videos to each other in video posts. To do this, participants utilized the *Moodle* plugin, *PoodLL* ([www.poodll.net](http://www.poodll.net)), which allows learners to upload a video to the forum in a time and location of their choice. Forums also targeted asynchronous written exchanges between learners (n = 12), as did blogs (n = 9), except with the added ability for students to determine a topic to continuously write about in their posts (e.g., cooking). The teacher-participants also created synchronous text-chats for more advanced interactions, which happened in real-time and consequently introduced timed pressure to the exchange (n = 25).

All participants chose to create gamified elements by using the free plugin, *Level Up!* ([https://moodle.org/plugins/block\\_xp](https://moodle.org/plugins/block_xp)), to assign point values to assignments. When a student completed an activity in these courses, the points would automatically be displayed on a leaderboard that would show a student's total points and their current level. One participant chose to make forums worth the most points so that students would be more likely to interact with their peers. To encourage students to review all materials in the course, one other participant used a free plugin, *Stash* ([https://moodle.org/plugins/block\\_stash](https://moodle.org/plugins/block_stash)), to hide coins throughout her course. Learners could add the coins to their stash if they happened to locate one by reviewing old activities. One teacher-participant chose to create an augmented reality scavenger hunt by using *Aris* (<https://fielddaylab.org/make/ariss/>) in which students could go on location-based missions and, at the same time, practice the simple present in interactions with their mobile devices.

**Table 4.2***Frequency of Customization and CALL Interaction Types*

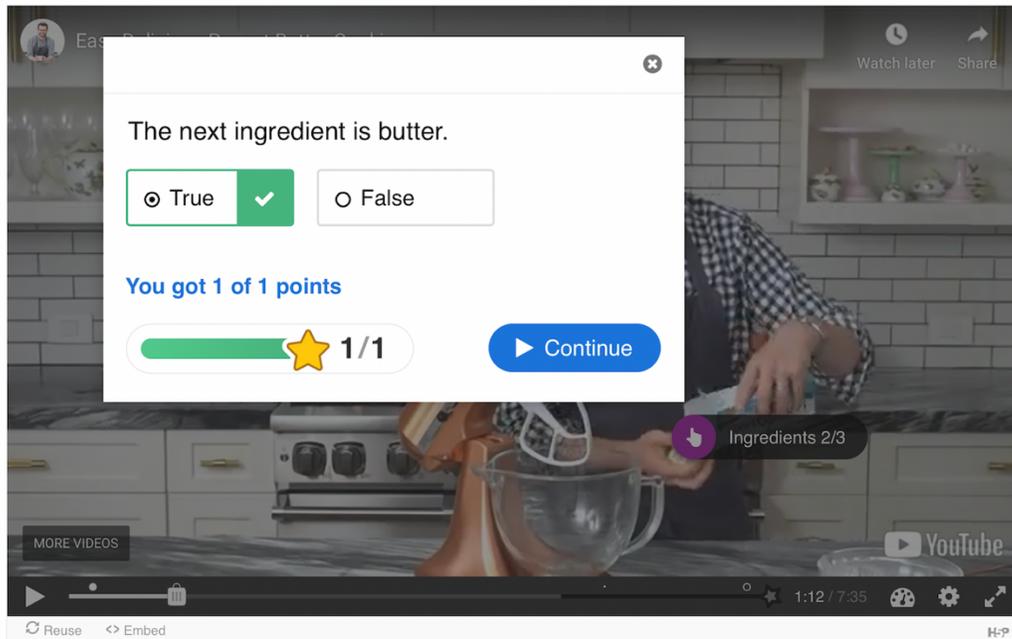
| Customization Type | CALL Interaction Type | N/179 | %      |
|--------------------|-----------------------|-------|--------|
| Creation           | Learner-Computer      | 49    | 27.37  |
|                    | Between-Learner       | 66    | 36.88  |
| Modification       | Learner-Computer      | 36    | 20.11  |
|                    | Between-Learner       | 0     | 0.00   |
| Adaptation         | Learner-Computer      | 28    | 15.64  |
|                    | Between-Learner       | 0     | 00.00  |
| Total              | --                    | 179   | 100.00 |

***Modified Materials***

All of the participants modified (20.11%; 36/179) materials by altering pre-existing online content so that their students could have interactions with computers in the target language. One way in which participants achieved this was by using the *H5P!* plug-in ([www.h5p.org](http://www.h5p.org)) to modify pre-existing *YouTube* videos. This enabled eight participants to super-impose comprehension questions that popped-up at specific points throughout a video, thus enabling their learners to answer questions and receive feedback about their ability to understand the video; in the case of correct responses, learners received experience points (see Figure 4.4 for an illustration of the interface). Participants also created pop-up links that would appear in the videos so that learners could have more information about a topic, as seen in Figure 4.4. These examples illustrate that teachers were able to modify pre-existing content, unintended for L2 teaching in this case, so that it could become useful for that purpose.

**Figure 4.4**

*An example of a participant's modified video with a true-or-false question superimposed over it*



All participants *modified* the text-to-speech resource *Quizlet* (<https://quizlet.com>) by altering the pre-existing content on sets of vocabulary flashcards so that they could make the activities more relevant to their students. Five teacher-participants created an assignment where learners needed to modify their own class's set of *Quizlet* flashcards by adding their own, thus providing students opportunities to participate in CALL material development. Like material adaptation, *modification* enabled teachers to take advantage of pre-existing materials with the added benefit of altering their content to make them more relevant and appropriate to their students. Similar to adaptation, none of the materials targeted between-learner L2 interactions.

### ***Adapted Materials***

All of the materials adapted (15.64%; 28/179) by the participants utilized pre-existing online materials that enabled learners to have L2 interactions with computers. These included the

adaptation of sets of TTS flashcards and level-appropriate *YouTube* videos (e.g., phonics songs), which were embedded in their Moodle courses. Nine participants adapted *YouTube* videos by incorporating a comprehension quiz to accompany a video, which learners would complete while watching it.

Interestingly, many of these adaptations made use of resources that had not been originally intended for L2 education. For example, consider the use of *Google Translate* (not a pedagogical tool) by one participant who assigned it to her students so that they could practice the pronunciation of difficult English words using its ASR feature.

It is in these ways that teachers took advantage of pre-existing online resources—*YouTube*, TTS, and ASR technology—and adapted them for L2 teaching without altering any of the original content or interface. These findings confirm that the levels have overlap, evidenced by the *creation* of a comprehension sheet to accompany an *adapted* video. Interestingly, as can be seen in Table 4.2, none of the participants adapted materials that targeted between-learner L2 interactions that can take place *through* the computer.

### **Pre-Service Teachers’ Perceived Use of the Three Levels of Customization: Qualitative (RQ #2)**

To answer the second research question, which aimed to understand how participants perceived they used Barcomb et al.’s (2018 – manuscript A) approach to customizing their own materials, this study utilized a Socratic-Wheel led discussion. Participants identified six key ways that represented their perception of the proposed approach, four of which are relevant to this study: (1) to stimulate L2 interaction, (2) to develop personally fulfilling materials, (3) to develop gamified materials, and (4) to target specific learner competencies. The following results will report the group’s ratings, from one to ten, for their perceptions of the approach at beginning

and end of the study, as well as in the future. Sample quotes are also included to provide insights into the participants' perceptions.

### ***Stimulating L2 Interaction: Spoke 1***

At the beginning of the course, the group did not perceive they could customize materials to stimulate interaction in the target language (group rating = 3/10), with quotes indicating that they lacked experience with CALL (e.g., "I think at the beginning of the course that I had experience creating materials for target language interaction but never with a computer really"). At the end of the course, conversely, the participants assigned a higher rating to their ability to customize such types of materials (group rating = 8/10; e.g., "I used customization to stimulate L2 interaction by searching through potential materials [online] and testing them out"). Participants did not negotiate a rating for the future because, as they explained, it depended on the school's resources. One participant, however, stated that it is not necessary to have an abundance of resources to customize CALL materials to stimulate interaction: "If you end up in a school that does not use much technology, you can always find online materials to adapt or modify [to stimulate L2 interaction]".

### ***Developing Personally Fulfilling Materials: Spoke 2***

Similar to the prior spoke, participants perceived being anxious and, in this case, unfulfilled by the materials they customized at first (group rating = 2/10); e.g., "At the beginning, I really didn't know what I was doing. I had to ask somebody what a URL was. That was not very fulfilling!" By the end of the course, participants perceived that they started using the approach to customize materials that were personally fulfilling (group rating = 10/10); e.g., "I want it to be fulfilling for me *and* [oral emphasis] the students. I would really like them to like what I am building." The group also assigned a high rating for personal fulfillment in the future

(group rating = 10/10), indicating that they would consider using the approach in their professional endeavors (e.g., “I always want to customize things that would be effective and that students would like, and that would make me feel like I was getting something out of it personally”).

### ***Developing Gamified Materials: Spoke 3***

All participants gamified their CALL resources and/or developed an augmented reality game. Participants were not aware of how they could use the proposed approach to develop these types of materials at the beginning of the course (group rating = 4/10); e.g., “At the beginning was like, ‘Yeah, it’s a game to learn. Blah, blah, blah.’” At the end of the course, all participants viewed themselves as capable of gamifying their pedagogical activities (group rating = 9/10); e.g., “Instead of teaching grammar points explicitly with instruction, it [the augmented reality game] was in the form of missions or like, one of the examples was a scenario where all of Dora’s notes flew away, so we have to go and gather all of the post-it notes. That kind of like setup, context, motivated me to create materials.” Participants reported that they intended to use gamification strategies in the future (group rating = 10/10) and learn more about it via participation in teacher-oriented events; e.g., “...at [local conference] they show you how to add gamification to your classes, so for conferences I think that would help to keep creating materials.”

### ***Targeting Specific Learning Competencies: Spoke 4***

The fifth and last spoke regarded the use of the proposed approach to develop materials that target specific learning competencies (e.g., a student’s ability to read an age-appropriate L2 text). At the beginning, participants reported lacking experience in designing materials that target specific learning competencies (group rating = 2); e.g., “...what is a 10-year-old kid supposed to

know? I can't find materials unless I know that." By the end of the course, participants had improved their perceptions on the topic (group rating = 6); e.g., "I applied competencies when I was customizing my own materials at the creation level. It was at that point that I began considering the level that my students were supposed to have for that project. And that helped me build all of my activities." Participants expressed that they were planning to continue to use the approach to target specific competencies in the future (group rating = 7); e.g., "Customization can go above and beyond normal activities, depending on what your students need."

### **Discussion**

The objective of this study was to assess the implementation of the approach proposed in Barcomb et al. (2018) (manuscript A), with the goals of determining: (1) the types of customization that pre-service teachers engaged in when developing their own CALL materials: adaptation, modification, and/or creation; and (2) how pre-service teachers perceived they used the proposed approach when customizing their own CALL materials. This section discusses this study's main findings based on the topics that guided this research.

#### **Types of Adapted, Modified, and Created CALL Materials: RQ #1**

The teacher-participants engaged in all three levels of customization when developing CALL resources to stimulate L2 interaction with and through computers, which was done in line with interactionist approaches to CALL (e.g., Chapelle, 1998, 2001, 2004; Chapelle & Jamieson, 2008). At the *adaptation* level, participants targeted interactions with computers by locating pre-existing resources and adapting their features so they became useful for L2 teaching. For instance, a participant adapted *Google Translate* by providing learners a list of words they could orally practice via the tool's built-in ASR capabilities, an approach found to be useful in the

acquisition of L2 pronunciation in previous research (e.g., van Lieshout & Cardoso, in press).

This finding exemplifies how teachers could work within their technological abilities to use pre-existing online resources for L2 teaching without altering any digital content.

At the *modification* level, participants showed that the approach to customization guided them in altering pre-existing content to stimulate interaction. For example, some participants developed assignments where students would modify a set of TTS flashcards by adding cards that their classmates could study, thus contributing to more constructivist approaches to CALL development (e.g., Brandl, 2002) and reinforcing Chapelle's (2001) notion of learner fit. These examples show that the proposed approach to customization might have also helped participants recognize their capabilities in CALL, as the modified materials detailed above contrast with their perceived abilities at the beginning of the study (e.g., "At the beginning, I really didn't know what I was doing. I had to ask someone what a URL was").

Participants most frequently engaged in *creating* their own resources, which included materials that provided L2 students more approachable ways for between-learner interactions. For instance, participants developed asynchronous speaking forums that provided learners the chance to send video messages to each other without the pressure associated with a face-to-face exchange (e.g., Carrio-Pastor, 2019), an approach that contributes to the production of more complex grammar and accurate speech (Guillén & Blake, 2017). This may also be a way for teachers to mitigate the anxiety that students experience when speaking in class (e.g., Baran-Lucarz, 2014), as entering a conversation becomes a more revocable action (i.e., learners can delete a video and re-record it if they wish). This use of technology is notable because it provides learners a way to approach a real-life activity, L2 interaction, but in a more approachable and possibly less anxiety inducing manner (Barcomb & Cardoso, 2020 – manuscript B; Fogg, 2002).

All of the participants chose to gamify materials to encourage students to interact with and through the target language in technology-enhanced settings. For example, a teacher participant confirmed that she developed strategies for creating a game that encouraged the use of CALL resources; e.g., “I could see how the structure of the gamified elements would affect a student’s motivation to interact with the activities.” Another participant created an augmented reality scavenger hunt, which is an approach that Godwin-Jones (2014) explains can extend the L2 classroom into the real-world. Finally, some participants created rewards systems that encouraged learners to review materials multiple times (e.g., by hiding coins students could collect), which is a key benefit of gamification (Bell 2018; Bogost, 2011).

### **Pre-Service Teachers’ Perceived Use of the Three Levels of Customization: RQ #2**

The second research question aimed to understand how participants perceived they used Barcomb et al.’s (2018) approach when customizing their materials. The data suggest that teacher-participants perceived they used Barcomb et al.’s (2018) approach to locate and develop materials to stimulate interaction among their students, despite reporting a lack of expertise to develop CALL materials at the beginning of the course. By the end of the course, however, all participants indicated they could use the approach to comfortably customize materials that they deemed to be personally fulfilling (e.g., “I always want to customize things that would be effective and that students would like, and that would make me feel like I was getting something out of it personally”). Unlike “first generation” CALL teachers who lacked experience as users of CALL (e.g., those reported in Kessler, 2010 were only familiar with the CD-ROM form of *Rosetta Stone*), the teachers in this course should have been more comfortable with CALL as a result of it being more prevalent in their daily life (e.g., all participants reported using *Google Translate* and *Duolingo*). This increase in access to CALL materials over the last decade might

have affected this study's results because the participants had a more extensive range of experiences with technology to draw from.

One possible reason the participants became aware of how to work within their abilities was that they could share and explore their experiences in class discussions, forum posts, and labs. This aligns with the constructivist aims of this study, as participants had a space to interpret their understanding and experiences (e.g., Creswell & Poth, 2018), which may have been a key aspect of them becoming aware of their aptitudes and limitations. Helping teachers to become aware of their abilities is a needed direction in CALL teacher training: if teachers are too anxious to engage with CALL educational technologies, they will likely avoid including it in their curricula (Kessler, 2010; Park & Son, 2009).

The Socratic-Wheel led discussion revealed that Barcomb et al.'s (2018) approach is malleable enough to satisfy different teacher skills, their teaching styles, and available resources. More importantly, our findings suggest its use can help teachers develop CALL materials that meet the guidelines of local or national schoolboards. For instance, some participants reported that they incorporated and adapted components of the local Québec government's learning competencies (e.g., interacting orally in English) in their activities; e.g., "I applied competencies when I was customizing my own materials at the creation level." This answers the second research question by showing that learners perceived using the approach to customize materials that addressed local requirements.

### **Limitations and Future Directions for Research**

The results reported provide some initial evidence for the effectiveness of Barcomb et al.'s (2018) approach in assisting teachers in the customization of materials. However, there are a number of limitations that require attention in future research. First, this study was embedded

within a project-based approach to CALL teacher training. Consistent with teacher training studies such as Kessler (2010) and Gruba (2017), project-based approaches provide opportunities for in-training teachers to become comfortable with CALL by discussing theory in forums and working together on projects, sometimes within course management systems. However, it should be acknowledged that the formal structures of the teacher-training setting where Barcomb et al.'s (2018) proposal was assessed present an inherent conflict, especially because the participants were evaluated for their performance in the course. To address this issue, one future direction is to test the approach with *in-service* teachers to determine the types of materials they can customize and whether they similarly feel at ease about customization. In this context, would in-service teachers choose to use the approach? If yes, it would be important to understand how they use it, how they perceive its use, and the forms of customization in which they engage.

A second limitation was the number of participants. Including more than 18 participants in the study might have shown different frequencies in the types of materials customized, and it would also make the findings more reliable and generalizable, at least to the targeted groups of ESL teachers in Montréal.

A final limitation was that the perception data was elicited at the end of the course. While this enabled participants to reflect on their experiences at the beginning of the course and their subsequent growth in CALL, future studies should include a pre- and post-test survey to better understand teacher-perceptions/beliefs about developing digital learning materials over the course of the study.

### **Concluding Remarks**

The objective of this study was to apply Barcomb et al.'s (2018 - manuscript A) approach to customization to a CALL teacher training context to: (1) determine what types of technology-

enhanced materials in-training teachers could customize (i.e., adapt, modify, create) to stimulate L2 interaction; and (2) examine student-teachers' perceptions of the ways in which they used the approach. With regard to the first objective, participants engaged in all three levels of customization to develop materials to stimulate their students' interaction *with* and *through* computers, with a specific emphasis on material *creation*, often including gamified elements. With regard to the second objective, participants indicated that they could comfortably use the approach to customize CALL resources for a variety of personal and pedagogical purposes. Altogether, the findings reported here support Barcomb et al.'s (2018) claims about teachers being able to work within their pre-existing technological abilities to customize CALL materials. Future research involving in-service teachers is an important direction that could provide a broader view of the ways in which customization may contribute to L2 teachers' professional development in CALL.

## Chapter 5: General Discussion

### Introduction

Godwin-Jones (2020a) describes the customization approach introduced in manuscript A (Chapter 2) as a future direction in L2 teaching, particularly because of its main benefit: it enables teachers to reflect on their pedagogical and technological abilities to develop CALL materials based on their time, technological expertise and resources, and their students' needs. Such an approach is needed because teaching with technology has been found to be an anxiety-inducing act for many L2 teachers (e.g., Kessler, 2010; Son, 2018), which has likely been exacerbated by the fact that the Coronavirus (COVID-19) health crisis has thrust language teachers into the CALL setting (Godwin-Jones, 2020b; Oskoz & Smith, 2020).

To this end, the three manuscripts featured in this dissertation shed some light on how teachers can become empowered to work on their own to categorize and customize CALL materials for their students to use. Specifically, the current dissertation contributes to an understanding of two overarching research questions:

1. How can L2 teachers work on their own to customize CALL materials directed at stimulating L2 learning?
2. What effect can a customized CALL resource made from widely available materials have on L2 learning?

In line with these questions, this chapter will review each manuscript, including an overview of the key findings and their contribution to the dissertation. This is followed by a summary of the main takeaways about CALL customization from the three manuscripts. The summary of the main takeaways is followed by a discussion of the pedagogical implications for

L2 teaching and learning, limitations of the dissertation, directions for future research, and concluding remarks.

## **Overview of the Manuscripts and Key Findings**

### ***Contributions of the Thesis***

Despite the limitations of the research included in this dissertation, there are some specific conclusions that can be drawn. The literature reviewed in Chapter 1 established a conceptual framework for the ways in which teachers can use technology to develop CALL materials, and it also established a need for an approachable way for teachers to develop such materials. Though Chapter 2 (manuscript A) was conceptual, it does achieve this goal by proposing an approach for teachers to customize materials within their resources. The evidence from Chapters 3 and 4 (manuscripts B and C) then provide answers to the two overarching research questions in this dissertation.

With regard to the first overarching research question, which examined the ways in which L2 teachers can work on their own to customize CALL materials for stimulating L2 learning, the evidence from manuscript C shows that the in-training teachers who participated in the study perceived they used the approach to customize CALL materials, even those who noted this would not have been a possibility at the beginning of the course. The CALL courses and materials the participants customized support these claims.

Regarding the second overarching research question, which investigated the effects that a customized CALL resource can have on L2 learning, manuscript B showed that learners improved at pronunciation from the pre- to post-test and that their qualitative responses indicate they developed a metalinguistic understanding of the target features, as a result of using a course customized at the *creation* level.

***Manuscript A. Foreign Language Teachers as Instructional Designers: Customizing Mobile Assisted Language Learning Technology***

The first overarching research question aimed to determine if L2 teachers could work on their own to customize CALL materials that promote learning. To better understand this possibility, manuscript A (Chapter 2) outlined and illustrated the implementation of three levels of teacher-customized materials (i.e., adaptation, modification, creation) in a technology-enhanced learning setting. The authors positioned language teachers as instructional designers to customize online materials in order to stimulate their students' L2 use and interaction *with* and *through* technology, sometimes including gamified elements.

The authors then defined parameters for each level of customization: *adaptation* includes pre-existing online materials that cannot be altered for L2 teaching; *modification* includes pre-existing online materials that can be altered for L2 teaching; and *creation* enables a teacher to create CALL materials that would not otherwise exist. Next, the authors provided examples of three levels of customized materials: *adaptable* digital vocabulary cards that allow teachers to use pre-existing tools to help their students learn about the pronunciation of unknown words or phrases, without modifying or creating any content (Level 1); *modifiable* TTS vocabulary cards that allow teachers to alter pre-existing online sets of cards to make them more relevant to their learners (Level 2); and, finally, *creatable* vocabulary quizzes (e.g., on Moodle), which provide teachers a way to have full control over the development of the pedagogical activities, sometimes including gamified elements (Level 3). In these ways, manuscript A (Chapter 2) proposed and illustrated three ways (i.e., via adaptation, modification, creation) in which L2 teachers might work on their own, within their resources, to customize current CALL resources to promote L2 learning (overarching research question #1).

***Manuscript B. Rock or Lock? Gamifying an online course management system for pronunciation instruction: Focus on English /r/ and /l/***

Manuscript B (Chapter 3) directly addressed the second overarching research question (i.e., what effect can a customized CALL resource made from widely available materials have on L2 learning) by implementing the customization approach proposed in manuscript A (Chapter 2). The resource built for this study followed interactionist approaches to CALL by developing a resource that provided learners opportunities to interact *with* the computer to learn L2 pronunciation. The study investigated how a gamified learning environment developed at the *creation* level might contribute to the L2 acquisition of /r/ and /l/ by a group of English learners in Japan. The creation level was of interest for manuscript B because it provided researchers the control necessary to develop materials to help them answer the main research question: What are the effects of the proposed gamified environment on the pronunciation of the /r/-/l/ distinction among Japanese learners of English? The question was subdivided into three sub-components:

- Does the proposed environment contribute to improved pronunciation of /r/ and /l/?
- Does the proposed environment increase awareness to the /r/-/l/ distinction?
- What are users' perceptions of learning pronunciation in the proposed environment?

The participants were Japanese junior high school students living in Japan. As part of the experiment, they watched simulated pronunciation videos about /r/ and /l/ pronunciation, took minimal-pair listening quizzes, and drew the articulators of the target phonemes that they were learning, all in L2 interactions *with* computers. Consistent with the design choices available at the creation level, the materials were developed and housed in a Moodle-based CALL site titled “English Detective”, which rewarded students with points and badges as they worked through a series of detective themed pronunciation activities.

Mixed-methods results indicate that the use of the customized materials contributed to the acquisition of English /r/-/l/ and the development of the participants' L2 metalinguistic knowledge. The participants also noted that they perceived the proposed learning environment to be an enjoyable experience, suggesting that these types of customizable CALL resources have the potential to satisfy users and consequently promote L2 learning. These findings address overarching research question #2 because they contribute to our understanding of the effect that a customized CALL resource can have on L2 learning.

***Manuscript C. Teachers as CALL Designers: Exploring perceptions of customization and approaches to designing materials***

Manuscript C (Chapter 4) aimed to better understand how L2 teachers can work on their own, within their resources, to customize CALL materials to promote L2 learning (overarching research question #1). The study took place in a teacher training course with participants representing a wide range of knowledge and experiences with regard to L2 teaching, pedagogical experience, and technological expertise. The research questions aimed to determine:

1. Based on Barcomb et al. (2018 - manuscript A), what types of customization do pre-service teachers engage in when developing their own CALL materials: adaptation, modification, and/or creation?
2. How do pre-service teachers perceive they used the proposed approach when customizing their own CALL materials?

To answer the first research question, the teacher-participants developed an online ESL course that included their customized materials. Results indicated that participants chose to *create* CALL resources with original content more often than adapting or modifying pre-existing materials. In line with interactionist approaches to CALL, the participants' instructional

materials targeted L2 interactions *with* and *through* computers, including opportunities for individualized instruction and chances to communicate with other learners both synchronously and asynchronously. The teacher participants also incorporated gamified elements to promote consistent study habits. Answers to the second research question emerged from a reflective discussion facilitated by the Socratic-Wheel technique (Chevalier & Buckles, 2018), which was held at the end of the course and was used to better understand pre-service teachers' perceptions of customizing CALL materials.

The results indicated that the participants perceived the customization approach to be useful when developing their digital L2 materials. More specifically, the application of Barcomb et al.'s (2018) strategies helped the participants to comfortably approach CALL customization in ways they deemed pedagogically useful and personally fulfilling. These findings yield initial evidence that, with some guidance, teachers can work independently and within their resources to customize materials for the promotion of L2 learning in a technology-enhanced environment (overarching research question #1).

### **Takeaways from the Three Manuscripts**

#### ***Customizing CALL Materials Does Not Require Sophisticated Technical Knowledge***

Based on the existing literature, teachers wishing to develop technology-enhanced activities for L2 teaching are encouraged to take one of the following actions: recommend resources for students to explore on their own outside of class (e.g., Godwin-Jones, 2019, 2020b), develop programming skills (e.g., Godwin-Jones, 2015), or work with teams of programmers (Caws & Hamel, 2016). Despite the benefits of these alternatives, manuscript A (chapter 2) proposed an alternative approach to customization that positions teachers as independent CALL designers, based on their technological abilities and resources, so that they

can adapt, modify, and/or create technology-enhanced materials without overextending their resources.

At the most basic level, adaptation enables teachers to include external resources that make pre-existing online materials relevant to particular groups of L2 learners. An example of a teacher-adapted resource could be seen in manuscript C (Chapter 4), when a teacher-participant developed a comprehension sheet for students to complete while watching a pre-existing online video. Instead of developing a CALL resource from scratch, the comprehension sheets that accompanied the assigned video-watching activity made the pre-existing resource useful for stimulating L2 interaction *with* a computer. As was seen, many of the materials in this dissertation made use of open or free materials, which provided teachers a way to apply their knowledge to the customization of CALL materials without straining financial resources.

The customized materials in this dissertation also exemplify how teachers can develop more complex resources from scratch without programming (i.e., via creation). As an example, manuscript B (Chapter 3) featured a teacher/researcher-customized gamified pronunciation site that encouraged learner interactions with the computer (a Moodle-based course). Similarly, teacher-participants in manuscript C (Chapter 4) sometimes worked at advanced levels of creation to customize materials that promoted L2 interactions *with* (e.g., to complete an ASR-based activity) and *through* computers (e.g., to communicate with others via asynchronous speaking forums).

Although programming and other technological skills can undoubtedly provide teachers an advantage (e.g., Godwin-Jones, 2015, Caws & Hamel, 2016), the above examples illustrate that teachers (and researchers) are capable of customizing their own CALL resources, ranging from simple to complex, by exercising basic technological abilities. This evidence addressed

overarching research question #1 by showing how teachers can work within their technological abilities and resources to customize technology-enhanced materials that promote L2 learning.

### ***Customizable CALL Materials Can Promote L2 Learning***

This dissertation aimed to determine how teachers can use technology to promote L2 learning, with attention directed towards cognitive interactionist approaches to CALL (e.g., Chapelle, 1998; Chapelle & Jamieson, 2008). To exemplify this possibility, the Japanese participants in manuscript B (Chapter 3) regularly used a gamified site that included pronunciation videos and listening quizzes. One possible reason for why participants used the resources repeatedly was due to the use of gamified elements, as indicated in their responses (e.g., some alluded to the fact that they were motivated to practice repeatedly so that they could receive experience points).

In addition to using gamification as a strategy to encourage learners to study, the activities in the pronunciation site (manuscript B) were specifically designed to make L2 use more approachable. For example, the videos enabled learners to practice an anxiety-inducing act (i.e., L2 pronunciation; Baran-Lucarz, 2014) in a comfortable manner, which allowed them to practice in private (Fogg, 2002). The pronunciation videos, which were developed in line with Saito's (2013) recommendations for providing explicit phonetic information to learners, also seem to have helped students develop metalinguistic knowledge, as evident in post-test responses (e.g., when participants explained that they had learned about the shape of one's mouth when pronouncing /l/). These resources and their effect on L2 learning conform with interactionist approaches to CALL, as L2 interactions *with* a computer can enabled learners to direct their attention to form by interacting with enhanced input (Chapelle, 2003). It seems that the gamified

elements, combined with the CALL resources, might have encouraged learners to routinely review materials specifically designed to help them learn to pronounce the targeted L2 segments.

Although future research with a control group is needed to determine the effect that customizable CALL resources can have on L2 acquisition, the initial evidence suggests that it can be beneficial. These results address overarching research question #2 by showing how a teacher-customized CALL resource can affect learning when students interact *with* computers.

### ***Teachers Can Comfortably Customize CALL Resources***

Working within one's abilities is an important starting point in CALL as teachers commonly have negative beliefs and anxiety about the prospect of using technology (Kessler, 2010; Park & Son, 2009; Son, 2018). Addressing this issue is important because anxious teachers will likely refrain from developing their own materials, which can negatively affect their decision to teach with technology in the future (Kuure et al., 2016). In the current dissertation, some teacher-participants in manuscript C (Chapter 4) perceived the pedagogical use of technology to be anxiety inducing and, as a consequence, they had little desire to teach with it at the beginning of the course. However, after becoming aware of their abilities (e.g., via exposure to the approach to customization introduced in manuscript A), they realized that they could develop their own CALL materials based on the available pool of resources. Their ability to develop materials became evident in the range of activities that they designed for their final projects (e.g., a fully-functional online ESL course). The manner in which the teacher-participants began customizing materials in such a short amount of time shows that they were able to identify ways to maximize their pre-existing technological abilities—a key goal of manuscript A (Chapter 2). For example, one participant pointed out that a “positive transfer”

existed between different types of customizable resources (e.g., she mitigated one tool's limitations with another tool's strengths by combining the two).

Though some teacher-participants were anxious at the beginning of the course, all reported being comfortable with customizing CALL resources by the end of the term. These findings address overarching research question #1 by providing evidence for how teachers can work on their own, within their resources, to customize CALL materials directed at promoting L2 learning, with emphasis on comfort.

### **Pedagogical Implications: Approaching CALL development**

#### ***Course Management Systems Support Teachers in the Customization of CALL Materials***

Socio-constructivist approaches to CALL teacher training promote exploration and skill development (e.g., Son, 2004, 2018), which are outcomes that can be supported by course management systems (CMS) such as Moodle (e.g., Gruba, 2017; Kessler, 2010). Moodle is a socio-constructivist tool that is assumed to benefit L2 pedagogy because of its emphasis on social interaction among learners (e.g., Dougiamas & Taylor, 2003).

Manuscript C (Chapter 4) highlighted how teacher-participants used Moodle to learn about CALL theory by sharing their thoughts about course readings in weekly forum discussions; their posts also stimulated in-class discussions that took place during class meetings. As the course progressed (and as required by the training program), participants also used their own CMSs to *adapt*, *modify*, and *create* materials for their L2 students. Course management systems are useful for this purpose because they provide teachers a way to comfortably develop technology-enhanced materials for the first time (e.g., Dick et al., 2014; Van Olphen, 2008), including the ability to personalize digital resources and troubleshoot documented problems (Carliner & Driscoll, 2019). While customization in a CMS does not seem like a constructivist

approach on the surface, the teacher-participants in manuscript C (Chapter 4) often collaborated by gathering in front of one computer to create gamified CALL resources via user-friendly drag-and-drop options. The evidence here does not directly answer the two overarching research questions, but it does show how CMSs, and Moodle in particular, can support teachers learning to work within their resources to customize CALL materials (overarching research question #1).

### ***Customizing Gamified CALL Materials Can Promote Learner and Teacher Engagement***

The pedagogical benefits of teachers customizing gamified CALL materials for their students are twofold: first, gamification can encourage learners to use resources in ways that promote consistent L2 learning (e.g., Reinhardt, 2019; manuscript B - Chapter 3); and second, developing gamified materials seems to motivate teachers to make dynamic CALL materials (e.g., creating an augmented reality game to teach L2 grammar; manuscript C - Chapter 4).

From a learner's perspective, the gamified pronunciation course in manuscript B (Chapter 3) encouraged participants to repeatedly practice and complete the assigned pronunciation activities to gain points, which they perceived to be an enjoyable experience. Conversely, from a teacher's perspective, gamifying CALL materials seems to have made material development more purposeful, as seen by comments from teacher-participants in manuscript C (Chapter 4). One participant, for instance, explained that she customized an augmented reality game so that their learners could study grammar in an interactive scavenger hunt. This dissertation shows that the development of gamified resources can benefit L2 learners by motivating them to practice and use the target language, and it can also cause teachers to become more involved in CALL customization.

## ***Customizable CALL Materials Can Promote L2 Learning in Out-of-Class Settings***

One final pedagogical implication of this dissertation is that many of the customized materials featured in the manuscripts can stimulate L2 interaction in out-of-class settings (e.g., between classes). Such materials are currently needed due to an expanding population of L2 teachers working in the distance setting and having fewer or shorter class meetings (e.g., due to COVID-19; Godwin-Jones, 2020b). Despite the need for teachers to develop CALL resources that promote out-of-class learning, they necessitate an approachable way to achieve this goal.

Manuscript A (Chapter 2) emphasized out-of-class learning by highlighting how teachers could customize materials to increase the amount of L2 input that students could receive in a time and location of their choice, thus promoting anytime-anywhere learning. Manuscript B (Chapter 3), in a more involved manner from a design standpoint, exemplified how a gamified course could encourage learners to practice L2 pronunciation in interactions *with* computers in a time and location of their choice. The teacher-participants in manuscript C (Chapter 4) also created a number of materials suitable for out-of-class L2 interactions *through* computers (e.g., asynchronous speaking forums), in settings less susceptible to causing speaking anxiety (Baran-Lucarz, 2014). The findings answer the first overarching research question by showing that teachers chose to engage in adapting, modifying, and creating CALL materials with the intent of stimulating out-of-class L2 interaction.

## **Limitations and Future Research Directions**

### ***Limitations***

Despite the potential for teacher-customized CALL materials to enhance the ways in which L2 learners can use the target language, there are a number of limitations that apply to the studies covered by this dissertation. First, it was not possible to determine the extent to which the

three levels of customization proposed in manuscript A (Chapter 2) contributed to pre-service teachers recognizing their own limitations in CALL. Second, the research reported in manuscript B (Chapter 3) did not contain a control group, thus making it challenging to draw specific conclusions from the study. Third, the two studies including human participants included a low number of participants. Finally, the dissertation focused on English, the most commonly researched L2 in SLA research. The following overview examines each of these limitations.

The first limitation is that manuscript A (Chapter 2) constitutes a framework to lead to reflection, particularly in relation to teachers' ability to recognize their own knowledge about CALL and limitations. As a result, the approach to customization proposed does not inform teachers where to begin or what they need to know—they need to arrive at this conclusion on their own. It should be noted that the teacher-participants in the study in manuscript C (Chapter 4), even those who identified as being anxious, still ultimately had the responsibility of customizing CALL resources to complete the course. This added responsibility seems to have motivated trainees to expand and explore their knowledge and abilities beyond what they otherwise would have.

A second limitation is that manuscript B (Chapter 3), which *pilot*-tested the effect that a customized resource at the creation level could have on L2 learning (overarching research question #2), did not include a control group. This makes it challenging to conclude that the gamified pronunciation course was fully responsible for the learning that was observed. With a control group, it would be possible to arrive at more reliable generalizations about the effect that the proposed environment could have on L2 learning. For example, an identical (comparable) course without gamified elements would help to determine the effect that its game-informed counterpart could have on pronunciation learning. Despite the potential of these preliminary

findings, a controlled experiment is needed to assess the effectiveness of the customized CALL resource.

The third limitation is that the two studies featuring human participants, manuscript B (Chapter 3) and manuscript C (Chapter 4), included a low number of participants. Manuscript B (Chapter 3) only included 11 participants in the pronunciation study, making it necessary to perform non-parametric testing and, therefore, difficult to draw any specific conclusions about L2 pronunciation gains. Manuscript C (Chapter 4) included only 18 teachers out of 25 potential participants for the first part of the study (the design-log), and only six for the second part, the Socratic-Wheel discussion. The low number of participants makes it difficult to make any generalizable claims about the types of customization in which teachers prefer to engage.

Finally, the fourth limitation is that the emphasis was on English, the most targeted L2 in foreign language education (Collins & Muñoz, 2016) and CALL research (Sauro, 2016). Researching less commonly taught L2s such as Arabic or French could aid in understanding not only more about customization, but about SLA in general.

### ***Future Directions***

The future directions discussed here aim to advance research about the effect that the approach to customization proposed in manuscript A (Chapter 2) can have on the development of digital materials designed to promote L2 learning. One possible future direction is to conduct a study that considers how in-service teachers customize materials without the structures of a formal teacher training course. Another direction is to conduct experiments with control groups about the effect that a customized CALL resource has on L2 learning. Finally, the inclusion of other languages could lead to a better understanding of customization and its potential effect on SLA.

Let us start with the first future direction, which is to conduct research about customization with *in-service* teachers working independent of the structures of a formal teacher training course. The approach to customization proposed in manuscript A (Chapter 2) does not tell teachers where to begin or what they need to know, as they instead must arrive at this conclusion on their own, based on self-reflection and/or discussion with others. Therefore, a potential direction for research is to examine material customization in an *in-service* teacher context to determine: (1) if teachers can use the approach to become aware of their pre-existing knowledge and abilities, and (2) if they can work within those perceived abilities to develop their own pedagogical materials. This is necessary because, though the pre-service teachers in manuscript C (Chapter 4) chose to adapt, modify, and create CALL materials, all of the resources were developed in a formal training context where trainees received assistance from the instructor, teaching assistants, and peers. It is therefore important to determine the effect that this approach could have on an in-service teacher's ability to tap into their pre-existing knowledge and abilities in the customization of their own CALL materials.

A second future direction is to conduct a full-scale experiment that includes a methodology similar to the one reported in manuscript B (Chapter 3), except in a controlled experiment (i.e., with a control group) and with a larger pool of participants. This is hypothesized to help determine the effect that a customized CALL resource can have on L2 learning. For instance, quantitative research could shed light on the ways in which a customized resource, with and without gamified elements, affects L2 pronunciation outcomes. Post-test interviews could provide insights into the strategies that learners employ when studying in such an environment.

Finally, future research should provide insights into whether the proposed approach is applicable in the context of understudied L2s such as Irish (e.g., Ní Chiaráin & Ní Chasaide, 2020) and French (Liakin et al., 2017). Implementing this approach in contexts outside L2 English could introduce customization to a new audience of teachers and elicit insights from those working in less commonly researched *foreign* language teaching contexts. These future directions would not only contribute to assessing the effectiveness of CALL customization from both teacher and learner perspectives, but they could also place some power in teachers' and researchers' hands by providing them an approach to developing their own CALL content that can be effective for L2 pedagogy.

### **Final Remarks**

The goal of this dissertation was to better understand how teachers can work on their own, within their resources, to customize CALL materials that promote L2 learning. This aim evolved directly from the work I did at the onset of my Ph.D. studies when my interests in CALL-based pronunciation instruction led me to the discovery that I could develop gamified L2 pronunciation resources on my own. It was at this point that I realized that I could create highly complex materials based on my technological and pedagogical aptitudes and preferences, as well as my students' needs, all without advanced technological abilities. The desire to share this possibility with other L2 teachers and researchers motivated the above three manuscripts. While future research is still needed to understand the full effect that customization can have on L2 pedagogy, this work offers some initial evidence that customization can enable teachers to comfortably work within their resources to develop CALL materials that reflect their technological abilities and students' needs. My hope is that manuscript A (Chapter 2) establishes how teachers can develop their own customizable materials, while the evidence in manuscripts B

and C (Chapters 3 and 4) encourages future research that positions teachers as customizers of their own modern CALL materials.

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## Appendix A: Screenshot of Teacher-Customized ESL Course

The screenshot shows a course interface for "Making English Cool Again". At the top, there are navigation icons (a hamburger menu, a bell, and a speech bubble) and the course title. Below the title, there are controls for "Open all" and "Close all", followed by instructions: "Instructions: Clicking on the section name will show / hide the section." The main content area is divided into two sections. The first section, labeled "1", is titled "Lesson 1: Making allies - Toggle" and is marked as "Topic 1". It contains introductory text: "In this course, you will be training alone but you will also need your classmates' help, so it is important that you introduce yourselves to each other!" and "In this topic, you must:" followed by a numbered list of four tasks: 1. Submit a video recording introducing yourself. 2. Reply to 2 classmates' videos. 3. Submit a document with three goals you have for this course. 4. Don't forget to check off what you completed in "Lesson 1 To-do list". Below the list, it says "For more details, click on the activities below." There are four activity items, each with an icon and a checkbox: "Checklist - Lesson 1 (5xp)", "Introduce yourselves! (15xp) + Replies (15xp)", "How to introduce yourself (5xp)", and "My 3 Goals (30xp)". The second section, labeled "2", is titled "Lesson 2: Knowing your surroundings - Toggle" and is marked as "Topic 2". On the right side of the interface, there is a "Blog menu" section with links: "View all entries for this course", "View my entries about this course", and "Add an entry about this course". Below this is a "Blog entries" section with a link "Add a new entry" and a search box with a "Search" button.

## Appendix B: Design-Log

Title of build:

Target learner age:

Location (in class or out-of-class):

Form of customization (adaptation, modification, creation):

Builder of material (teacher-built, student-built, hybrid):

Type of L2 interaction (reading, writing, listening, speaking):

Type of interaction with technology (typing, touching, listening, etc.):

Hardware to be used (e.g., microphone, speakers, camera, etc.):

Game or game-like elements to be used (commercial game, serious game, gamification):

Name of software(s) to be used (e.g., Moodle, Level Up!, Quizlet, PowerPoint, etc.):

Moodle feature(s) to be used:

## Appendix C: Screenshot of Socratic-Wheel Conversation

