

Learning Pronunciation with Google Translate: Focus on English Past -ed

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ABSTRACT

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The limited amount of time is one of the most common problems that teachers and second language (L2) students face in language classrooms, particularly for pronunciation instruction. To address the problem, teachers often ask students to engage in self-directed and out-of-classroom activities (e.g., homework) by using technologies such as Text-to-Speech Synthesis (TTS) and Automatic-Speech-Recognition (ASR). However, little is known about the feasibility of using TTS and ASR combined (as found in Google Translate - GT) as pedagogical tools, nor do we understand what happens when the learner is asked to use the technology to learn on their own, outside of their classrooms.

Following a pre-test-post-test design, this mixed-methods one-shot study investigates the pedagogical affordances of GT's TTS and ASR speech capabilities and how their use can help learners acquire L2 pronunciation. More specifically, the present study focuses on the acquisition of English past -ed pronunciation, a challenging learning target (in terms of phonological awareness, listening discrimination or perception, and production) in a teacher-guided semi-autonomous out-of-class context. Emulating the completion of a homework assignment, 20 Farsi-speaking English learners used GT's TTS and ASR functions to learn the pronunciation of past -ed allomorphy (/d/, /t/, /id/) through various listening (via TTS) and speaking activities (via ASR).

Findings indicate that there were significant improvements in both the participants' *awareness* and *perception* of the English past -ed allomorphy, thus confirming that GT and its speech capabilities can help learners acquire the target pronunciation feature in these two initial

stages of L2 pronunciation development. However, in *production* (the subsequent stage), only one of the allomorphs (/id/) had improved by the end of the experiment.

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Chapter One

It was in 1997 when I first began learning English as a foreign language in Iran. At that time, one of my biggest issues was learning pronunciation, owing to very few resources being at my disposal, namely the teachers and the traditional audio cassettes that accompanied the required language textbooks. Such a shortage of resources adversely impacted the quality and quantity of the language input that I could have received, and the output that I wished to produce. In this scenario, I only saw my English teachers for approximately three hours per week, during which they only devoted a negligible proportion of class time for pronunciation practice (including feedback), as they had other important parts of the syllabus to cover (see Foote et al., 2011 for similar claims in North America). The issue of lack of practice was further exacerbated by the quality of the input I received, as my teachers were heavily accented in English and probably not highly intelligible, if my memory serves me well. As for the audio cassettes, these mostly focused on a single North American variety of English and, more importantly, they did not allow for any creativity or language exploration (i.e., students could only listen to the dialogues that had been pre-recorded).

Spending many hours outside of the English classroom doing homework and self-study, I genuinely felt the need for more resources. With the hope that technology could provide me with additional resources, my parents bought me a PC – a luxury in those days! The so-called “Talking Dictionary” applications installed on my PC were able to help me improve my pronunciation to some extent by showing me how to pronounce certain words. Nonetheless, I was still confined to what the applications had to offer, as those Talking Dictionaries contained only the pronunciation of the *words* stored in their limited database, in isolation. In addition, I was unable to verify the accuracy of my attempts to orally produce the words and phrases that I had just learned.

Some years later, my passion for the field of education led me to become an English language teacher. Based on my own learning experience as a student and the difficulties I experienced learning pronunciation, I now pay particular attention to this important L2 ability. However, in practice, I encountered a serious limitation to implement the ideas that I had in mind regarding pronunciation instruction: lack of time.

One of my colleagues, Mary (a pseudonym), a passionate English language teacher, shared with me that she has been experiencing the same problem when teaching pronunciation: she could only devote a small amount of time for the task in her classes because the course syllabus covered other important (as well as time-consuming) skills such speaking, reading, and writing. As a result, she only briefly explained the basics of pronunciation and, after a few minutes of practice, she had to move on to the next section of the syllabus without knowing if the students had acquired the target feature.

Mary's story exemplifies one of the most common challenges with which both teachers and learners struggle: the limited amount of time available in language classrooms (Collins & Muñoz, 2016; Moghaddam et al., 2012; Morin 2007). Such limited time deprives students of receiving enough and high-quality aural input (e.g., listening to the teacher, audio files) and producing enough output (e.g., speaking, interacting with peers). Requiring hours of input and output practice (Cardoso, 2018; Everly, 2019), pronunciation learning can be one of the most susceptible abilities to be negatively affected by time constraints, as discussed in Mary's story.

Pronunciation Teaching and Technology

Over the past few decades, we have seen the expansion of the internet and the creation of new technologies that permeate every corner of our lives. Fortunately, these new technologies are highly accessible (most often available at no cost) and easy to use. In addition, they have great

potential to attend to the time limitations that afflict language teachers such as Mary, as they can extend the reach of the language classroom (Nunan & Richards, 2015, p. 216) by encouraging students to explore the language autonomously (e.g., in out-of-class assignments), beyond the walls of their schools. Two pedagogically interesting technologies for this purpose are Text-to-Speech Synthesizers and Automatic-Speech-Recognition.

Text-to-Speech (TTS) is a technology that converts written text into voice output, providing language learners with aural input in large and varied quantities (Cardoso, 2018) and with speech quality that resembles that of human speakers (Bione & Cardoso, 2020). Automatic-Speech-Recognition (ASR), on the other hand, converts spoken language into text, thus providing students with opportunities for oral producing and for receiving corrective feedback. Research has shown that these two technologies can be pedagogically beneficial for pronunciation learning (Liakin et al., 2017a).

In this study, Google Translate was selected for a variety of reasons: it combines the two abovementioned technologies (TTS and ASR) in a single application; it is easily accessible at no cost to the user; it is easy to use, as most potential users are familiar with Google's interface and its *modus operandi*; it is a popular application (Ducar & Schocket, 2018); and more importantly, the quality of its synthesized voices and speech recognizer is considered of excellent quality (see Van Lieshout & Cardoso, *in press* and McCrocklin et al., 2019 for TTS and ASR respectively).

This study: Google Translate and its Speech Capabilities in Pronunciation Learning

This study examines the pedagogical affordances of GT's speech capabilities (TTS and ASR) and how their use can help learners acquire L2 pronunciation. More specifically, the present study focuses on the acquisition of the patterns involved in the pronunciation of English past -ed allomorphy in terms of sound awareness, listening discrimination (or perception), and oral

production - three stages in pronunciation development (Celce-Murcia et al., 2010) in a teacher-guided, semi-autonomous context, conceptualized as an extension of the classroom (i.e., via a homework assignment).

The findings of this study will provide teachers with a better understanding of what happens when a learner is asked to use a technology (e.g., GT and its speech capabilities) to learn on their own, outside of their classrooms. With such knowledge, teachers can become more motivated to engage learners in teacher-initiated semi-autonomous activities and, at the same time, alleviate them from the time limitation described earlier.

As per the guidelines for a manuscript-based MA thesis, the next section constitutes “a full submittable draft of a manuscript” that presents the full literature review, methodology, results, and discussion of the abovementioned research.

Chapter Two

Mary is a passionate and qualified English language teacher who has well over a decade of teaching experience with adult learners. In the last session, she taught her class the grammar of regular past tense verbs. The textbook that she used contained a pronunciation section that dealt with the morphophonemic variation involving the past marker -ed (e.g., it is pronounced /d/, /t/ or /ɪd/ depending on the preceding phonological environment). However, Mary was faced with an important choice: Because the course syllabus covered a variety of skills, including speaking, reading, and writing, each of which could easily monopolize classroom time, she decided to devote only a limited amount of time in class to -ed pronunciation. As such, she only briefly explained the basics of past -ed pronunciation and, after a few minutes of practice, she moved on to the next section of the course syllabus without confirming that the students had fully acquired this important feature of English grammar.

Mary's hypothetical classroom epitomizes one of the most common hurdles with which both teachers and second language (L2) students grapple: the limited amount of time of language classrooms (Collins & Muñoz, 2016; Moghaddam et al., 2012; Morin 2007). Such time constraint deprives students of receiving sufficient linguistic input (e.g., listening to other speakers of the target language) and producing enough output (e.g., speaking, interacting with others). One of the areas in language learning that can be profoundly and negatively impacted by this time limit, as discussed in our fictional example above, is L2 pronunciation because it requires hours of input and output practice (Everly, 2019).

Several experienced teachers like Mary ask students to engage in self-directed and out-of-classroom activities to address some of the limitations pertaining to in-classroom learning. To do so, due to the pervasive role of technology in today's life (Khademi & Farokhmehr, 2016), some

teachers choose to rely on certain applications such as Text-to-Speech Synthesis and Automatic-Speech-Recognition, to encourage their students to practice and, consequently, extend the reach of their classrooms (Nunan & Richards, 2015).

Text-to-Speech (TTS) is a technology that converts written text into spoken voice output, while Automatic-Speech-Recognition (ASR) does the reverse: it transcribes spoken language into text. These two technologies can be used as effective pedagogical tools (Bione & Cardoso, 2020; Cardoso et al., 2015; Cardoso, 2018), as TTS and ASR can engage learners with a wide range of out-of-classroom assignments, including the promotion of input (TTS) and output (ASR) practice for the acquisition of L2 pronunciation (Liakin et al., 2017a).

Research has shown that TTS and ASR applications can play a significant role in fostering learner's autonomy beyond the walls of the classroom (Ekşi & Yeşilçınar, 2016; González, 2007; Van Lieshout & Cardoso, in press). In other words, a teacher can have the students use these tools to practice a part of the syllabus on their own (e.g., at home or “on the move”) without needing the presence of a teacher (Gonzalez, 2007). One can thus assume that TTS and ASR can be used as pedagogical tools that can assist in the development of L2 learners' autonomy (Cardoso, 2018; LaRocca et al., 1999; Liakin et al., 2017a; McCrocklin, 2016).

In the vast majority of available studies (see Van Lieshout & Cardoso, in press for an exception), TTS and ASR have been studied separately; accordingly, little research has been conducted to investigate the two applications combined into a single tool to help learners acquire target L2 features. To address this gap, this study aimed to explore the pedagogical use of Google Translate to improve learners' pronunciation of regular past tense marker -ed allomorphy in terms of awareness (i.e., conscious noticing and understanding of patterns and rules in a language; Schmidt, 1995), perception (i.e., the ability to discriminate between distinctive sounds; Cardoso,

2011), and production (i.e., the ability to intelligibly pronounce the target sound; Soler-Urzúa, 2011).

Google Translate has been chosen because it possesses two speech capabilities (TTS and ASR), which enable it to fulfil three important criteria, as GT: 1) meets Dickerson's (2013, 2015) requirements for the development of L2 pronunciation (i.e., promotes access to input, output practice, and opportunity for learners to predict pronunciation patterns based on grapheme-to-phoneme associations); (2) can promote learners' autonomy (Liakin et al., 2017a); and 3) satisfies the criteria for technology adoption put forth by Chapelle (2001; see the forthcoming discussion). In addition, GT is free, accessible, and widely popular among the general population (Ducar & Schocket, 2018).

This study aims to provide a microscopic snapshot of what happens between the initiation of a teacher's intervention (e.g., when Mary asks her students to use technology to learn a language feature; in this study, the pronunciation of past -ed) and a possible outcome (i.e., the learning of past -ed allomorphy). Therefore, it is predicted that the homework assigned by Mary can help her learners acquire certain aspects of what it means to acquire past -ed morphophonemics in English: awareness to its pronunciation, perceptions of its allomorphs (/t/, /d/, /id/), and/or their production in a teacher-facilitated but learner-directed environment.

Background

Pronunciation: An Important Aspect of Language and Language Learning

Intelligible pronunciation plays an important role in successful oral communication (Derwing & Munro, 2009; Levis & Grant, 2003; Munro & Derwing, 2015), the primary goal of many aspects of language use (Finocchiaro & Brumfit, 1983; Parikh, 2000). Both learners and teachers seem to agree upon the significance of this component of language; students believe that

pronunciation is important in their language learning (Grim & Sturm, 2016) and, without proper pronunciation training, they may experience misunderstandings and even communication breakdowns (as a result of the lack of mutual intelligibility; Sifakis & Sougari, 2005).

Time, the Perennial Problem!

According to Neri (2007), pronunciation is regarded as one of the most difficult skills when learning and teaching an L2 (Burgess & Spencer, 2000). One of the contributing factors to the difficulty in achieving intelligible speech is that the acquisition of pronunciation skills requires hours of listening (input) and speaking (output) practice (Everly, 2019), preferably followed by corrective feedback (Saito & Lyster, 2012). However, classroom time has always been an issue for teachers and students (Collins & Muñoz, 2016; Moghaddam et al., 2012; Morin, 2007). Levis and Grant (2003) argue that although students view pronunciation as an important part of learning and ask for more class time to be devoted to it, teachers are uncertain as to how they can incorporate pronunciation into the curriculum without depriving their students of other important aspects of learning the L2. One of the reasons behind this uncertainty is the insufficient time in class (Cao, 2014; Moghaddam et al., 2012; Morin, 2007; Li, 2019), which prevents pronunciation from being a central part of the regular course syllabus (Gilbert, 2008; Munro & Derwing, 2015) and, consequently, may hinder phonological acquisition in terms of awareness, perception and production.

Phonological Awareness

Lack of pronunciation instruction and practice can result in limited opportunities for students to notice aspects of the L2 (see Fouz-González, 2017; Schmidt, 1990, 1995), which can potentially affect language awareness (Fairclough, 1992). Noticing is an important step in the development of language awareness, for it directs one's attention to specific L2 features that can

eventually lead to learning. Language awareness is defined by Svalberg (2012) as explicit knowledge about language and conscious perception and sensitivity in language use. From a phonological perspective, awareness has been defined as “one’s degree of sensitivity to the sound structure of oral language” (Anthony & Francis, 2005, p. 255). According to Linebaugh and Roche (2015), pronunciation training (emphasizing both input and output practice) is necessary to create this type of awareness, thus paving the way to improvements in perception (Celce-Murcia et al., 2010).

Perception: Aural Discrimination

Perception is defined as a speaker’s ability to recognize a phoneme and to distinguish it from others when it is heard (Soler-Urzúa, 2011). Previous literature shows that perception is heavily dependent on the quantity and quality of the input received by the learners (Flege, 1991), and on its phonological prominence (Soler-Urzúa (2011). In the same line of research, Linebaugh and Roche (2015) believe that focused aural exposure to L2 sounds (i.e., input) leads to improvement in the ability to perceptually discriminate them.

To help the learners better perceive sounds and/or phonemes, it is recommended that the L2 input be enhanced by, for example, the use of slow speech, repetition, and other input-enhancement techniques (see Liakin et al., 2015). However, as discussed before, the inadequate amount of practice and/or instruction, which is a consequence of insufficient time dedicated to pronunciation in the classroom, and scarce exposure to the language outside the classroom (Bione et al., 2016) leave students with insufficient time for input (and consequently noticing) practice. Assuming that perception precedes oral production (Broselow & Park, 1995; Cardoso, 2011; Celce-Murcia et al., 2010; Flege, 1995), this can lead to difficulties in aural discrimination (perception) and consequently in production (Thomson, 2012; Lee & Lyster, 2017).

Production: Output and Corrective Feedback

Soler-Urzúa (2011) defines oral production (output) as “the ability to appropriately pronounce the target sound” (p. 50) and hypothesizes that enhancing the aural input in the L2 (e.g., via slow speech, repetition) might lead to an improvement in oral production because this move provides L2 learners with ample opportunities to perceive and process the target L2 feature (see also Liakin et al., 2017a and Flege, 1991 for similar claims). Output practice can help learners develop automaticity, noticing abilities (including awareness), and hypothesis testing, allowing learners to understand how the target L2 phonological system functions (Swain, 2000).

Many scholars believe that corrective feedback can benefit learners on both perception and production of pronunciation (Baker & Burri, 2016; Couper, 2019; Lee et al., 2015; Lyster et al., 2013; Saito & Lyster, 2012; Smith & Beckmann, 2010) by directing learners’ attention to the form and consequently helping them notice the differences between their own output and what they should produce (Darcy, 2018).

Technology: A Possible Solution

Technology has assisted L2 pedagogy for many years (Nunan, 2010) and has always been an important component of learning and teaching (Ahmadi, 2018). In the 1990s, with the advent of the Internet and the World Wide Web, technology became even more pervasive in the L2 classroom (Warschauer, 1999; Beatty, 2003) by providing unlimited resources to language learners. In recent years, we have seen a plethora of studies focused on the use of technology to improve the pronunciation of L2 learners, including, but not limited to, TTS (Cardoso, 2018), ASR (Liakin et al., 2015; Myers, 2000; Neri et al., 2008), Intelligent Personal Assistants, IPAs for short (Dizon, 2017; Moussalli & Cardoso, 2020), voice blogs (Sun, 2009), and social media (Fouz-González, 2017; Xodabande, 2017).

One of the advantages of using technology in L2 pedagogy is that it may foster autonomous learning beyond the classroom (Lai, 2019), as it can provide ample opportunities for meaningful and authentic language use, which are not always available in the classroom (Richards, 2015). Pawlak and Szyszka (2018) believe that a certain degree of autonomy, or “the ability to take charge of one’s own learning” as defined by Holec (1981, p. 3), is necessary for learning an L2 and its pronunciation in particular. Via the use of technology, learners can enhance their autonomy by controlling their own learning and accessing a great amount of information without the presence of a teacher (Pourhossein Gilakjani & Sabouri, 2014).

This study targets two ways in which technology can be beneficial: to increase and enhance the L2 input (e.g., using Text-to-Speech Synthesizers), and to provide learners with opportunities for output practice (e.g., using Automatic Speech Recognition) via the use of a single tool that combines the two technologies: Google Translate.

Text-To-Speech Synthesizers

Text-to-speech synthesizers (TTS) convert written text into speech, providing learners with audio input (Bione & Cardoso, 2020; Cardoso, 2018). TTS synthesizers have proved to play an important role in L2 pedagogy, particularly involving pronunciation (Cardoso, 2018; Liakin, et al., 2017b; Soler-Urzúa, 2011). They can help students receive ample amounts of comprehensible input (Bione & Cardoso, 2020; Cardoso, 2018; Liakin et al., 2017a) and, at the same time, develop autonomy to learn on their own (Ekşi & Yeşilçınar, 2016; Kim, 2018). For instance, learners can listen to a target L2 word or phrase whenever and wherever they wish, for as many times as they want, without the need of a teacher’s assistance (González, 2007; Liakin et al., 2017b; Moon, 2012). As a result, TTS can help teachers and learners to extend the reach of the classroom (Bione & Cardoso, 2020; Liakin et al., 2017b; Nunan & Richards, 2015), thus alleviating the time

constraints discussed earlier. Studies that have examined the pedagogical use of TTS for learning L2 pronunciation include Cardoso (2018; focus on past -ed allomorphy in English), Liakin et al. (2017b; focus on French liaison), and Soler-Urzúa (2011; focus on the acquisition of English /ɪ/).

In addition to the enhanced input afforded by TTS, learners need opportunities for output practice so that they test their hypotheses about how the language functions orally.

Automatic-Speech-Recognition

Automatic speech recognition (ASR) is the conversion of speech into readable text in real-time: via a microphone, the software identifies the words a person speaks, analyzes it using a set of algorithms, and finally produces an output in the form of a text.

ASR has proved to offer many pedagogical advantages such as providing learners with opportunities for oral practice, i.e., output (Derwing et al., 2000; Liakin et al., 2017a) and corrective feedback on their pronunciation via its written output (Eskenazi, 1999; LaRocca et al., 1999; Levis & Suvorov, 2012; Neri et al., 2006). McCrocklin (2016) pointed out that one of ASR's main advantages is its ability to foster learners' autonomy, an affordance that is assumed to be motivated by the tool's ability to provide feedback (Cucchiaroni et al., 2009; Eskenazi, 1999; Levis & Suvorov, 2012; Neri et al., 2006; Sheerin, 1997). Due to the abovementioned advantages, ASR has proved to be an effective pedagogical tool due its ability to extend the reach of the classroom (Liakin et al., 2015, 2017a). We hypothesize that when combined with TTS (as is the case with Google Translate), these benefits are enhanced.

Google Translate: An All-In-One Tool

Google Translate (GT) is a free multilingual machine translation service, developed by Google, which translates texts and websites from one language into another. GT has greatly evolved over time, and now not only can it translate languages instantaneously, but it also is able

to listen, speak, and read via TTS and ASR. Despite its recency, GT has become one of the most interesting current technologies when used for pedagogical purposes. Since its launch in 2006, the technology has contributed to L2 learning by helping enhance students' learning experience (Obari & Lambacher, 2015), increasing their level of comfort (Altena, 2015), motivation (Ciampa, 2014), and willingness to use the technology (Cumming & Rodriguez, 2013). A GT user-feedback survey conducted by Google in 2010 revealed that language learners were using GT for a wide variety of purposes, ranging from understanding and learning foreign words/phrases, reading foreign texts, and learning to write and pronounce foreign words/phrases (Garcia & Pena, 2011).

Despite these pedagogical benefits, can Google Translate be suitable for *pronunciation* instruction? According to Dickerson (2013, 2015), linguistic competence in an L2 includes learners' ability to perceive (e.g., distinguish a sound from another), produce (e.g., articulate a sound), and predict pronunciation patterns. These three elements or 'trilogy of goals' (3Ps: *perception*, *production*, and *prediction*) are respectively fulfilled by GT and its built-in features of TTS (for perception, input exposure), ASR (for production practice), and a combination of TTS and ASR (for prediction, via grapheme-to-phoneme associations; see Liakin et al., 2015; Liakin et al., 2017a for the rationale).

GT also fulfills Chapelle's (2001) criteria for selecting Computer Assisted Language Learning (CALL) tasks, as it offers (1) *Language learning potential* by providing learners with opportunities to focus on form (Niño, 2008; Van Lieshout & Cardoso, in press); (2) *Learner fit* by fostering various learning styles (Kim, 2018), and giving the learner the possibility of exercising language preferences (Musk, 2013); (3) *focus on form and meaning* by drawing learners' attention to certain language features (Niño, 2008; Van Lieshout & Cardoso, in press); (4) *authentic* interactions with and through their devices (González & St. Louis, 2008; Van Lieshout & Cardoso,

in press); (5) *positive impact* on users by promoting language learning (Van Lieshout & Cardoso, in press); and finally, (6) *practicality* because it is easy to use and easily accessible (Medvedev, 2016), free (Mundt & Groves, 2016), and available on different platforms (Groves & Mundt, 2015).

Grimshaw et al. (2018) evaluated and compared several applications in terms of comprehensibility, naturalness, and intelligibility. They asked the participants to listen to and rate recordings of short story clips produced by five different applications using a six-point Likert scale. The results showed that GT's TTS capability is one of the most pedagogically appropriate choices for L2 learners, ranking second in comprehensibility and naturalness, and third in intelligibility. Van Leishout & Cardoso (in press) also found that L2 learners can benefit from GT and its TTS and ASR capabilities to learn basic phrases in L2 Dutch.

Although these studies have yielded positive results about the pedagogical use of TTS and ASR when used separately, little do we know about their effectiveness when they are used together. To explore the pedagogical affordances of GT's speech capabilities for teacher-guided semi-autonomous learning (e.g., as a technology-assisted homework assignment, described earlier), this study examined the acquisition of the morphophonemics that characterize past -ed pronunciation in English.

Allomorphy in English past -ed

Many studies have examined the acquisition of -ed allomorphy, possibly because it is a rule-governed process and consequently easily teachable (Royani & Rahmi, 2019). In addition, it is hard to acquire (Collins et al., 2009). There are a number of reasons why acquiring past -ed allomorphy is difficult. These include the effects of: L1 transfer (Frese 2006; Alves & Silveira, 2009), orthography (Delatorre, 2010), style or task (Delatorre, 2006), allophonic perceptual

salience (Frese, 2006), markedness (involving manner of articulation: Silveira, 2004; consonant cluster length and sonority: Delatorre, 2006), frequency of the preceding segment (Gomes, 2008), and finally, lack of exposure to the target form in the classroom (Collins et al., 2009; Soler-Urzúa, 2011).

Current Study

Little is known about the feasibility of using TTS and ASR combined (as found in Google Translate) as pedagogical tools, nor do we have an understanding of what happens when the learner is asked to use the technology to learn on their own, outside of their classrooms. The present study sought to investigate the pedagogical affordances of GT's TTS and ASR capabilities and how their use can contribute to the acquisition of the morphophonemics of regular past tense marking in a teacher-guided, semi-autonomous context, conceptualized as an extension of the classroom (i.e., via a homework assignment). To achieve this goal, the following three-partite research question is proposed:

(1) Using GT's TTS and ASR features in a teacher-guided semi-autonomous context, can

English learners acquire the pronunciation of English past -ed in terms of their ability to:

- a) demonstrate their *awareness* of the morphophonemic differences (awareness)
- b) *perceive* past tense forms and their morphophonemic differences (perception)
- c) *produce* the target morphophonemic forms (production)?

It is hypothesized that using GT and its built-in TTS and ASR capabilities will help L2 students to learn (at least aspects of) the target pronunciation feature in terms of awareness, perception and production - three stages in pronunciation development (Celce-Murcia et al., 2010). However, we acknowledge that due to individual differences, the duration of the intervention, or insufficient exposure, some participants might not improve in all these stages.

Method

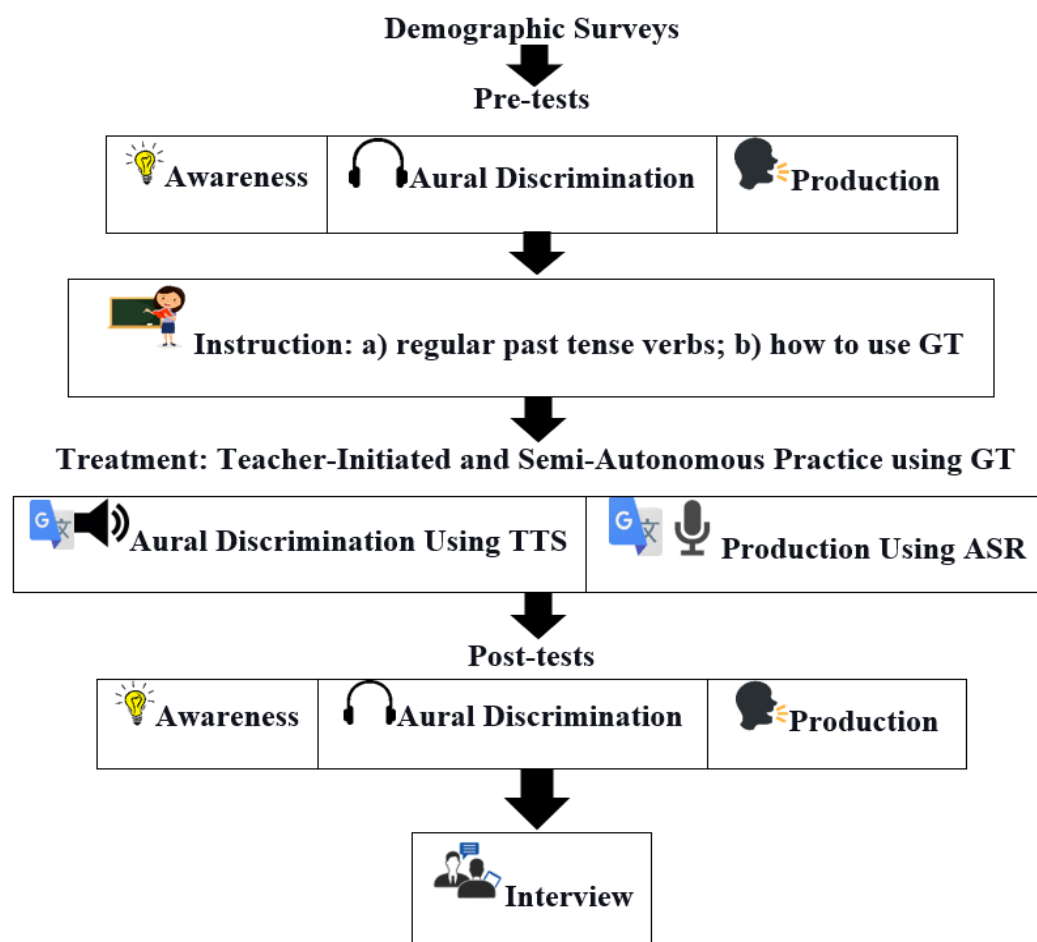
Participants

20 ESL students participated in the study (age: 30-40; L1: Farsi; proficiency: lower intermediate). Their proficiency level was determined based on self-reports and the results of the pre-test (e.g., those who were fully aware or could properly pronounce past -ed were not included in the data analysis; only those who scored 40% or less were included). To recruit participants, the researcher distributed a call for research participation on social media (e.g., Facebook, Instagram).

Design

This one-shot (approximately 2-hour) study followed a pre-test-post-test research design. As illustrated in Figure 1, the participants took a set of pre-tests on awareness, aural discrimination, and production of the past -ed allomorphy. They then watched a video containing a brief instruction on how regular past tense verbs are formed and how to use Google Translate's speech capabilities. To ensure test reliability and validity, the participants were not informed of the three -ed allomorphs.

During the practice phase, learners used GT to work individually on listening and pronouncing the past -ed forms. After the treatment, the participants completed the post-tests, which are similar to pre-tests but with all items randomized to mitigate testing effects. These tests assessed their awareness, aural discrimination abilities, and production of the target pronunciation, past -ed. Finally, they participated in a short interview to share some insights about their pedagogical experience using GT.

Figure 1*Design of the study*

Note. GT = Google Translate; TTS = Text-To-Speech synthesizer; ASR = Automatic-Speech-Recognition feature.

Procedure, Instruments and Materials

All stages of this study (including the demographic questionnaire, pre-tests, and post-tests) were completely carried out on Moodle (an online course management system), while the researcher was available online via Zoom or Skype to answer questions or solve technical problems. During the “semi-autonomous” learning phase (treatment), participants could log out from Skype or Zoom.

Consent Form

The researcher emailed the consent form (Appendix A) to all potential participants. When they agreed to participate, the researcher met them in an unrecorded virtual meeting (using Zoom or Skype) and presented and explained the consent form and the scope of the study. When they agreed to participate, they were asked to provide written consent by printing and signing the consent form and returning a scanned or photographed copy to the researcher.

Demographic Surveys

The participants were asked to fill out a demographic survey including questions about their age, linguistic knowledge, familiarity with technology, etc. (Appendix B).

Pre-tests

After filling out the demographic surveys, the pre-tests were administered (about 30 minutes) to assess their level of awareness, aural discrimination (perception), and oral production of past -ed forms. To triangulate data collection and capture different dimensions of the same phenomenon, two instruments were adopted for each pronunciation measure, for a total of six tests.

Awareness. In the first test, the students were asked to answer a set of open-ended questions to determine whether or not they knew how past -ed is pronounced (Appendix C). The second test, as shown in Figure 2, asked the participants to match a set of regular past tense verbs based on how they believed their inflected endings are pronounced, via associations with existing forms such as *used* /d/, *added* /ɪd/, and *asked* /t/ (see Appendix D).

Figure 2*Awareness Test #2*

admitted <input type="button" value="v"/>	allowed <input type="button" value="v"/>	stopped <input type="button" value="v"/>
needed <input type="button" value="v"/>	suggested <input type="button" value="v"/>	laughed <input type="button" value="v"/>
wanted <input type="button" value="v"/>	opened <input type="button" value="v"/>	enjoyed <input type="button" value="v"/>
promised <input type="button" value="v"/>	cried <input type="button" value="v"/>	watched <input type="button" value="v"/>
imagined <input type="button" value="v"/>	finished <input type="button" value="v"/>	hated <input type="button" value="v"/>
cleaned <input type="button" value="v"/>	walked <input type="button" value="v"/>	parked <input type="button" value="v"/>
ended <input type="button" value="v"/>	lived <input type="button" value="v"/>	decided <input type="button" value="v"/>

Aural discrimination. Two levels of aural discrimination were utilized, each comprising five short phrases for each allomorph (e.g., *I called my mother*, *I jumped in the freezing lake*) and five distractors (20 in total). The participants listened to an audio file, which was played on Moodle once. As depicted in figure 3, there were 2 sections in each question. The first asked the participants to decide on whether they heard a form in the past (PAST) or in another tense (NOT PAST – Figure 3A). If the participants select PAST, they are asked to categorize what they heard considering the three past -ed allomorphs (i.e., PAST-ASKED for /t/, PAST-USED for /d/, and PAST-ADDED for /id/ - Figure 3B). If they select NOT PAST, they must then select NOT PAST-None of them (see Appendix E).

Figure 3*Aural Discrimination Test: A Sample*

A

NOT PAST
PAST

PAST-asked ☐
PAST-used ☐
PAST-added ☐
NOT PAST-None of them ☐

B

PAST-asked ☐
PAST-used ☐
PAST-added ☐
NOT PAST-None of them ☐

Oral production. Finally, two production tests were adopted to assess the participants’ pronunciation of past -ed. First, they were asked to read aloud a list of 85 words containing past -ed forms (e.g., *cleaned*; 20 items for each -ed allomorph and 25 distractors), while being audio-recorded on Moodle (Appendix F). This was followed by the second test, a more spontaneous speaking task, in which the participants and researcher role-played an “interview” situation: the participants were asked to answer questions about what a fictional character did during the COVID-19 quarantine period. This task consisted of 10 items for each target allomorph (Appendix G).

Instruction

The participants received a short (10 minutes) instructional screencast video (Appendix H) about how regular past tense verbs are formed, without mentioning any information about the pronunciation of past -ed allomorphy. The video also offered training on how to use Google Translate’s TTS and ASR options to practice pronunciation. The reason behind this instruction was to make sure all participants knew about the target feature (e.g., how it is conjugated), and how GT works (thus emulating the classroom/homework scenario described at the outset of this proposal).

Practice

In the same session, the learners were asked to practice the pronunciation of past -ed in a self-directed environment (at home) for approximately one hour, as if they were completing it as a homework assignment. They needed to use Google Translate's TTS and ASR to practice their listening (including aural discrimination) and speaking skills (oral production), respectively.

To practice their “aural discrimination” of past -ed, participants were given two sets of activities which were carried out using GT's TTS for access to input. In the first activity, they worked on two stories consisting of a balanced distribution of the three -ed allomorphs, four of each (Appendix I): they needed to copy and paste each text into GT, and as they were listening to GT, they filled in the blanks, without looking at the original text. The second listening activity was comprised of a list of words (all words extracted from a list of the 600 most frequently-used English verbs; see Appendix J) containing regular simple past tense verbs. The participants were asked to copy and paste the verbs (60 verbs, 20 for each allomorph) in Google Translate and listen to their (synthesized) pronunciation. The participants then had to match the verbs based on how they believed their inflected endings are pronounced, via associations with existing forms such as *used* /d/, *added* /id/, and *asked* /t/

For oral production (i.e., output practice and orthographic feedback), two activities were assigned to the participants to be carried out using Google Translate's ASR. First, they were given a list of 81 pairs of verbs in both present and past tense (27 items for each alternation; see Appendix K). Using GT, they were asked to read both present and past tense forms aloud to verify if the intended form appears on the screen. If Google Translate showed a different form than what they intended to say, they were asked to try again until it showed the exact form of the verb they were reading. The second activity contained a list of 60 short sentences in both present and past (10 items for each variation; see Appendix L). Similar to the first production activity, the participants

were asked to read both present and past tense forms aloud using the ASR feature to verify if the intended form appeared on the screen. If Google Translate showed a different text output than what they intended to say, they needed to try again until the ASR was able to recognize what they were reading.

During the allotted practice time, the participants were free to apply their preferred learning strategies using GT, i.e., they could listen to GT reading a part of the story as many times as they needed or make notes of the points they might have noticed about the pronunciation of past -ed.

Post-tests

When the participants' learning phase was over (i.e., when they completed their "homework"), the post-tests were administered (duration: 30 minutes). Similar to the pre-tests, these tests assessed the participants' development in terms of phonological awareness, aural discrimination, and production via three sets of tests for a total of six tests. These tests were the exact same ones used in pre-tests, but in a randomized order.

Interview

Finally, short semi-structured interviews were conducted online, asking the participants some general questions to delve into their perception of GT and its speech capabilities, the strategies they applied to learn about past -ed, etc. (see Appendix M for details).

Analysis

Appropriate statistical measures were adopted to determine gains in terms of awareness, aural discrimination, and production, e.g., *t-tests* were used to compare the participants' performances in pre-tests with those in post-tests.

Participants' awareness of past -ed morphophonemics was measured using values ranging from 1 to 4. "1" was given to participants who showed *no knowledge* about past -ed pronunciation.

Learners who had *partial knowledge* received “2” or “3” depending on the scope of their knowledge: those who were able to articulate their knowledge about *one* -ed form received “2”, while those expressing knowledge about two -ed allomorphs were given “3”. Finally, “4” was given to those who exhibited full awareness to past -ed pronunciation (e.g., they articulated the three distinct -ed allomorphs in their responses). The second awareness test evaluated learners’ awareness out of 21, as there are seven items for each allomorph.

The two aural discrimination tests evaluated the participants’ perception by computing the number of correct answers in each test: out of 20 in the first test (PAST or NOT PAST), and out of 15 in the second test (if PAST: PAST-ASKED for /t/, PAST-USED for /d/, and PAST-ADDED for /id/).

Oral production was measured based on the accuracy of the participants’ pronunciation in two tests: In the first test, learners’ oral production was measured out of 60 as there are 20 items for each allomorph along with 20 distractors; in the second test, learners’ performance was evaluated out of 30, with 10 items for each allomorph.

The interviews were transcribed and coded for any insightful statements that the participants had about the use of GT and its speech capabilities as pedagogical tools. As such, they were used to provide a better understanding of the quantitative results, when relevant.

Results

This study explored two speech technologies in Google Translate (TTS and ASR) to assist in L2 pronunciation learning in a teacher-guided semi-autonomous context. Accordingly, it aimed to answer the following research question: Can English learners acquire the pronunciation of English past -ed in terms of their ability to: demonstrate their awareness to the morphophonemic

differences (*awareness*), perceive past tense forms and their morphophonemic differences (*perception*), and produce the target morphophonemic forms (*production*)?

Phonological Awareness 1: Quantified answers to open-ended question

For the first awareness test, the participants were rated based on an analysis of their answers to a set of general questions (e.g., *Do you know how past tense -ed is pronounced? Explain*) that probed their phonological awareness of past -ed pronunciation: 1 (no knowledge), 2 (knowledge of one allomorph), 3 (knowledge of two allomorphs), 4 (knowledge of all three allomorphs).

Table 1 illustrates the results of the *t*-tests conducted between the pre-test and post-test scores. As shown, the post-test scores ($M = 3.80$, $SD = 0.41$) are significantly higher than those of the pre-test ($M = 3.30$, $SD = 0.80$), indicating that the participants' level of phonological awareness improved significantly during the treatment, $t(19) = -3.24$, $p = 0.002 \leq 0.05$.

Table 1

Awareness # 1. t-test Results

	Pre-test		Post-test		<i>t</i> -test
	<i>M</i> /4	<i>SD</i>	<i>M</i> /4	<i>SD</i>	
Total	3.30	0.80	3.80	0.41	*-3.24

* $p \leq 0.05$

Note. *M* = Mean (out of 4); *SD* = Standard Deviation.

Phonological Awareness 2: Association with other inflected -ed forms

The second awareness test was assessed based on the participants' ability to associate 21 target -ed forms (7 for each allomorph) with their corresponding allomorphic pronunciation in English.

T-test results presented in Table 2 show that the participants' overall phonological awareness significantly improved from pre-test ($M = 8.30$, $SD = 1.69$) to post-test ($M = 10.65$, $SD = 2.00$), $t(19) = -5.17$, $p = 2.73054E-05 \leq 0.05$. An inspection of the results based on the individual allomorphs partially confirms these findings, revealing that, while awareness of /d/ was not significantly affected by the treatment, $t(19) = -1.53$, $p = 0.07 \geq 0.05$, awareness of both the /id/ and /t/ allomorphs was, $t(19) = -3.81$, $p = 0.0005 \leq 0.05$ for /id/; $t(19) = -2.44$, $p = 0.01 \leq 0.05$ for /t/.

Table 2

Awareness # 2. t-test Results

	Pre-test		Post-test		<i>t-test</i>
	<i>M /7</i>	<i>SD</i>	<i>M /7</i>	<i>SD</i>	
/d/	3.90	1.45	4.35	1.14	-1.53
/id/	2.85	1.04	4	1.02	*-3.81
/t/	1.55	0.99	2.3	1.03	*-2.44
Total /21	8.30	1.69	10.65	2.00	*-5.17

* $p \leq 0.05$

In summary, the findings obtained from the two awareness tests indicate that the pedagogical use of GT's speech features, as conceptualized in this study, successfully raised the participants' awareness of the past -ed allomorphy, particularly regarding the /id/ and /t/ allomorphs.

Perception 1: Aural discrimination between past or not past

The first aural discrimination test (perception) asked the participants to listen to a set of short phrases (15 involving *past* constructions, the others in *non-past* forms) and then decide whether they were produced in the “past” or “not past.”

As Table 3 illustrates, the participants significantly had improved in their ability to discriminate past from non-past constructions by the end of the experiment (compare the following pre-test and post-test results respectively: $M = 10.65$, $SD = 1.98$ and $M = 12.25$, $SD = 0.91$), $t(19) = -5.14$, $p = 2.90093E-05 \leq 0.05$.

Table 3

Perception # 1. t-test Results

	Pre-test		Post-test		<i>t-test</i>
	<i>M/15</i>	<i>SD</i>	<i>M/15</i>	<i>SD</i>	
Total	10.65	1.98	12.25	0.91	*-5.14

* $p \leq 0.05$

Perception 2: Aural discrimination between -ed allomorphs

The second perception test assessed the participants’ ability to aurally discriminate, among 15 past forms (5 for each allomorph), the target three -ed allomorphs.

Table 4 shows that the participants significantly improved in their ability to aurally perceive the three -ed allomorphs from pre-test ($M = 4.95$, 1.54) to post-test ($M = 7.1$, 1.25), $t(19) = -9.73$, $p = 4.07534E-09 \leq 0.05$. Significant results are also observed when the three allomorphs are analyzed individually: $t(19) = -4.26$, $p = 0.0002 \leq 0.05$ for /d/, $t(19) = -7.96$, $p = 9.05663E-08 \leq 0.05$ for /id/, and $t(19) = -2.18$, $p = 0.02 \leq 0.05$ for /t/.

Table 4*Perception # 2. t-test Results*

	Pre-test		Post-test		<i>t-test</i>
	<i>M/5</i>	<i>SD</i>	<i>M/5</i>	<i>SD</i>	
/d/	1.65	0.81	2.4	0.68	*-4.26
/id/	2.4	0.68	3.4	0.59	*-7.96
/t/	0.9	0.71	1.3	0.66	*-2.18
Total /15	4.95	1.54	7.1	1.25	*-9.73

* $p \leq 0.05$

Overall, these findings demonstrate that, from a perception perspective, the participants significantly benefited from the GT-based pedagogical treatment, as their ability to aurally discriminate between past vs. non-past constructions and to identify the three -ed allomorphs increased during the experiment.

Production 1: Word-list reading aloud

The first oral production test consisted of a reading-aloud task in which the participants were asked to produce 60 ed-inflected forms in isolation (20 for each allomorph).

As illustrated in Table 5, no significant improvements were observed in the participants' overall performance in -ed pronunciation, $t(19) = -1.28$, $p = 0.10 \geq 0.05$. Interestingly, when analyzed in isolation, the participants had underperformed in /d/ production by the end of the treatment, with only slight gains in /t/ production. The only allomorph that showed a significant post-treatment improvement was /id/, $t(19) = -2.85$, $p = 0.005 \leq 0.05$.

Table 5*Production # 1. t-test Results*

	Pre-test		Post-test		<i>t-test</i>
	<i>M/20</i>	<i>SD</i>	<i>M/20</i>	<i>SD</i>	
/d/	7.15	2.30	6.90	2.38	1.31
/id/	5.05	1.96	5.65	2.18	*-2.85
/t/	3.60	1.57	3.65	1.69	-0.22
Total /60	15.80	5.54	16.20	5.54	-1.28

* $p \leq 0.05$

Production 2: Role play

Finally, the last production test evaluated the participants' ability to orally produce the target -ed forms in a less controlled role-play activity, in which they were prompted to produce 30 -ed forms (10 for each allomorph).

As Table 6 illustrates, and similar to what was observed for the reading-aloud test, there were no overall significant differences between the pre-test and post-test results when all allomorphs were considered, $t(19) = -2.24$, $p = 0.11 \geq 0.05$. When analyzed in isolation, the only allomorph that showed a significant post-treatment improvement was /id/, $t(19) = -2.63$, $p = 0.008 \leq 0.05$. Interestingly, as was the case in the first production test, there was a decrease in /d/ production from pre-test to post-test, and only slight (not significant) gains in /t/ production.

Table 6*Production # 2. t-test Results*

	Pre-test		Post-test		<i>t-test</i>
	<i>M/10</i>	<i>SD</i>	<i>M/10</i>	<i>SD</i>	
/d/	3.70	1.45	3.55	1.54	0.90
/id/	2.55	1.19	2.95	1.19	*-2.63
/t/	0.90	0.85	0.95	0.82	-0.32
Total /30	7.15	3.23	7.45	2.99	-1.24

* $p \leq 0.05$

The results from the two production tests indicate that there was no overall improvement in -ed production in the study, except when the three allomorphs are analyzed in isolation. In that case, we observed a significant increase in /id/ production only in both tests.

Discussion

This study set out to investigate Google Translate (and its speech capabilities, ASR and TTS) as an L2 pronunciation learning tool to answer the following research questions: in a teacher-guided semi-autonomous context (i.e., as a homework assignment), can English learners acquire the pronunciation of English past -ed in terms of awareness, perception, and production?

The t-test results showed that there were significant improvements in both the participants' awareness and perception of the English past -ed allomorphy, thus confirming the hypothesis that the pedagogical use of GT and its speech capabilities can help learners to acquire the target pronunciation feature in these two first stages of L2 pronunciation development (Celce-Murcia et al., 2010). However, in terms of production (the subsequent stage), no significant progress was observed, except for the allomorph /id/.

The following paragraphs provide possible explanations, more in-depth discussion, and certain excerpts of the interviews to shed some light on the findings.

Awareness

In this study, the pedagogical use of Google Translate and its speech features successfully raised the participants' awareness of the allomorphs of English past -ed, corroborating recent research that shows that TTS and ASR, the two speech capabilities in GT, can help learners develop their phonological and morphophonemic awareness (for TTS, see Cardoso, 2018 and Bione & Cardoso, 2020; for ASR, see Guskaroska, 2019, 2020). An analysis of the interview data collected in this study corroborates these findings, as some participants indicated that although they knew that there are different ways of pronouncing the past -ed, only after the focused practice phase could they consciously discern them. For instance, as one participant noted: "I assumed there were variations of /d/ in pronouncing past -ed; [...] by the end of the study not only could I consciously differentiate those variations as /d/ and /id/, but I also had discovered /t/."

Focusing on /d/, the only allomorph unaffected for awareness development, it is possible that the pattern observed can be attributed to the fact that the learners' awareness of this allomorph was already high at the outset (3.9 /7; see also Seddighi, 2010 for similar claims for Farsi-speaking English learners) – a clear example of the participants reaching the ceiling of what can be acquired at that stage in their learning trajectories (Rifkin, 2005). Another explanation may be orthography, as there is transparent correspondence between -ed and the allomorph /d/ (see Delatorre, 2010 for similar claims regarding the facilitative nature of orthography in past -ed development). This observation is confirmed by statements from five participants who claimed that their awareness of both /d/ and /id/ is due to the presence of the letter "d" in past tense marking -ed: "[t]o me /d/ is the most obvious one because that is exactly how we write it; the letter "d" exists in the endings

of [...] past tense verbs.” While this generalization also applies to the /id/ allomorph to some extent (both had relatively higher awareness in pre-tests, 3.9 and 2.85 respectively), it does not fully explain why /id/ was not subject to the ceiling effect just described.

The /t/ allomorph was the form with the least level of awareness on the pre-test, thus giving the participants ample opportunities to improve. As a result, the /t/ had exhibited the highest degree of improvement by the end of the experiment, a finding that was articulated by most participants by statements that highlighted their “discovery”; e.g., “a sound that really drew my attention was /t/ as it has nothing to do with the spelling of -ed.” This pattern is consistent with previous research involving oral production, wherein /t/ is believed to be the most challenging and the last -ed allomorph to be acquired (Cardoso, 2018; Dwight, 2012). As such, these findings add an alternative way of explaining why /t/ is difficult to acquire: learners are simply not aware of its existence.

With awareness being the cornerstone of the three main stages in pronunciation development (Celce-Murcia et al., 2010), it can be concluded that GT has the potential to be an effective pedagogical tool to initiate the process of developing past -ed morphophonemics in the subsequent stages, perception and production.

Perception

Our findings indicate that GT helped the participants significantly improve their perception of all three allomorphs, thus echoing Van Lieshout & Cardoso’s (in press) claim that GT’s built-in speech capabilities can be effective pedagogical tools for the development of aural skills. We speculate that these optimistic findings for perception may be due to the nature of TTS synthesis, which rendered the past -ed allomorphs more salient and consequently more perceptible by the learners. For instance, while in classroom contexts the three past -ed allomorphs tend to co-

articulate with the following word's initial onset (e.g., “watched the game” – in which the allomorph /t/ is co-articulated with the following [Δ]) or completely deleted (e.g., watched TV – in which /t/ may is often deleted - See Collins et al. (2009) for details), TTS tends to be more conservative and faithful in its ability to reproduce past -ed. This is in line with the findings of John and Cardoso (2016), who conducted comparisons of TTS' ability to reproduce -ed marking with a human speaker. They found that TTS performs equally to humans in pronouncing -ed and, in some contexts (e.g., in /d/ production), TTS may even outperform humans (see also Bione & Cardoso, 2020 for similar claims).

The quality of current TTS synthesis, combined with the affordances of the technology (e.g., it encourages repetition and practice – González, 2007; Liakin et al., 2017a; Moon, 2012; creates a stress-free learning environment – Liakin et al., 2017a), may explain why the participants significantly improved in their ability to discriminate between past from non-past constructions, and among the three -ed allomorphs.

Production

According to the results for both oral production tests, only the /id/ allomorph improved after the GT-enhanced treatment. The overall lack of significant improvements for the other allomorphs can be attributed to the length of this one-shot experiment (approximately one hour), which attempted to simulate what happens when students are asked to complete homework assignments to complement class discussions. A study by Cardoso (2018), which examined the production development of English past -ed in TTS-based instruction, found that learners need more than three hours of *spaced* practice to fully acquire -ed allomorphy, particularly when learning is accrued implicitly in an autonomous setting (Cardoso, 2018).

One explanation for why the participants only significantly improved in /id/ production has to do with the fact that the other two allomorphs (/d/ and /t/) are produced after a consonant, thus yielding a consonant cluster – a complex coda constituent (e.g., “arrived” /vd/, “walked” /kt/). From an articulatory standpoint, complex codas are highly difficult to produce (Easterday, 2019) in comparison with singleton codas (as /d/ in “added” /id/ - see also Alves, 2004 for the effects of constraints on complex codas in learner English speech). This is particularly problematic among speakers of L1s such as Farsi, a language that does not allow complex codas. As one participant articulated, “it is very difficult to pronounce /d/ right after other consonants; my tongue seems to twist.”

Another possible explanation may be orthography, as the /id/ allomorph is the most transparent of the three allomorphs, with a clear spelling-to-sound correspondence. Unlike /d/ (which is partially transparent due to the “d” in -ed) and /t/ (which is completely opaque, without any trace of either “e” or “d”), the vowel-consonant /id/ sequence clearly resembles its orthographic counterpart, -ed. To complicate the matter, the two production tests adopted in this study employed some type of reading (i.e., either words in isolation – test #1; or sentences to be orally manipulated – test #2), exacerbating the abovementioned orthographic effects. As indicated earlier, these results and analysis reflect previous studies that claim a facilitative role for orthography in the acquisition of -ed form (Delatorre, 2010).

Overall, our findings seem to corroborate Celce-Murcia et al.’s (2010) assumption that the acquisition of L2 pronunciation (and consequently its teaching) goes through three general developmental stages in which learners first become aware of the target sounds (awareness), then they learn how to aurally discriminate them (perception) in order to produce the newly acquired forms in controlled, guided or communicative interactions (production). In this study, the

participants' performance was mostly affected in the first two stages of pronunciation development.

Conclusion

The purpose of this study was to explore Google Translate and its built-in speech technologies (TTS and ASR) as pedagogical tools in the acquisition of L2 English pronunciation (past -ed allomorphy) in terms of *awareness*, *perception*, and *production* in a teacher-guided semi-autonomous context. The results indicate that, although the adopted technology helped improve learners' phonological awareness and aural discrimination skills regarding past -ed pronunciation, the same level of improvement does not apply to oral production, the next stage in pronunciation development (Celce-Murcia et al., 2010).

Despite these optimistic findings, there are a number of limitations that will need to be addressed in future research. The first main limitation relates to the two-hour duration of this one-shot study, in which participants were asked to learn the intricacies of past -ed allomorphy without direct teacher intervention, in a semi-autonomous fashion (like students do when completing homework assignments). For production, research has shown that English learners need more time to acquire past -ed (Cardoso, 2018). Accordingly, a longitudinal study, preferably employing spaced practice over a longer period of time, will be able to address this limitation and, at the same time, explore GT's full potential for pronunciation instruction. Another serious limitation is the number ($n=20$) and diversity (Farsi L1 native speakers) of the target population. Although there is evidence that GT can help these learners improve their pronunciation skills (at least in terms of phonological awareness and perception), it is not clear whether these findings are generalizable to the larger population of English learners. Would the same hold for speakers of other L1s? On a related note, this research was conducted during the COVID-19 pandemic, making the recruitment

and training of the participants difficult (e.g., all activities were conducted online and, consequently, they were affected by technological glitches such as loss of internet connection, malfunctioning microphones, etc.). Finally, this study focused on a single online Translation tool, Google Translate, and consequently excluded applications such as DeepL Translator and Microsoft Translate. While it is possible that these alternative tools can offer similar benefits for L2 learners, further replication studies could explore their pedagogical potential for a larger and more diverse population.

Despite the above-mentioned limitations, the present study offers some important pedagogical implications. The most important one is that it has shown that learners *can* acquire certain aspects of L2 pronunciation (e.g., phonological awareness of past -ed allomorphy) when engaged in teacher-initiated semi-autonomous activities such as those that characterize homework assignments. Via technologies such as GT and its speech capabilities, teachers like Mary can mitigate the time limitation that prevents her from focusing on pronunciation instruction, and consequently extend the reach of her classroom to an environment that has the potential to provide input that is abundant and varied (via TTS), with ample opportunities for production practice and feedback (via ASR).

Chapter Three

This chapter will present a summary of the results and conclusions that were discussed in chapter two, their implications for research and language education, and potential future directions for research.

Summary of Goals and Findings

Following a pre-test-post-test design, this mixed-methods study set out to explore the pedagogical affordances of GT's speech capabilities (TTS and ASR) in learning L2 English pronunciation (past -ed allomorphy) considering these tools' ability to assist in the development of *sound awareness*, *perception* (listening discrimination), and *production* – the three initial stages in pronunciation development, according to Celce-Murcia et al. (2010). In a teacher-guided semi-autonomous context, as an extension of the classroom, 20 ESL Farsi-speaking students participated in a two-hour pronunciation treatment (operationalized here as the completion of a set of TTS/ASR-based homework assignments). As such, they were asked to learn the different pronunciations that characterize English past -ed allomorphy through various listening (via TTS; e.g., by listening to a synthesized text and filling in the missing gaps) and speaking activities (via ASR; e.g., by reading aloud text passages and verifying their own pronunciation accuracy through the ASR output).

The results demonstrated that GT and its speech capabilities assisted learners in improving their phonological awareness and perception regarding the pronunciation of past -ed allomorphy. However, the same level of success was not observed for oral production (except for one of the allomorphs, /id/), the following stage in pronunciation development.

Implications for Education

The majority of the available studies examining the pedagogical affordances of TTS and ASR have focused on the use of these technologies in isolation. The main contribution of this study is that it explored both TTS and ASR as pedagogical tools to extend the reach of the classroom in a teacher-guided semi-autonomous setting (i.e., via homework assignments). As such, our findings can inform teachers, students, as well as materials designers and school administrators about the affordances of the target technologies. More importantly, it confirms our initial hypothesis that the combined and semi-autonomous use of TTS and ASR can positively affect the learning of pronunciation – more specifically, the alternations of English past -ed allomorphy in the development of sound awareness, perception, and oral production. As a result, the proposed teaching approach has the potential to maximize classroom time (e.g., by allowing teachers and students to focus on other important aspects of L2 learning, such as fluency and achieving mutually intelligible speech with other humans). In addition, our proposed approach may be able to increase and enhance the L2 input (via TTS) and at the same time provide students with ample opportunities for oral practice (via ASR).

Further Research

Despite the pedagogical contributions of the present study, there are important limitations to be addressed and directions to be taken by future research. First, longitudinal studies seem to be required as the present research was a one-shot 2-hour study. As noted in chapter two, this study included only one hour for practice, during which the participants were asked to learn past -ed allomorphy in a semi-autonomous fashion to simulate the completion of a “standard” homework assignment. While we observed that interesting and positive learning effects could occur within this timeframe, research has shown that English learners need more time to orally and accurately

articulate past -ed allomorphy (Cardoso, 2018). Further, it is recommended that future research select a larger and more diverse sample, as only 20 Farsi-speaking ESL learners were included in this study. Even though the findings suggest that GT and its speech capabilities can help learners acquire L2 pronunciation to some extent (i.e., the participants improved in sound awareness and perception on immediate posttests), to make the results more generalizable, we suggest that a larger population with various linguistic backgrounds be recruited to determine whether similar results could be observed. Lastly, this study used only one online Translation tool, Google Translate. Further research should be conducted using different tools such as DeepL Translator and Microsoft Translate to confirm whether similar pedagogical benefits can be found.

Conclusion

For years, lack of time has been a perennial problem in language classrooms. Now, with widely available and easy-to-use technologies such as Google Translate and its TTS and ASR speech capabilities, teachers can mitigate this serious limitation. As highlighted in this study, the L2 learning/teaching process can be enhanced by integrating these applications into teacher-initiated semi-autonomous activities as extensions of the language classroom (e.g., in the form of homework assignments).

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Appendices

Appendix A



INFORMATION AND CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Study Title: Beyond the walls of classrooms: Exploring the effectiveness of Text-to-Speech synthesizers and Automatic-Speech-Recognition on the development of L2 pronunciation

Researcher: Hamidreza Khademi (Master's student in Applied Linguistics)

Researcher's Contact Information: hamidreza.khademi@concordia.ca

Faculty Supervisors: Dr. Walcir Cardoso Applied Linguistics/Education

Faculty Supervisor's Contact Information:

Dr. Walcir Cardoso: walcir.cardoso@concordia.ca; 514-848-2424 x2451; office S-FG 6441
Faubourg Ste-Catherine Building,
1610 St. Catherine W.

Source of funding for the study: None

You are being invited to participate in the research study mentioned above. This form provides information about what participating would mean. Please read it carefully before deciding if you want to participate or not. If there is anything you do not understand, or if you want more information, please ask the researcher.

A. PURPOSE

The purpose of the research is to investigate the pedagogical role of Google Translate on improving your pronunciation in English, and your perceptions of the technology and learning experience.

B. PROCEDURES

If you participate, you will be asked to complete the following tasks remotely (times are approximate):

- Fill out the demographic survey (about 5 minutes)
- Take a set of online pre-tests on English pronunciation (about 30 minutes).
- Watch a short video teaching you about English past -ed and how to use Google Translate to practice pronunciation (about 10 minutes).

- Practice the pronunciation of a list of words using Google Translate (about 45-60 minutes)
- Take a set of online post-tests on English pronunciation (about 30 minutes).
- Participate in a short oral interview (about 10-15 minutes)

As mentioned earlier all aspects of the study will be conducted remotely and the interview will be recorded for further data analysis. Neither your face nor your name will appear on the recording or will be published.

In total, this study will be done in one session that will take approximatively 2:00 hours.

C. RISKS AND BENEFITS

There are no known risks associated with participating in this research. One benefit could be that you will enjoy a crash course, in the form of a recorded video, on the regular past tense verbs in English. As well, the study will introduce you to a potentially beneficial technology that can help you improve your pronunciation in English.

D. CONFIDENTIALITY

We will gather the following information as part of this research:

- Through an interview, we will collect data on your learning strategies and perceptions of using Google Translate as a learning tool. We will also record the interview so that it can be transcribed and analyzed.
- We will not allow anyone to access your information, except people directly involved in the research. We will only use the information for the purposes of the research described in this form.
- The information gathered will be coded and interviews will be transcribed. Your name will be removed and replaced by a pseudonym which means your name will not appear anywhere in the written study. No-one else will have access to your information.
- We will protect the information by keeping all digital files on a password protected computer.
- We intend to publish the results of the research. However, it will not be possible to identify you in the published results.
- We will destroy the information three years after the end of the study.

F. CONDITIONS OF PARTICIPATION

- You do not have to participate in this research. It is purely your decision. If you do participate, you can stop at any time. You can also ask that the information you provided not be used, and your choice will be respected. If you decide that you don't want us to use your information, you must tell the researcher before **April 30, 2021**.

- As a compensatory indemnity for participating in this research, you will receive \$20. If you withdraw before the end of the research, you will receive \$10 regardless of when you withdraw.
- There are no negative consequences for not participating, stopping in the middle, or asking us not to use your information.

G. PARTICIPANT'S DECLARATION

I have read and understood this form. I have had the chance to ask questions and any questions have been answered. I agree to participate in this research under the conditions described.

NAME (please print) _____

SIGNATURE _____

DATE _____

If you have questions about the scientific or scholarly aspects of this research, please contact the researcher. Their contact information is on page 1. You may also contact the faculty supervisor (Dr. Walcir Cardoso: walcir.cardoso@concoria.ca)

If you have concerns about ethical issues in this research, please contact the Manager, Research Ethics, Concordia University, 514.848.2424 ex. 7481 or oor.ethics@concordia.ca.

Appendix B

Demographic questionnaire

Please fill out the following form.

1. Age: _____ 2. Name: _____
3. Gender: Female () Male () Prefer not to say () Prefer to self-describe: _____
1. What is your course level (if you are already attending an English course): _____
2. How many languages do you know? And what is your proficiency level in them?

Language	Beginner	Lower-intermediate	Upper-intermediate	Advanced

3. On a scale from 1 (No knowledge) to 9 (Very advanced knowledge), rate your knowledge level when using technology in general:
 (No knowledge) 1 2 3 4 5 6 7 8 9 (Very advanced knowledge)
4. How often do you use text-to-speech feature of GT to improve your English pronunciation?
 Always () Often () Sometimes () rarely () Never ()
5. How often do you use automatic-speech-recognition feature of GT to improve your English pronunciation?
 Always () Often () Sometimes () rarely () Never ()
6. How often do you use Google Translate to learn English outside of the classroom?
 Always () Often () Sometimes () rarely () Never ()

Appendix C

Pre- and Post-test: Awareness #1

Do you know how past tense -ed is pronounced? Explain.

- Follow-up questions:
 - Please explain what sound is produced when -ed is added to the end of a verb
 - Give examples if you can.

Appendix D

Pre- and Post-test: Awareness #2

Select the verbs that have similar ending pronunciations

Note: -eds that are pronounced

/t/ are color coded in **red**

/d/ are color coded in **blue**

/id/ are color coded in **green**

1) admitted a) used b) asked c) added	8) laughed a) used b) asked c) added	15) cried a) used b) asked c) added
2) promised a) used b) asked c) added	9) suggested a) used b) asked c) added	16) finished a) used b) asked c) added
3) enjoyed a) used b) asked c) added	10) watched a) used b) asked c) added	17) hated a) used b) asked c) added
4) opened a) used b) asked c) added	11) wanted a) used b) asked c) added	18) cleaned a) used b) asked c) added
5) needed a) used b) asked c) added	12) imagined a) used b) asked c) added	19) walked a) used b) asked c) added
6) stopped a) used b) asked c) added	13) parked a) used b) asked c) added	20) lived a) used b) asked c) added
7) allowed a) used b) asked c) added	14) decided a) used b) asked c) added	21) ended a) used b) asked c) added

Appendix E

Pre- and Post-test: Aural Discrimination #1 and #2

In this last task, you will listen to 20 sentences (5 items for each allomorph). You will be asked if you heard a certain sound in them. The sound target you will be focusing on is the **past tense** -
ed.

When listening to these sentences, please listen carefully and check either 1) not past, or 2) past.

If you choose “past”, you will need to choose one of the verbs, “**used**,” “**asked**,” “**added**,” that has the similar ending pronunciation with the verb that you have heard in the question. You choose “NOT PAST – None of them” if you have chosen “not past” in the first section.

Let's practice!

Practice Sentence 1:

- a) Not past
- b) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Practice Sentence 2:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Let's start:

- (1) Check whether you heard the past tense *-ed* sound or not (Perception #1)**
- (2) If you heard the past, indicate which of these verbs, “**used**,” “**asked**,” or “**added**” has the similar ending pronunciation with the verb you heard in the audio? (Perception #2). If you have chosen “not past” in the first section, choose “NOT PAST – None of them.”**

Sentence 1:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Sentence 2:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Sentence 3:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) Not PAST – None of them

Sentence 4:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST- None of them

Sentence 5:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST- None of them

Sentence 6:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Sentence 7:

- 1) Not past
- 2) Past
 - a) Past – used

Sentence 11:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past- asked
 - c) Past- added
 - d) NOT PAST- None of them

Sentence 12:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past- asked
 - c) Past- added
 - d) NOT PAST- None of them

Sentence 13:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past- asked
 - c) Past- added
 - d) NOT PAST – none of them

Sentence 14:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past- asked
 - c) Past- added
 - d) NOT PAST – None of them

Sentence 15:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past- asked
 - c) Past- added
 - d) NOT PAST – None of them

Sentence 16:

- 1) Not past
- 2) Past
 - a) Past – used
 - b) Past – asked
 - c) Past – added
 - d) NOT PAST – None of them

Sentence 17:

- 1) Not past
- 2) Past
 - a) Past – used

b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 8:</u> 1. Not past 2. Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 9:</u> 1) Not past 2) Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 10:</u> 1) Not past 2) Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them	b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 18:</u> 1) Not past 2) Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 19:</u> 1) Not past 2) Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them <u>Sentence 20:</u> 1) Not past 2) Past a) Past – used b) Past – asked c) Past – added d) NOT PAST – None of them
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Transcripts:

Practice sentence 1. You lived in Vancouver.

Practice sentence 2. I stop the game.

1. I **called** my mother.
2. I visit my cousin Sam.
3. I **talked** with Jeff in the hallway.
4. I **cleaned** my room.
5. I **corrected** my math homework.
6. I **jumped** in the freezing lake in winter.
7. I study English for 4 hours.

8. I **invited** him to dinner.
9. I **typed** my assignment.
10. I finish my homework at 9pm.
11. I receive many presents on my birthday.
12. I **opened** the door for her.
13. I **fixed** the problems around the house.
14. I **hated** the movie.
15. I **danced** to the music.
16. I **waited** two hours for my friend.
17. I **asked** my questions from my teacher.
18. I **painted** some pictures.
19. I **ordered** a large pizza.
20. I water my garden.

Appendix F

Pre- and Post-test: Production #1

Here you have a list of 85 words (20 items for each allomorph). Please read them out loud as each word appears on the screen. Once you finish reading it, click next for the next word to appear.

1. tested
2. have seen
3. kissed
4. stopped
5. book
6. accepted
7. described
8. guessed
9. dragged
10. night
11. cleaned
12. studying
13. dressed
14. smiled
15. started
16. cat
17. looked
18. followed

19. afforded
20. forced
21. corrected
22. umbrella
23. offered
24. clock
25. named
26. knocked
27. sniffed
28. perfect
29. stayed
30. bell
31. waited
32. answered
33. cold
34. decided
35. filled
36. table
37. wished
38. washed
39. expanded
40. school
41. noted

42. wanted

43. relaxed

44. money

45. painted

46. stuffed

47. helped

48. wall

49. thanked

50. loved

51. pig

52. filled

53. driving

54. hated

55. passed

56. pen

57. planned

58. moved

59. repeated

60. dog

61. damaged

62. walked

63. teacher

64. needed

65. ended

66. planet

67. liked

68. baked

69. doctor

70. called

71. started

72. picked

73. closed

74. will come

75. guided

76. attracted

77. filmed

78. car

79. divided

80. played

81. belonged

82. brushed

83. enjoyed

84. elephant

85. hunted

Appendix G

Pre- and Post-test: Production #2

Participants will be asked to answer questions about what a fictional character did during the quarantine. (10 items of each allomorph).

Please answer the questions in the table about what Sara did during the quarantine.

Before you begin, please see the model answers below that are done for you.



Model:

	YES	NO
Did she study English?	✓	

YOU SAY: **Yes**, she studied English

	YES	NO
Did she study English ?		✓ (French)

YOU SAY: **No**, she studied **French**

	YES	NO
Did she plant new flowers in the garden?	✓	
watch the "Star Wars" movies?		✓ (The Lord of the Rings)
rearrange her furniture?	✓	
post a photo on social media?	✓	
call her grandparents by the phone ?		✓ (via video call)
create a handicraft?	✓	
clean her bedroom?	✓	
decide to learn a new skill?	✓	
bake some bread?		✓ (a cake)
learn French?		✓ (English)

search for covid-19 symptoms on the Internet?	✓	
fix her torn clothes?	✓	
complete an assignment online?	✓	
practise yoga?	✓	
play some board games ?		✓(video games)
organize her home schooling?	✓	
shop online?	✓	
invent something interesting?	✓	
attend a free online course?		✓ (expensive webinar)
listen to the pop music ?		✓(Rock music)
walk in the park?	✓	
form a routine for new activities?	✓	
paint in watercolour ?	✓	
accept a friend request on Instagram ?		✓ (Facebook)
Check her email?	✓	
try a new social media ?		✓ (online game)
cook her favorite food?	✓	
count the number of days she was home?	✓	
help her mother with doing housework?	✓	
enjoy the activities during the quarantine?	✓	

Appendix H

The transcript of the video

The Past Tense:

The past tense is used to talk about an action that happened or finished in the past.

Here are some examples:

I bought this house 3 years ago.

Alex forgot his cell phone at home this morning.

Last year, I worked from home.

Past tense verbs are divided into 2 groups, 1) regular and 2) irregular verbs.

In this video we want to learn about the regular verbs:

In writing, the past tense of regular verbs is made by adding -ed to the base of the verb.

For example,

talk – talked walk – walked need – needed listen – listened

The past tense verb is the same for all subjects:

I walked

You walked

He walked

She walked

It walked

We walked

You walked

They walked

Now, we are going to use Google Translate to practice your pronunciation. Google Translate has 2 features that we are going to use today.

First, as you know, Google translate can pronounce the words and sentences for you. All you need to do is type the word or the sentences in the box or simply copy and paste it here and click on the speaker icon to have the Google Translate read the entry aloud for you. If you click once the entry will be read at a normal pace and if you click a second time you will hear it at a slower pace.

Do not forget to choose English as the language.

Now the second feature which might not be as popular as the first one is a capability that allows you to practice your speaking using Google Translate. You can click on the microphone icon here and read a word or a sentence aloud and Google Translate will type it for you. If what is typed by Google Translate is not what you intended to say, it means your pronunciation was not clear or correct and you should try another.

Appendix I

Practice Materials; Aural discrimination # 1

Copy and paste the stories (the first story with 12 Target Items, 4 of each allomorph and the second story with 5 distractors - 30 Target Items, 10 of each allomorph) in Google Translate and Listen to the story read by Google Translate. Without looking at the original text fill in the blanks by typing the correct verb in the blank.

Baby Food (The Original Text)

A four-year-old boy named Joey was at the doctor's. He waited for his mother. He watched the clock on the wall. One second, two seconds, three seconds... He was bored. Then he saw a pregnant woman on the other side of the room. Joey stopped counting, waited some seconds, and walked to the chair where the woman was sitting. He was very curious and asked, "Why is your stomach so big?"

The woman replied with a laugh, "Because I'm having a baby."

Joey looked surprised and asked quietly, "Is the baby in your stomach?"

"Yes, of course!" said the woman. She grabbed the boy's hand and put it on her stomach, "Can you feel the baby kick?" Joey felt something move inside the woman's stomach and pulled back his hand.

"But is it a good baby?" Joey questioned with a confused look on his face.

"Oh, yes. I'm sure it's a really good baby," added the woman. "I am sure this baby will become a good little boy like you!" She repeated: "Just like you".

At this point, Joey looked very scared. He moved back two steps and asked, "If he is such a good baby, then why did you eat him?"

4 Distractors

A Surprise Birthday Party! ((The Original Text))

Last week, Mari **decided** to throw a surprise birthday party for her roommate, Lily. Beth **planned** everything; she **decorated** the apartment, and **moved** some of the furniture to her room and **turned** the living room into a dance floor. Mari **invited** some friends and also **called** Lily's mom to come to Lily's birthday party. Mari **remembered** that Lily always **liked** a strawberry cake. She **cracked** some eggs into a small bowl, then she **heated** some milk, **added** some flour to the milk. Next, she **chopped** some strawberries and **mixed** all the ingredients in a big bowl. Finally, she **tasted** the dough and **baked** it for 20 minutes. After that, she **prepared** some pink frosting and **covered** the cake with it. Mari then **placed** 25 candles on top of the cake. Mari, Lily's mom and other guests **waited** for Lily to come home from work. When Lily **arrived** home, everyone **jumped** in front of the door and **surprised** her. They all **kissed** Lily and **wished** her a happy birthday. They all **talked**, **played** blasting music, **danced**, and **enjoyed** the party. The party **lasted** for the whole evening. Lily **opened** the gifts and **thanked** everyone. Lily **received** a lot of presents, but she **believed** that the cake was the best one; she simply **loved** her birthday cake. After the party, Lily **helped** Mari clean the apartment. They **collected** the dirty dishes and glasses and **washed** them in the kitchen. Before going to bed, Lily **posted** the photos of her birthday party on her Facebook. In the captions, she wrote, "Lily **started** a personal new year tonight!"

Appendix J

Practice Materials; Aural discrimination # 2

Copy and paste the verbs one by one (60 verbs, 20 for each variation) in the Google Translate and listen to their pronunciation produced by Google Translate. Then, select the right verb based on their ending pronunciation of past -ed.

1) guided a) used b) asked c) added	21) rained a) used b) asked c) added	41) offered a) used b) asked c) added
2) called a) used b) asked c) added	22) ended a) used b) asked c) added	42) sniffed a) used b) asked c) added
3) jumped a) used b) asked c) added	23) planted a) used b) asked c) added	43) stayed a) used b) asked c) added
4) attracted a) used b) asked c) added	24) enjoyed a) used b) asked c) added	44) created a) used b) asked c) added
5) filmed a) used b) asked c) added	25) wished a) used b) asked c) added	45) looked a) used b) asked c) added
6) divided a) used b) asked c) added	26) moved a) used b) asked c) added	46) followed a) used b) asked c) added
7) brushed a) used b) asked c) added	27) waited a) used b) asked c) added	47) guessed a) used b) asked c) added
8) played a) used b) asked c) added	28) answered a) used b) asked c) added	48) cried a) used b) asked c) added
9) talked a) used b) asked c) added	29) washed a) used b) asked c) added	49) finished a) used b) asked c) added

10) waited a) used b) asked c) added	30) afforded a) used b) asked c) added	50) welcomed a) used b) asked c) added
11) rearranged a) used b) asked c) added	31) burned a) used b) asked c) added	51) dragged a) used b) asked c) added
12) hunted a) used b) asked c) added	32) stuffed a) used b) asked c) added	52) described a) used b) asked c) added
13) baked a) used b) asked c) added	33) decided a) used b) asked c) added	53) accepted a) used b) asked c) added
14) picked a) used b) asked c) added	34) filled a) used b) asked c) added	54) stopped a) used b) asked c) added
15) belonged a) used b) asked c) added	35) named a) used b) asked c) added	55) kissed a) used b) asked c) added
16) completed a) used b) asked c) added	36) wanted a) used b) asked c) added	56) tested a) used b) asked c) added
17) walked a) used b) asked c) added	37) relaxed a) used b) asked c) added	57) expanded a) used b) asked c) added
18) needed a) used b) asked c) added	38) noted a) used b) asked c) added	58) hated a) used b) asked c) added
19) liked a) used b) asked c) added	39) painted a) used b) asked c) added	59) searched a) used b) asked c) added
20) passed a) used b) asked c) added	40) knocked a) used b) asked c) added	60) shopped a) used b) asked c) added

Appendix K

Practice Materials (Production #1)

You have a list of 81 pairs of verbs in both present and past (27 items for each variation). Read both present and past tense forms aloud using Google Translate and see if the right form of verb appears on the screen. If Google Translate shows a different form than what you intended to say, try again until it shows the exact form of the verb you are reading.

ask, asked

need, needed

join, joined

book, booked

open, opened

calculate, calculated

check, checked

crack, cracked

apologize, apologized

expand, expanded

crush, crushed

hate, hated

invite, invented

borrow, borrowed

dress, dressed

arrive, arrived

bake, baked

annoy, annoyed

suggest, suggested

dislike, disliked

start, started

cross, crossed

attend, attended

label, labeled

learn, learned

attract, attracted

dance, danced

plant, planted

guess, guessed

test, tested

color, colored

manage, managed

develop, developed

drip, dripped

burn, burned

drop, dropped

cheat, cheated

escape, escaped

worry, worried

face, faced

rain, rained

decorate, decorated

divide, divided

repeat, repeated

fix, fixed

connect, connected

advise, advised

argue, argued

force, forced

answer, answered

end, ended

help, helped

visit, visited

watch, watched

shave, shaved

complete, completed

work, worked

allow, allowed

search, searched

avoid, avoided

shop, shopped

arrange, arranged

analyze, analyzed

arrest, arrested

agree, agreed

thank, thanked

type, typed

paint, painted

walk, walked

clean, cleaned

drag, dragged

use, used

stuff, stuffed

close, closed

welcome, welcomed

add, added

wash, washed

accept, accepted

kill, killed

correct, corrected

count, counted

love, loved

decide, decided

wait, waited

sniff, sniffed

want, wanted

Appendix L

Practice Materials (Production #2)

You have a list of 60 sentences in both present and past (10 items for each variation). Please read both present and past tense form aloud using Google Translate and see if the right form of verb appears on the screen. If Google Translate shows a different form than what you intended to say, try again until it shows the exact form of the verb you are reading.

The classes **started** at 5 o'clock.

The classes start at 5 o'clock.

The dogs **jumped** over the fence.

The dogs jump over the fence.

Mary and Kate **described** the man to the Police.

Mary and Kate describe the man to the Police.

They **posted** a video on Youtube.

They post a video on Youtube.

You **ordered** a bag from Amazon.

You order a bag from Amazon.

I **decided** to learn French.

I decide to learn French.

They **walked** in the park.

They walk in the park.

I **closed** my store.

I close my store.

John and Mathew **cleaned** everywhere.

John and Mathew clean everywhere

We **wished** her a happy birthday.

We wish her a happy birthday.

Peter and his friend **joined** the team.

Peter and his friend join the team.

They **waited** for 2 hours.

They wait for 2 hours.

I **asked** my questions in the class.

I ask my question in the class.

You **fixed** your car.

You fix your car.

They **offered** me a good job.

They offer me a good job.

They **repeated** their questions.

They repeat their question.

We **loved** the book.

We love the book.

They **arrested** the robber.

They arrest the robber.

You **brushed** your teeth.

You brush your teeth.

We **planted** a tree in the yard.

We plant a tree in the yard.

They **played** soccer.

They play soccer.

We **danced** with the music.

We dance with the music.

Carol and John **corrected** my mistakes.

Carol and John correct my mistakes.

We **stayed** in his house.

We stay in his house.

I **called** you at 4 O'clock.

I call you at 4 O'clock.

They **painted** the house.

They paint the house.

You **knocked** on the door.

You knock on the door.

They **attracted** a lot of tourists.

They attract a lot of tourists.

I **helped** him with his English.

I help him with his English.

We **baked** a cake.

We bake a cake.

Appendix M

Post-Test- Interview Questions

- 1- What do you think this study is about?
- 2- How do you like doing assigned homework that must be done by using Google Translate?
- 3- What do you think are the benefits of using GT in learning English pronunciation?
- 4- What do you think are the disadvantages of using GT in learning English pronunciation?
- 5- Do you think you should spend more time using GT to learn pronunciation outside of classroom?
- 6- Which feature do you prefer using in GT, TTS or ASR? Why?
- 7- Some students are more visual than others, while other need to hear things, Do you think using GT satisfies your learning style? How?
- 8- What are your recommendations for better using GT to learn English pronunciation outside of classroom?
- 9- Explain the strategies/steps you adopted in using GT to do the activities (How do you use GT to learn English pronunciation)?
- 10- How many times did you listen to each text/word?
- 11- How much time did you spend on the activities?
- 12- Are you willing to use GT for other purposes (e.g., learning a different language, learning the pronunciation of different words, learning grammatical items, etc.)? Why?