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App resources for developing English pronunciation: a focus on mobile technology

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App resources for developing English pronunciation: a focus on mobile technology

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ABSTRACT

Pronunciation is one of the components of L2 speaking which is necessary for successful communication to take place (GOH; BURNS, 2012) and the lack of instruction might result in learners who are not confident enough to speak, or end up having difficulties to understand and be understood in the L2. Scholars agree that the goal of pronunciation teaching nowadays should be to enable learners to develop intelligible pronunciation, and in order to do this, it is important to teach perception and production of the most relevant segmental and suprasegmental features of pronunciation, according to specific groups of learners (CELCE-MURCIA; BRINTON; GOODWIN, 2010). However, the teaching of pronunciation faces many challenges, such as few opportunities to provide output and feedback, large classrooms, limited time, lack of teacher's knowledge base in the area, anxiety and motivation (CELCE-MURCIA; BRINTON; GOODWIN, 2010; HARMER, 2007; MARTINS, 2015, STANLEY, 2013). Technology has always played an important role in the area of pronunciation teaching, starting with the first gramophones, record players, CDs, software, and more recently, Mobile Assisted Language Learning (MALL) materials (CELCE-MURCIA; BRINTON; GOODWIN, 2010; HINKS, 2015; STANLEY, 2013; STOCKWELL; HUBBARD, 2013). The apps which have been developed for pronunciation instruction enable learners not only to engage in pronunciation activities in small slots of time anytime, anywhere, but also to have access to a greater variety of input, receive immediate feedback, and to increase their motivation and autonomy. As these tools proliferate, however, it becomes difficult to understand how they differ from one another, what their best features are, and what pedagogical benefits may be derived from their use. Having this in mind, this study aimed at analyzing the content, the pronunciation teaching method, and the features and usability resources present in four pronunciation apps. In order to guide the analysis, a framework was developed based on literature related to the areas of pronunciation teaching and MALL. With this instrument, the apps were analyzed quantitatively and qualitatively. The results showed that even though most apps offer content regarding segmentals and suprasegmentals features of pronunciation, there is a tendency to focus more on segmentals. All of the apps analyzed offer description and analysis, listening discrimination, and controlled practice of the pronunciation features, as well as feedback. However, none of them enable guided and communicative practice of pronunciation. In spite of this and other limitations regarding mainly the Automated Speech Recognition (ASR) feature and variety of input, the apps may be an effective pedagogical resource for developing English pronunciation.
Keywords: Pronunciation teaching. MALL. Pronunciation apps.

RESUMO

A pronúncia é um dos componentes da habilidade da fala necessários para que haja comunicação (GOH; BURNS, 2012), e a falta de ensino desta pode resultar em estudantes que não se sentem confiantes suficiente para falar, ou que têm dificuldades para entender e serem entendidos na L2. Estudiosos concordam que o objetivo do ensino de pronúncia hoje deveria possibilitar os estudantes a desenvolver uma fala inteligível, e para isso, é importante ensinar a percepção e produção tanto de segmentos quanto de suprassegmentos da pronúncia, sempre levando em consideração os grupos específicos de estudantes (CELCE-MURCIA; BRINTON; GOODWIN, 2010). No entanto, o ensino de pronúncia enfrenta muitos desafios, como, poucas oportunidades de promover prática e fornecer feedback, salas de aula numerosas, tempo limitado, falta de conhecimento dos professores na área, ansiedade, e motivação (CELCE-MURCIA; BRINTON; GOODWIN, 2010; HARMER, 2007; MARTINS, 2015, STANLEY, 2013). A tecnologia sempre teve um papel importante na área de ensino de pronúncia, começando pelos primeiros gramofones, toca discos, CDS, softwares de computador, e mais recentemente, com os materiais desenvolvidos para *Mobile Assisted Language Learning (MALL)* (CELCE-MURCIA; BRINTON; GOODWIN, 2010; HINKS, 2015; STANLEY, 2013; STOCKWELL; HUBBARD, 2013). Os aplicativos que têm sido desenvolvidos para pronúncia possibilitam que os estudantes possam não apenas a praticar pronúncia em curtos períodos de tempo, em qualquer lugar, a qualquer hora, mas também a ter acesso a uma variedade de insumo linguístico, receber feedback imediato, e aumentar sua motivação e autonomia. No entanto, à medida que essas ferramentas se proliferam, torna-se difícil entender como elas diferem umas das outras, quais são seus melhores recursos, e quais são as implicações pedagógicas que podem originar de seu uso. Com isso em mente, este estudo buscou analisar o conteúdo, o método de ensino, e os recursos e a usabilidade de quatro aplicativos que foram desenvolvidos para ensino de pronúncia. Para guiar a análise, um framework foi desenvolvido baseado na literatura a respeito de ensino de pronúncia e MALL. Com este instrumento, os aplicativos foram analisados tanto quantitativa quanto qualitativamente. Os resultados mostraram que, apesar de os aplicativos oferecerem conteúdo relacionado a segmentos e suprassegmentos, há uma tendência de focar mais em segmentos. Todos os aplicativos analisados oferecem apresentação, prática de escuta, e prática controlada, bem como feedback. No entanto, nenhum deles possibilita prática guiada e prática comunicativa de pronúncia. Apesar disso e de limitações relacionadas ao recurso de reconhecimento de voz e variedade de insumo linguístico, por exemplo, os aplicativos podem ser considerados um recurso pedagógico eficaz para desenvolver a pronúncia em língua inglesa.

Palavras-chave: Ensino de pronúncia. MALL. Aplicativos de pronúncia.

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LIST OF ABBREVIATIONS

ASR - Automated Speech Recognition

CALL - Computer Assisted Language Learning

CMC - Computer Mediated Communication

ESL - English as a Second Language

L1 - First Language

L2 - Second Language

MALL - Mobile Assisted Language Learning

ML - Mobile Learning

PDA - Personal Digital Assistant

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1 INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

The process of developing a second language (L2)[1] speaking competence is a complex one, as it requires not only knowledge of the target language, development of core skills, and communication strategies (GOH; BURNS, 2012), but also presents challenges for learners and teachers, such as limited time, large classrooms, few opportunities to provide output and feedback, anxiety, and motivation (GOH; BURNS, 2012). Pronunciation is one of the core skills of speaking which is necessary for successful communication to take place and the lack of instruction might result in learners who are not confident enough to speak, or end up having difficulties to understand and be understood in the L2. According to Celce-Murcia, Brinton, and Goodwin (2010, p. 9), a realistic goal in pronunciation teaching is not to make learners sound like native speakers, but to enable them to "surpass the threshold level so that pronunciation will not detract from their ability to communicate", and also to make their communication more intelligible. In order to reach that goal, learners must be provided with opportunities to practice perception and production of the most important segmental[2] and suprasegmental[3] features of pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001) through activities that include presentation, listening, and practice focused on both form and meaning of the given features, all of them followed by feedback (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

Since the 1960's, studies in the area of Computer Assisted Language Learning (CALL) have investigated how technology can be applied in order to enhance language learning, with activities that go beyond the language classroom and are often more motivating for learners (BAX, 2003; CHAPELLE; JAMIESON, 2008; GRUBA, 2006; LEVY; HUBBARD, 2007). As technology, once restricted to computers, has not only evolved but gone mobile, a new subset of CALL has emerged and is known as Mobile Assisted Language Learning (MALL). In MALL, mobiles are devices which are portable and personal, and these features added to their connectivity enable learners to practice the L2 at the time and place

[1] In this study, the term Second Language refers to both Second and Foreign Language.
[2] Segmental features refer to the individual sounds, or phonemes.
[3] Suprasegmental features refer to word stress, sentence stress, connected speech, intonation, and prominence.

that is most suitable for them. This not only may increase the time engaged in language learning activities, but also allows learning to happen in more naturalistic[4] settings, which could lower the barriers between what happens in the classroom and in students' lives (STOCKWELL, 2013).

Studies in MALL have generally focused on three devices: MP3 players, Personal Digital Assistants (PDAs), and mobile phones, with an increasing number of studies on mobile phones in the last decade (STOCKWELL, 2013). Applications (apps) which have been developed for mobile phones and focus on language learning have become popular among L2 teachers and learners. These apps, which initially focused on written language, seem to be a helpful tool to support pronunciation instruction, providing practice of receptive and productive skills of pronunciation and offering immediate feedback, in an environment where learners may feel more comfortable and which allows unlimited attempts toward confidence (GUO, 2014).

Regarding the development of L2 speaking and pronunciation through mobile devices, studies (ARAGÃO; PAIVA; JUNIOR, 2017; CAMPOS; FREITAS, 2016; GONZALEZ, 2012; GUO, 2014; HAN; KESKIN, 2016; PAIVA 2017, 2018; SALBEGO, 2019; SARAN, SEFEROGLU; CAGILTAY, 2009; SUN et al., 2017) have shown that mobile phones and language learning apps have the potential to develop L2 speaking and pronunciation, as well as to promote more opportunities for practice, increasing students' motivation and decreasing anxiety that may be related to speaking in an L2. However, as these tools proliferate, it becomes difficult to understand how they differ from one another, what their best features are, and what pedagogical benefits may be derived from their use (KUKULSKA-HULME; LEE; NORRIS, 2017). Therefore, this research aims to contribute to the areas of pronunciation teaching and MALL by investigating four pronunciation apps.

1.2 GENERAL AND SPECIFIC OBJECTIVES

The main objective of this study is to investigate four pronunciation apps according to their content, pronunciation teaching method, as well as the features and usability incorporated by them to promote pronunciation development.

[4] The term naturalistic is used in this study to refer to settings outside language classroom.

The specific objectives of this study are:

- To investigate whether the apps include content related to segmental and suprasegmental features of pronunciation;
- To investigate whether the apps work with the five steps of the framework for teaching pronunciation: description and analysis, listening discrimination, controlled, guided, and communicative practice of the features of pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), as well as the feedback provided by them.
- To investigate the features and usability resources incorporated by the apps and how they promote pronunciation development.

1.3 RESEARCH QUESTIONS

The following research questions are intended to be answered in this study:

(RQ1)

Do the apps include content related to segmental and suprasegmental features of pronunciation?

(RQ2)

Do the apps work with the five steps of the framework for teaching pronunciation: description and analysis, listening discrimination, controlled, guided, and communicative practice of the features of pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), also providing feedback?

(RQ3)

What are the features and usability resources incorporated by the apps and how they promote pronunciation development?

1.4 SIGNIFICANCE OF THE STUDY

Today, the importance of intelligible pronunciation for successful communication is recognized by scholars and language teachers. However, research shows that in language learning environments the teaching of pronunciation is many times neglected possibly due to constraints such as few opportunities to provide output and feedback, large classrooms, limited time, lack of teacher's knowledge base in the area, anxiety, and motivation.

Technology has always played an important role in the area of language learning, especially for pronunciation. Several tools have been used in order to improve pronunciation instruction throughout the decades (HINKS, 2015), such as the gramophones, record players, CDs, computer software, and, more recently, mobile devices and mobile apps. The pronunciation apps may contribute to overcome the challenges regarding the teaching of pronunciation, once these tools may offer, for instance, a greater variety of input on demand, as well as output and feedback opportunities many times not possible in traditional classroom contexts, at a suitable time and place for learners.

Hence, this study aims to contribute to the areas of pronunciation teaching and MALL by analyzing the content, pronunciation teaching method, and the features and usability resources incorporated by four pronunciation apps. The results presented by this research can be useful to inform researchers, teachers, and learners who are interested in promoting the development of L2 speaking and pronunciation through the use of mobile apps. Furthermore, the framework developed in order to carry out the analysis of the apps in this study can be used to analyze other pronunciation apps not included in this research, or even adapted with the purpose of analyzing other materials developed for pronunciation instruction as well as any other areas of language.

1.5 SUMMARY AND ORGANIZATION OF THE CHAPTERS

The first chapter of this study presented its contextualization, as well as the background and significance of the problem being investigated. It also addressed the main and specific objectives and the research questions.

Chapter 2 provides a review of literature of the study. Initially, it presents the components of L2 speaking, including the core skill of pronunciation, followed by discussions on pronunciation instruction and current issues concerning its practice. Following this, the relationship of digital technology and language learning is discussed, with a focus on apps and pronunciation. Next, studies carried out regarding MALL and the development of L2 speaking and pronunciation are presented. Finally, a summary of the chapter is provided.

Chapter 3 presents the method adopted for the research, explaining the development of the framework which is used to guide the analysis of the apps, as well as the steps taken in order to select and analyze them. It ends with a summary of the chapter.

Chapter 4 presents individual analysis of the four apps, as well as a general discussion regarding such findings. At its end, a summary of the chapter is provided. Finally, Chapter 5, named Final Remarks, presents a summary of the findings and provides answers to the research questions. It also comments on its pedagogical implications, possible limitations of the study, and presents suggestions for further research.

2 REVIEW OF LITERATURE

The process of developing L2 speaking requires knowledge of the target language, development of core skills, and communication strategies (GOH; BURNS, 2012). The teaching of pronunciation, core skill which is the main concern of this research, is known for being challenging (GONZALEZ, 2012; HARMER, 2007; STANLEY, 2013) and may find in mobile technology, more specifically in apps, a way of improving this process.

Section 2.1 of this chapter presents an overview regarding the importance of teaching every component of speaking, including the core skill of pronunciation. Section 2.2 discusses the different roles pronunciation has had throughout different language teaching methods, what has been agreed among scholars to be the goal of pronunciation instruction nowadays, and comments on current issues concerning its practice. On Section 2.3, literature on digital technology applied to language learning is provided, highlighting the relationship of apps and pronunciation instruction. Section 2.4 presents studies which have been carried out concerned with MALL and L2 speaking and pronunciation development. Finally, in section 2.5, a review of the chapter is provided.

2.1 SPEAKING AND PRONUNCIATION IN AN L2

Pronunciation is one of the core skills of L2 speaking which is necessary for successful communication to take place, and developing it may be a challenging process for the majority of learners. Speaking is "so natural and integral that we forget how we once struggled to achieve this ability - until, that is, we have to learn it all over again" (THORNBURY, 2005, p. 1). In terms of the mental processing involved, speaking in L1 and in L2 are mostly the same[5]; however, speaking in an L2 also involves emotional factors, specific knowledge of the target language, and core skills. According to the holistic model for teaching speaking proposed by Goh and Burns (2012, p. 53), the development of L2 speaking is the "increasing ability to use linguistic knowledge, core speaking skills, and communication and discourse strategies in order to produce utterances and discourses that are fluent, accurate, and socially appropriate within the constraints of cognitive processing". In order to develop L2 speaking, then, it is not enough to provide learners with opportunities to speak *per se* (GOH; BURNS, 2012), but to teach and provide practice of each of the components composing the model, namely *Knowledge of language and discourse, core skills,* and *communication strategies*.

Goh and Burns (2012) defined the first component of their model, *Knowledge of language and discourse,* as grammatical, phonological, lexical, and discourse knowledge. The authors explained that teachers must provide opportunities for learners to understand and use the syntax of the language (grammar), to know the target language sounds and acquire phonological knowledge at word, sentence and discourse level (phonological), activate and increase the vocabulary size (lexical), and enable the production of utterances that are appropriate to the settings and participants (discourse knowledge). However, "it's not enough for learners to know *about* grammar, vocabulary, pronunciation, and discourse. The term skill will be used to refer to learner's knowledge that is 'put into action' when in speech production" (GOH; BURNS, 2012, p.58).

According to the authors, the second component refers to the four *core skills* which must be developed in the L2: a) pronunciation - producing the sounds of the target language

[5] Check Goh and Burns (2012) and Thornbury (2005) for details regarding the three stages of speech production: conceptualization, formulation, and articulation, followed by self-monitoring.

at segmental and suprasegmental levels; b) speech function - performing a precise communicative function or speech act; c) interaction management - regulating conversations and discussions during interactions; and d) discourse organization - creating extended discourse in various spoken genres.

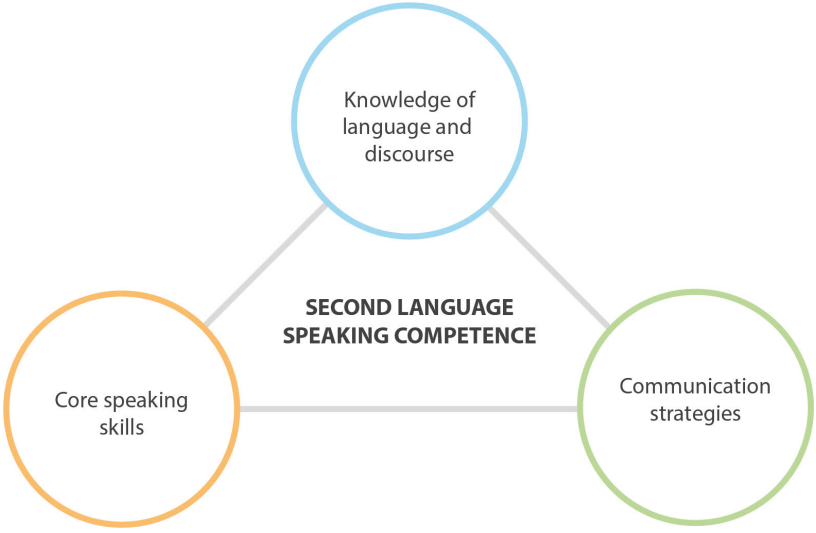
The last component of the speaking competence model proposed by them is *communication strategies*, which can be a) cognitive - techniques to compensate gaps in lexical knowledge; b) metacognitive - mental operations to regulate thinking and language during speaking; and c) interactional - social behaviors to negotiate meaning during interaction.

Summarizing, for Goh and Burns (2012), L2 speaking competence:

> requires knowledge of the target language as a system, for making meaning and an awareness of the contextual demands of speaking. It also calls for the use of various skills for using speech effectively and appropriately, according to different communicative purposes. Last, but not least, speaking competence includes the ability to use a range of strategies to compensate for gaps in knowledge and ineffective speaking skills (GOH; BURNS, 2012, p. 67).

Figure 1 illustrates the components of L1 speaking competence proposed by Goh and Burns (2012):

Figure 1 - Aspects of second language speaking competence



Source: Goh and Burns, 2012, p. 53

For effective development of L2 speaking competence to take place, then, Goh and Burns (2012) claimed that L2 speaking activities must be applied focusing on specific knowledge, skills, or strategies to be practiced. In addition to this, teacher's evaluation of the

given activities must be always related to the specific demands of the given task, instead of on the whole product. Therefore, in order to provide effective pronunciation instruction, activities should focus on that specific core skill, as well as the feedback provided by the teacher.

Having understood the importance of teaching every component of L2 speaking, the focus will now be on the specific core skill of pronunciation, which is the main concern of this research.

2.2 A FOCUS ON PRONUNCIATION INSTRUCTION

Pronunciation has had different roles throughout language teaching methods (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KANG; KERMAD, 2018; MURPHY; BAKER, 2015; SILVEIRA, 2004), being the Direct and Naturalistic the first ones to consider its importance. In these methods, learners would either listen and imitate, or would listen until they were comfortable enough to speak the sounds of the L2, without any instruction. With the Reform Movement[6], new notions of pronunciation in language teaching were added by phoneticians, such as teaching the spoken form of a language first, and applying findings of phonetics to language teaching. In the Audiolingual method, emerged in the 1950s, pronunciation teaching was considered very important and taught both through imitation and the use of phonetic information, such as transcriptions and charts. Within the Cognitive Approach in the 1960s pronunciation lost emphasis, due to the belief that native like pronunciation, which had been the goal in the previous methods, was not achievable and time would be better spent teaching grammar and vocabulary, for instance.

Following this period, linguists became more interested in how language is put to use in actual communication (THORNBURY, 2017). As a consequence, the Communicative Approach[7] emerged in the 1980s, and is currently the dominant method in language teaching (CELCE-MURCIA; BRINTON; GOODWIN, 2010). It advocates the purpose of language learning is communication, so using language to communicate should be the goal of

[6] During this period, around 1890s, the International Phonetic Alphabet (IPA) was developed and resulted in the establishment of phonetics as a science dedicated to describing and analyzing the sound systems of languages (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

[7] Also referred as Communicative Language Teaching (CLT).

classroom language instruction. This focus on language for communication, according to Celce-Murcia, Brinton, and Goodwin (2010, p. 8), "brings renewed urgency to the teaching of pronunciation, since both empirical and anecdotal evidence indicates that there is a threshold level of pronunciation for nonnative speakers of English".

The goal of teaching pronunciation within the Communicative Approach then, is not to make learners sound like native speakers, but to enable them to surpass the threshold level and be able to communicate. Even though the nativeness principle still permeates within the field (DERWING; MUNRO, 2015b), scholars agree a realistic goal in pronunciation teaching is intelligibility[8] (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017), given that aiming at native-like pronunciation is incongruent with empirical evidence (SILVEIRA et al., 2017). Based on this, it is important to know whether the goals encouraged by pedagogical resources developed for pronunciation instruction are based on achieving a native-like pronunciation or intelligibility.

Until the Communicative Approach, pronunciation instruction focused mainly on getting sounds right at word level. Nowadays, the importance of teaching the most relevant[9] aspects of segmental and suprasegmental features has been recognized, once the inaccurate use of either phonemes, stress, or intonation can inhibit successful communication (CELCE-MURCIA; BRINTON; GOODWIN, 2010). The teacher is the one responsible for choosing what should be taught, integrating such features appropriately to meet the needs of specific groups of learners (CELE-MURCIA et al., 2010; KELLY, 2001; MARTINS, 2015; SILVEIRA, 2004). Having said that, any analysis of pedagogical resources developed for pronunciation instruction must focus on whether their content offer opportunities to practice segmentals and suprasegmental features of pronunciation.

Celce-Murcia, Brinton, and Goodwin (2010) claimed that even though the proponents of the approach stated intelligible pronunciation to be the goal of teaching, they did not develop a set of strategies or methodology for doing it. Kang and Kermad (2018) also acknowledged that pronunciation became marginalized and, for many years, it was not of

[8] Derwing and Munro (2015, p. 385) define intelligibility as "the extent to which a listener actually understands an utterance", regardless of the speakers' accent.

[9] Regarding connected speech, for instance, C to V linking, V to V linking, consonant assimilation, and palatalization should be highlighted, as they frequently occur in spoken English. In what it concerns word stress, only three levels of word stress should be taught instead of six, as not all levels are discernible and therefore, are not useful for pedagogical purposes (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

primary concern. Today a variety of techniques and activities developed throughout all previously mentioned language teaching methods are still used for teaching pronunciation, such as: listen and imitate, minimal-pair perception/production and related activities, visual aids, phonetic training, tongue twisters, reading aloud, taping, and so forth.

In this context, Celce-Murcia, Brinton, and Goodwin (2010) proposed a framework for teaching pronunciation, which is grounded in the principles of the Communicative Approach. The principles are: a) language is best learned within a larger framework of communication, and the ultimate goal is to use language effectively for communicative purposes; b) materials and tasks should reflect the interests and needs of learners; c) learners acquire language most efficiently when they are active participants; d) language syllabus should focus on enabling learners to express their ideas in a variety of social interactions; e) errors are viewed as a natural part of the communicative process and may be repaired through exposure or feedback (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

The framework for teaching pronunciation developed by Celce-Murcia, Brinton, and Goodwin (2010) recommends a division of the pronunciation lesson into five steps which start by providing learners with analytical information and awareness raising of the features, followed by listening discrimination, and three different types of practice: controlled, guided, and communicative. Each step is described in Table 1:

Table 1 - Framework for teaching pronunciation communicatively

1-Description and Analysis	Oral and written illustrations of how the feature is produced and when it occurs within spoken discourse
2-Listening discrimination	Focused listening practice with feedback on learners' ability to correctly discriminate the feature
3-Controlled practice	Oral reading of minimal-pair sentences, short dialogues, etc., with special attention paid to the highlighted feature in order to raise learner's consciousness
4-Guided practice	Structured communication exercises, such as information-gap activities or cued dialogues, that enable the learner to monitor for the specified feature
5-Communicative practice	Less structured, fluency-building activities (e.g., role play, problem solving) that require the learner to attend to both form and content of utterances.

Source: Celce-Murcia, Brinton, and Goodwin (2010, p. 45)

The first step, description and analysis of each pronunciation feature, may occur through a variety of ways such as textual, visual, and aural information, calling learner's attention to the articulatory features, that is, the position of the organs, whether the vocal cords are vibrating or not, and whether there is tenseness or laxness of the muscles involved (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

In listening discrimination, which is the second step, learners are asked to listen to a feature and either identify it or distinguish it from other similar features. According to Celce-Murcia, Brinton, and Goodwin (2010), the goal of this step is to allow learners to gradually train their ears to the target features and to raise consciousness about them.

The third step, controlled practice, involves activities in which production is usually focused on specific sound features, and focuses on form. Some examples of activities within this step are repetition and oral reading, especially of minimal-pair words or sentences and short dialogues. The fourth step, named guided practice, is meant to focus both on form and meaning, that is, accuracy and fluency. Within this step, exercises are structured, with the context and much of the language provided, and the learner may add meaning by adding personal information and ideas. Activities in guided practice include cued dialogues, simple information-gap exercises, sequencing tasks such as strip stories, and so forth. Communicative practice, the fifth and last step, also focuses on form and meaning, but entails genuine exchanges of information, including activities such as storytelling, role-plays, interviews, and debate, for instance.

The authors emphasized that each phase plays a key role in the acquisition of new pronunciation features. As pronunciation learning is a complex and nonlinear process, the complete framework is meant to be applied throughout several lessons and every step can be revisited whenever necessary. In addition to this, they asserted the importance of systematic feedback in all stages.

According to Celce-Murcia, Brinton, and Goodwin (2010) feedback for description and analysis is provided on the placement of articulatory organs. Regarding listening discrimination, learners are made aware if they have correctly identified the target sound. Once the goal of controlled practice is accuracy, feedback may occur at any time and it may be delivered by the teacher or peers. During guided and communicative practice, as the goal

of the activity is communication, feedback tends to be delayed until the end and may also be delivered by the teacher or other learners.

Within the framework, the presentation of phonetic transcription for pronunciation instruction is also considered depending on the group of learners, as it may allow them to comprehend the elements of pronunciation visually and aurally and to promote learners' autonomy (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015).

Then, in order to verify whether the pedagogical resources for pronunciation instruction follow the pronunciation teaching method proposed by Celce-Murcia, Brinton, and Goodwin (2010), it is necessary to investigate whether description and analysis, listening discrimination, controlled, guided, and communicative practice are enabled by them, as well as if feedback is provided in every step.

Despite the acknowledgement that teaching all features of pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001) is important as well as providing opportunities for learners to go through the five steps of the framework proposed by Celce-Murcia, Brinton, and Goodwin (2010) (ALVES, 2015), scholars agree that pronunciation is an area of language which is overlooked in materials and language classrooms (ALBINI; KLUGE, 2011; SILVEIRA, 2004; STANLEY, 2013).

At the same time language teachers require at least a basic knowledge of introductory linguistics and of the principles of L2 pronunciation in order to provide effective pedagogy, research has demonstrated they receive insufficient formal instruction in these areas (DERWING; MUNRO, 2015a; LEVIS, 2007). Rauber (2009) affirmed it is very common to find English teachers who recognize the importance of pronunciation instruction but are not aware of many pronunciation problems that may hinder communication. Research by Derwing and Munro (2015b) has also indicated that while students are motivated for learning pronunciation, most teachers are hesitant and uncomfortable for doing it, teach less than students would like, or focus mainly on segmentals. Similarly, Derwing (2018) pointed out teacher's reluctance of teaching pronunciation and recommended encouraging them to do so.

With regards to the Brazilian context, a study carried out by Costa (2016) analyzed teacher's beliefs and practices on pronunciation teaching. Results showed that even though teacher-participants of the study considered pronunciation teaching to be important, they did

not specify what should be approached, and seemed to avoid explicit teaching during the observed classes. When doing so, they focused mainly on segments and did not use a variety of techniques and resources. Costa (2016) concluded this may be related to the lack of deep knowledge of pronunciation features and how to teach them.

Given that most teachers of English as a second language (ESL) have an L1 which is not English (CELCE-MURCIA; BRINTON; GOODWIN, 2010), technology has the potential to assist them in overcoming their own difficulties, considering that many institutions do not offer pedagogical support for teachers such as training regarding pronunciation teaching and learning (LEVIS, 2007; MARTINS, 2015). For Celce-Murcia, Brinton, and Goodwin (2010), teacher's knowledge base must include knowledge of the organs involved in articulation of vowels and consonants, the way sounds vary in context, awareness of the features of stress, rhythm, intonation, connected speech, and how these features work to express meaning within discourse. Teachers should also be aware of features that can negatively affect students' intelligibility and be able to set the pedagogical priorities for each group of learners, deciding what should be taught and when. In other words, not everything must be taught. In the same way, Silveira (2004) affirmed the content of the pronunciation syllabus should vary taking into account the type of learner, setting, institution, learners' L1, and course methodology.

In addition to the issues aforementioned related to teacher's pedagogy, large classrooms and limited time are other aspects that contribute for pronunciation instruction to remain neglected (HARMER, 2007; STANLEY, 2013). This reality can be changed by the use of digital technology, given that computers and mobile devices may allow learners to spend more time engaged in pronunciation related activities, practicing this core skill at the most suitable time and place for them. Martins (2015) affirmed the use of specific software for L2 pronunciation development, for instance, may increase learners' motivation and make them more engaged in learning L2 pronunciation, once they easily offer several types of input through multimodal resources such as animations, sounds, videos, and images. With the development of digital technology, most of these software features are likely to be present in mobiles and mobile app available today.

Once the goals of pronunciation instruction and current issues concerning its practice have been discussed, the next section provides an overview regarding digital technology and the area of language learning, focusing mainly on apps and L2 pronunciation development.

2.3 DIGITAL TECHNOLOGY AND L2 LEARNING

Technology permeates many aspects of our lives, including language learning environments where it can be used to access information, get exposure to a target language, seek entertainment, communicate, interact, manage learning, and contribute for learners to feel more motivated and engaged (STANLEY, 2013). The area of research concerned with the development and use of digital technology in language teaching and learning emerged in the 1960's, and is known by the acronym CALL. Influenced by learning theories, language teaching methods and the development of technology, three phases of CALL have been documented by scholars so far: Behavioristic[10], Communicative, and Integrative (BAX, 2003; SOUZA, 2004; WARSCHAUER, 2000; WARSCHAUER; HEALEY, 1998).

The Behavioristic phase, in the 1960's/1970's, is the one when the computer had the role of a tutor, used mainly to deliver drill and practice exercises, providing positive and negative feedback to the user. The activities in this phase focused on accuracy and resembled those from the Grammar-Translation and the Audiolingual methods. In Communicative CALL, in the 1980's, authoring programs became available so that teachers could construct and edit their own activities, such as filling the gaps and reconstructing texts. There were games and simulations and, influenced by the Communicative Approach, it was also suggested that computers could be used to promote communicative situations and interaction among learners. The rise of the multimedia and internet brought the Integrative phase of CALL, which enabled learners to engage in activities that integrated many skills simultaneously and also to seek information, to communicate synchronously with people all around the world, and to work collaboratively.

Even though these are called phases (WARSCHAUER, 2000; WARSCHAUER; HEALEY, 1998), Bax (2003) suggested referring to them as approaches instead, as one did not replace the other, and all of them are currently in use. Bax (2003) named the three approaches as Restricted, Open, and Integrated CALL. In Restricted, technology allows activities such as text reconstruction and answering closed questions, and there is minimal interaction among students. The type of feedback is either correct or incorrect, and the teacher's role is restricted to monitoring. In Open CALL, activities such as games and

[10] Authors as Gruba (2006) refer to this phase as Structuralist.

simulations are available and learners are able to interact with the computers and, occasionally, with other learners. Feedback within this approach, according to Bax (2003), is more open and flexible, and teachers have the role of monitors and facilitators. In both Restricted and Open approaches, technology is not integrated into the syllabus, but seen as optional and extra, and preceding learners' needs. In Integrated CALL, Computer Mediated Communication (CMC) and e-mails are used as activities, for instance, and there is frequent interaction among users. Feedback interprets, evaluates, comments, and stimulates thoughts. Within this approach, the teacher is not only facilitator, but the manager, and learner's needs precede the use of technology.

According to Bax (2003, p. 23), Integrated CALL is reached through the concept of normalization, that is, "the stage when a technology is invisible, hardly even recognized as a technology, taken for granted in everyday life". For the author, this is the stage when 1) computers, probably in smaller shapes and sizes are used by language students and teachers as a part of the lesson, alongside books and notebooks, and, 2) when technology is treated as secondary to learning itself, that is, when learner's needs are carefully analyzed first of all, and then the computer is used to serve those needs.

As noted by Bax (2003), computers had their size reduced and several other features embedded to them, became portable and are part of teachers and learners' everyday lives, having their place in classroom environments as well. Today most technology once restricted to computers has gone mobile, and as a consequence a new subset of CALL emerged and became known as MALL. Differently from CALL practices which tend to happen in the classroom context, MALL may happen in the most suitable time and place for learners and allows small amounts of time and space for learning (CHINNERY, 2006). It may also increase the time spent engaged in language learning activities and allow learning to happen in more naturalistic settings, hence lowering the barriers between what happens in the classroom and in students’ lives (STOCKWELL, 2013).

As for a definition of Mobile Learning (ML), Kukulska-Hulme and Shield (2008, p.3) refer to it as "learning mediated via handheld devices and available anytime, anywhere. Such learning may be formal and informal". Chinnery (2006, p. 9) affirms ML environments "may be face-to-face, distance, or online; further, they may be self-paced or calendar based". For Kukulska-Hulme (2006, p. 120), "mobile devices may be used for learning at home, in a

classroom, in a social space, on field trips, in museums and art galleries or as part of everyday learning". Stockwell (2013) claimed ML occurs predominantly out of class environments, but acknowledged it may happen in both contexts. Likewise, Kukulska-Hulme et al. (2017, p. 217), affirmed that "although mobile learning offers certain benefits in the classroom, the use of mobile devices also potentially extends learning beyond the classroom setting". The term MALL in this research will be used to refer to the use of mobile devices[11] applied to language learning anywhere.

According to Stockwell and Hubbard (2013), some features related to MALL are, for instance: a) push feature[12], that is, stimulus being sent inviting or reminding the user to take a lesson, for instance. For the authors, the user should be given some control over when the push events occur; b) the length of the tasks, which must be short and succinct and/or divided into smaller and coherent chunks. This way, the learner is able to engage in language learning activities in small periods of time; c) tasks should be developed to fit that technology and environment and still allow effective learning - one should not expect learners to read long passages in a small screen, or completing listening/speaking tasks in a library; and d) guidance and training for learners are required, regardless if they already use such tools in their personal life.

Among all opportunities enabled for language learning through the use of mobile devices, one that has called attention are the apps developed for language learning. The apps may focus on general or specific language skills. Regarding the ones focused on pronunciation, they may present several features which will be discussed in the following section.

2.3.1 Apps for L2 pronunciation development

Pronunciation apps have many built-in features designed to assist the development of pronunciation. One of the features is the exposure to a variety of input on demand (LEVIS, 2007), as learners may have access to different varieties of English, regional accents, and

[11] Mobiles in MALL are portable and personal devices such as smartphones, tablets, music players, handheld video games, and PDAs (PIRES, 2018a).

[12] Scholars may refer to this feature as the push aspect (SARAN et al., 2009, STOCKWELL; HUBBARD, 2013).

male/female voices at their fingertips, at the most suitable time and place for them. This contrasts with most language classrooms where the main input is provided by the coursebook materials, generally limited to North American or British English varieties. In this sense, technology allows the use of many pronunciation models which are needed to increase communicative flexibility and respect for accent diversity (CELCE-MURCIA; BRINTON; GOODWIN, 2010; LEVIS, 2007).

As learner's L1 has an effect[13] on the development of L2 pronunciation, the apps may be embedded with a feature that allows the selection of users' L1. This way, materials and exercises which are most relevant for the learner with that specific L1 may be provided, taking into consideration possible cross-linguistic influences[14] which may hinder intelligible pronunciation, for instance.

In addition to this, learners may have individual differences and different goals regarding their pronunciation development, so apps may be embedded with a feature that provides one proficiency test in order to identify users' main difficulties, or simply to allow him/her to select the level of difficulty and aspects of L2 pronunciation he/she is aiming at practicing. This feature not only contributes to develop learners' autonomy, compensating the limits of classrooms and fostering L2 learning without the presence of a teacher (MARTINS, 2015), but also contributes to overcome one of the biggest problems in the use of most digital technology materials for L2 pronunciation instruction: the absence of priority-setting features. According to Munro and Derwing (2015a p. 393) "the common one-size-fits-all approach in which practice is offered in 'everything' is unhelpful to teachers and students who need to focus their attention on issues that will genuinely improve their communication skills". Therefore, the possibility of selecting user's L1 and also different levels of lessons when using the apps are important aspects to be taken into account regarding pronunciation apps.

Pronunciation apps may allow the presentation of the features of pronunciation in a variety of ways, for instance, through the use of textual information, illustrations,

[13] Check Celce-Murcia, Brinton, and Goodwin (2010) and Trofimovich; Kennedy; Foote, (2015) for more on learners' L1 influence on L2 pronunciation development, as well as for other individual differences which may affect L2 pronunciation learning.

[14] Cross-linguistic influence is the term used to explain how two or more languages may affect one another in bilingual and multilingual individuals.

learner-friendly diagrams, and videos[15]. The media must be well designed[16], otherwise the apps may be ineffective. For Pires (2018b), who analyzed the six most popular language learning apps for vocabulary acquisition, the apps may sometimes display pictures which are not relevant to the activity proposed, confusing the learners. Similar to Pires (2018b), Kukulska-Hulme et al. (2017) have revealed the incongruity of meaning between the modes of language and visuals in a commercial vocabulary app, with one-fifth of the images being unclear, decontextualized, and potentially confusing for users. Considering a minimal-pair pronunciation activity, for instance, a picture which does not easily relate to the given word may be a problem for the learner. Finally, not only is the choice of pictures important, but also their quality, given that a picture which is blurry or in an inadequate format may also affect understanding (CHINNERY, 2006).

Another important feature of pronunciation apps is the voice. According to Mayer (2009, p. 256), "a machine-synthesized voice – although perceptually discernable – may not convey as much sense of social presence – that is, it may not strongly convey the idea that someone is speaking directly to you. Thus, voice cues may affect the degree to which a learner feels a social response to the instructional message". In the same way, Hinks (2015) affirmed that the greatest research challenge at present is to improve the naturalness of the sound and pronunciation. As the voice present in pronunciation apps can often sound quite artificial, developers have been wary of using it as a teaching model, preferring recordings of natural voices. Therefore, the choice and quality of videos, illustrations, pictures, and voices must be included in any analysis of pedagogical resources developed for pronunciation instruction.

The ASR feature can be considered another relevant feature of pronunciation apps, considering that when they are equipped with this feature, learners may practice pronunciation and receive immediate feedback, something which is not always possible in a classroom context, due to time constraints and large number of students. In addition to this, ASR feedback may be more accurate than the teacher's (MARTINS; BORGES; LEVIS,

[15] According to Tumolo (2017), videos can be considered an efficient didactic resource allowing customized visualization for the learner, who defines how many times and what parts need to be seen again. Its multimodal composition also allows the information to be understood through the combination of sounds, images, and sometimes, narration.
[16] See Mayer (2009).

2016). In spite of its promising features, ASR is still a developing technology, and regarding pronunciation apps, most times it has limitations such as not taking into account the users' L1 or the variety he/she is speaking, thus, not recognizing cross-linguistic influences and failing at identifying what users are trying to say. This could discourage L2 learners to use pronunciation apps. When analyzing apps for learning English, Paiva (2018) concluded that even saying things "correctly", sometimes the app does not recognize and gives "incorrect" as feedback. The consequences of a negative feedback may be enormous (LEVIS, 2007), as learners may not be aware that they do sound intelligibile, despite the app not having identified their production.

There may be different types of feedback provided by the apps, from "right/wrong", to "amount of % correct" or "% amount of native likeness", sounds such as clapping hands, or even visual feedback for showing an approximation of intonation contour, for instance. As previously discussed in section 2.2 of this study, feedback is required in all steps of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), and, according to Gonzalez (2012, p. 86), app "users should always know why they have made the mistake and, if possible, be given suggestions for improvement". Having said that, the ASR feature and feedback provided by it are features which must be included in an analysis of pronunciation apps.

Also relevant when discussing pronunciation apps is the feature regarding their availability offline. Most apps only work with internet connection, which may hinder their use, given that the majority of learners may not have internet access in their mobile phone, and even if they do, the access may be limited to a few mega (CHINNERY, 2006). In this sense, any analysis of pronunciation apps must verify whether they are available offline, which makes them especially relevant for students which do not have full access to internet (CHINNERY, 2006), but have a mobile phone which can be used for improving L2 speaking, including pronunciation (BRINTON, 2018).

The availability of the push feature in pronunciation apps (STOCKWELL; HUBBARD, 2013) may also encourage learners to engage in language learning activities outside the classroom context (SARAN et al., 2009). An example of the push feature is the fact that some apps are able to send notifications inviting or reminding of lessons during anytime of the day, whether at random or pre-set times chosen by the user.

The short duration of each module, when appropriately designed, lasting from thirty seconds to ten minutes can also be appealing to students (STOCKWELL; HUBBARD, 2013; KUKULSKA-HULME; SHIELD, 2008), allowing them to engage in pronunciation activities in small amounts of time, anytime, anywhere, without previously planning it (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008). Therefore, the availability of the push feature and the size of the lessons are features which must be taken into account in any analysis of pronunciation apps.

In addition to the pronunciation app features previously discussed, which are related to the areas of pronunciation instruction and MALL, a complete analysis of pronunciation apps must also be concerned with their usability, that is, the ease of using them. According to Krug (2008), websites and apps must be clear and self-explained, developed in a way so that the user is able to understand it and how to use it without much effort. Likewise, Garret (2011, p.10) affirmed that regardless of the type, sites[17] are a "self-service product. There is no instruction manual to read beforehand (...) There is only the user, facing the site alone with only her wits and personal experience to guide her". For Krug (2008), well designed websites and apps do not bring names which are not obvious and make users spend energy trying to understand what they mean, or present links and icons which are not obvious whether they should be clicked or not. The author affirmed that every doubt the user has may increase his/her work, distracting from the task which he/she was proposed to perform. In general, users do not appreciate having to find out what to do and blame themselves for not being able to understand. The author also mentioned the importance of having a balanced amount of information in the screen, which must also be well hierarchized, so the user is not overwhelmed and is able to guide him/herself during the use. For this reason, the usability of pronunciation apps must also be also considered when analyzing such materials, given that it may influence learners on using or not the apps for developing their L2 pronunciation.

It is important to mention that directions for choosing what and how to learn are required, and it is the teacher's job to provide learners with the necessary guidance for selecting and evaluating instructional materials (STOCKWELL; HUBBARD, 2013), as well as setting the pedagogical priorities for specific groups of learners (CHAPELLE;

[17] According to the author, the term sites refers to both content-oriented web products and interactive web applications.

JAMIESON, 2008; MARTINS; BORGES; LEVIS, 2016). According to Kang and Kermad (2017, p. 518), "it is an educator's role to diagnose students' pronunciation and assign certain areas in which students can begin to self-monitor and adjust their pronunciation". Technology alone does not create learning - it provides tools for learning and requires the skills and impetus for learners to do it (CHINNERY, 2006). And, based on studies such as this one, teachers can make informed choices to assist the development of pronunciation.

In sum, a complete analysis of pronunciation apps must look into its content, that is, verify whether it includes the most relevant segmental and suprasegmental features of pronunciation, and also investigate the pronunciation teaching method adopted by it. These aspects have been discussed in section 2.2 of this chapter. In addition to this, any pronunciation apps analysis must be concerned with the features and usability resources incorporated by them in order to promote pronunciation development, items discussed in section 2.3.1 of this chapter.

Once the important aspects which must be taken into account in an analysis of pronunciation apps have been discussed, studies regarding MALL and L2 speaking and pronunciation development are presented in the next section.

2.4 STUDIES IN MALL AND L2 PRONUNCIATION DEVELOPMENT

As a result of technological constraints, studies related to speaking development and (mobile) technology are less common to be found if compared to other areas of language. Yet, this reality is beginning to change. The studies reviewed in this section have been carried out in different countries and give valuable insights on how mobile technology can be used in order to provide practice of speaking, more specifically on the core skill of pronunciation, which is the main concern of this research.

Paiva (2018) carried out a study on the use of digital tools by Brazilian undergraduate students in order to improve their English oral skills. The researcher designed fifteen tasks to be delivered and completed by two groups of 35 students during a semester. The tools used were selected by being free of cost and software installation, as well as being available for use either on the desktop or on mobile devices, given the preference of students for the use of mobile phones. The investigation of the learning experience showed the tools

made students more relaxed about speaking in English and were considered by them as relevant for learning pronunciation. In the interview, students mentioned the importance of being able to go back and correct themselves before completing the task, as well as being able to notice their gaps and improve their pronunciation.

Aragão, Paiva, and Junior (2017) analyzed the emotions emerged during an online discipline for English oral skills development for undergraduate students of Letras at UFMG, a university in Brazil. The researchers created all the tasks delivered for the sixteen weeks of course, which was available on Moodle, and provided collective feedback regarding vocabulary, sintax, and pronunciation. The activities for pronunciation included phonetic transcription, software text-to-speech to practice pronunciation, and audio recording. Through interviews, researchers concluded that students found the course positive, innovative, engaging, and that they had experienced confidence increase and decrease of fear of speaking in English. Students mentioned the tools not only allowed cognitive development, but also helped lowering their anxiety regarding speaking English. Even though the course was based on Moodle, which is usually accessed through desktop computers, it can also be accessed through mobile phones, as well as all the digital tools (*Vacaroo, Voki, Utellstory, PowToon, Foto-babble, Voicethread, Audioboom,* text-to-speech, audio and video recording softwares embedded on phones) which were used in the activities to develop students' oral skills.

At a university in Turkey, Han and Keskin (2016) investigated the use of the mobile application *WhatsApp* to reduce the anxiety of undergraduate students to speak English, and their perceptions about the activities conducted. The activities were applied in the classroom context during four weeks, when students were supposed to write a mini dialogue about something learned on that day, and after getting feedback from the teacher, record it using *WhatsApp*. By comparing pre and post tests, the researchers concluded students experienced less anxiety for speaking English after four weeks using the app, and in the interview carried out, students reported using the app was relevant in helping them with their pronunciation as they were able to listen and record their production until they felt confident.

Salbego (2019) analyzed the online oral negotiated interaction of beginner learners of English with the use of *WhatsApp* at a technical high school in Brazil. Questionnaires and oral interviews regarding participants' perception revealed that most students thought using

WhatsApp for the proposed activity helped reduce their anxiety and contributed to cognitive aspects of English listening, speaking, and pronunciation development.

Regarding young learners in China, pre and post tests of Sun et al. (2017) showed that the experimental group who had used mobile social networking during six months for speaking practice had greater improvement of fluency than the control group. Even though accuracy and pronunciation levels were similar for both groups, the interviews showed that the use of mobiles reduced students' anxiety by giving the opportunity for them to be heard by the teacher, something which does not happen in the classroom context due to constraints such as limited time and number of students. Results showed that students uploaded more versions of the audio recording than it had been required by the teacher. They mentioned that by using the mobile they had more opportunities to work on cognitive aspects before uploading the activity, as well as the possibility to speak as many times as they wanted, contributing to feeling more confident when speaking English.

Saran et al. (2009) sent pronunciation instruction for university students in Turkey via multimedia message, website, and handout papers during four weeks. Pre and post tests showed that the group receiving instructions via multimedia messages improved their pronunciation the most, followed by the website, and by the handout papers groups. Interviews also showed that students enjoyed instructional materials being sent to their mobiles and found the audiovisual representations effective, as they provided pronunciation instruction through both sounds and images in addition to the textual information. The fact that mobiles allowed opportunities to repeat the activities was also mentioned as being positive by the students. The authors concluded that carefully designed instructional materials for mobiles can display rich content such as visual representations, textual information, audio, and animations. This type of content may contribute with both cognitive and affective aspects of learning, once they provide the same information through various ways which may also bring a sense of fun for learners, thus motivating them. Messages in the study had been sent at set times previously agreed between researchers and participants. The authors highlighted the strengths of the mobile push aspect, which encouraged regular study, and the fact that students could use their spare time to learn and review the activities on mobiles, as many times as they wanted.

In a study which analyzed the first unit of the four most popular mobile apps for English language learning, Paiva (2017) found out that all apps had insufficient oral comprehension practice in terms of variety, being the activities mainly dictation style, such as listening and writing. *Duolingo* offered exercises of sentences recording, so once the user gets the recording correctly pronounced, the translation of the sentence is given by the app. However, the author reported to have committed pronunciation errors on purpose which were not identified by the app, demonstrating the limitation of this feature. Paiva (2017) also concluded that one of the limitations of the apps was the use of synthesized voice, such as found in *Duolingo*, which made intonation sound artificial. As previously stated, scholars have recognized this as a major challenge in digital materials for pronunciation instruction (HINKS, 2015).

A study regarding the implementation of mobile apps for English language learning in an undergraduate program in Brazil was carried out by Campos and Freitas (2016). They analyzed the ASR feature of the app *Babbel*, affirming that it could help overcome problems such as shortage of opportunities for practicing speaking English with peers in language classroom context, and immediate feedback. One of the limitations cited by the authors, however, is that in case of mistakes, the feature is not able to tell the student what the mistake is, or what should be done in order to correct it, which may be frustrating for learners.

In investigating apps developed for English speaking, Guo (2014) found out that concerning their content and pedagogic features, twenty-three out of the thirty-four apps analyzed had a pronunciation category. The main pronunciation goal of such apps was for learners to practice English words or phrases, focusing on accuracy. Learners listen to a model pronunciation and record their voices in order to compare and see how accurate they are. When equipped with ASR, the apps may give feedback as *right* or *wrong,* or even provide scores of learner's pronunciation performance. In the study, interviews revealed that participants used the apps at different times of the day and different places (during the commute or break, at home), for a period of up to twenty minutes each time, one of the features in MALL materials previously discussed in this chapter (CHINNERY, 2006 STOCKWELL; HUBBARD, 2013). Participants also reported to have enjoyed the experience of using the apps for a week time and pointed out several strengths such as the possibility of choosing when and where to use the app. As for the limitations cited by participants are the

quality of the ASR feature, which sometimes did not recognize user's speech, and the lack of interaction among users.

Regarding pronunciation apps, Gonzalez (2012) investigated if best-selling apps for pronunciation on App Store[18] could assist learners to improve English pronunciation autonomously. He identified that the apps had potential to teach sounds however, apps still had limitations regarding the teaching of prosodic elements and the type of feedback provided, which did not inform the users what to do in order to repair the mistake. The author affirmed that such limitations could be easily overcome with the advancement of technology.

In spite of research concerned with the development of speaking and mobile technology being in its early stage if compared with other areas of language, the studies reviewed in this section have contributed to ensuring that mobile technology have promising features for the development of L2 pronunciation. The use of mobiles and pronunciation apps has been reported to be positive regarding cognitive and emotional aspects of learning among different groups of learners. These features have the potential to develop learners' speaking and pronunciation, as well as to promote more opportunities for practice, increasing students' motivation and decreasing anxiety which may be related to speaking in an L2.

Yet, to the best of my knowledge, no studies have analyzed the content, pronunciation teaching method, and the features and usability resources incorporated by the apps to promote pronunciation development, which is the objective of this study.

2.5 SUMMARY OF THE CHAPTER

Firstly, Chapter 2 discussed the development of L2 speaking competence (section 2.1), highlighting the importance to teach all components composing the model, that is, *knowledge of the target language, core speaking skills*, and *communication strategies* (GOH; BURNS, 2012). After that, it focused on the core skill of pronunciation (section 2.2), which is the primary concern of this research, discussing the different roles it had throughout language teaching methods, what has been agreed to be the goal of pronunciation teaching nowadays,

[18] The App Store is a digital distribution platform, developed and maintained by Apple Inc., for mobile apps on its iOS operating system.

and current issues concerning its practice (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001; SILVEIRA et al., 2017).

Digital technology and L2 learning (section 2.3), and more specifically apps for L2 pronunciation development were discussed (section 2.3.1), highlighting how the features embedded in apps may contribute to promote pronunciation development. The chapter also presented research studies which investigated the use of mobile and apps in order to promote L2 speaking and pronunciation (section 2.4).

Next chapter, Method, aims at describing the characteristics of this study, the procedures for developing the framework used in the analysis of the apps, the selection of the pronunciation apps, and the procedures for data collection and analysis.

3 METHOD

In this chapter the methodological decisions made in order to carry out the research are explained. Thus, it starts by characterizing the research (section 3.1) and explaining the development of the framework for analyzing the apps (section 3.2). Following this, the procedure adopted to select the apps, criteria for inclusion and exclusion (section 3.3), and the process of data collection and data analysis are explained (section 3.4).

3.1 CHARACTERIZATION OF THE RESEARCH

The focus of this study was to investigate the content (section 2.2), pronunciation teaching method (section 2.2), as well as the features and usability resources (section 2.3.1) incorporated by four pronunciation apps.

This study can be considered exploratory since it consisted in examining an issue that has not been thoroughly investigated yet (DORNYEI, 2007; GIL, 2009). Moreover, research involving digital technology tends to always be exploratory due to the constant evolving characteristics of technological resources and devices (SALBEGO, 2019). It can also be considered a descriptive research, as it has the purpose of describing a phenomenon, correlating the facts without the influence of the researcher (GIL, 2009).

In order to guide the analysis proposed by this research, that is, to understand the content, pronunciation teaching method, and the features and usability resources incorporated by the apps to promote pronunciation development, a framework was developed by this researcher. Then, data was collected and analyzed quantitatively and qualitatively by using the same framework. The process of developing this framework for analysis is explained in the following section.

3.2 DEVELOPMENT OF THE FRAMEWORK

As previously mentioned, a framework was developed by this researcher with the purpose of analyzing the content, pronunciation teaching method, and features and usability incorporated by four pronunciation apps to promote pronunciation development. The framework was based on literature regarding the teaching of pronunciation and MALL (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; CHINNERY, 2006; GARRET, 2011; KELLY, 2001; KRUG, 2008; KUKULSKA-HULME; SHIELD, 2008; MAYER, 2009; SILVEIRA et al., 2017; STOCKWELL, 2013; STOCKWELL; HUBBARD, 2013), and it is divided into three categories, namely: 1) Content; 2) Pronunciation teaching method; 3) Features and usability. Each of these categories will be now explained with more details.

Content was developed taking into consideration the English segmental and suprasegmental features of pronunciation which must be included during a course (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001) in order to develop intelligible pronunciation. Regarding the segments, they are also expected to be presented in contrast[19] and in different positions within words[20].

Pronunciation teaching method is related to the five steps of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010). The description and analysis of each pronunciation feature may occur through a variety of ways such as textual, visual, and aural information. The use of phonetic transcription is also considered

[19] According to Celce-Murcia, Brinton, and Goodwin (2010), even though sounds can be presented individually, they are often taught in contrast, as in minimal-pair activities. It is important for the teacher to be aware of which individual sounds and sound contrasts may cause difficulty for specific groups of learners.

[20] Some sounds may have different characteristics regarding their position.

depending on the group of learners, as it may allow them to comprehend the elements of pronunciation visually and aurally and to promote learners' autonomy (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015). Besides this, it is also necessary to provide learners with opportunities of listening discrimination, controlled, guided, and communicative practice (CELCE-MURCIA; BRINTON; GOODWIN, 2010) of each feature of pronunciation.

As feedback is required in every step of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), the framework developed by this researcher to analyse the apps also includes items which enable understanding how feedback is provided to the user[21]. The items under the categories Content and Pronunciation teaching method are detailed below:

1. Content

1.1 Does the app work with the consonant system and consonant contrasts?

1.2 Does the app work with positional variation (initial, medial, and final stops; flap; syllabic consonants; clusters)?

1.3 Does the app work with vowel system and vowel contrasts?

1.4 Does the app work with positional variation (vowel length; r + l coloring; nasalization; vowel reduction)?

1.5 Does the app work with connected speech (C to V and V to V linking; consonant assimilation; palatalization)?

1.6 Does the app work with levels of stress within a word and hierarchy of stress within an utterance?

1.7 Does the app work with prominence (new or important information/special emphasis/contrast)?

1.8 Does the app work with the relationship between intonation and meaning?

2. Pronunciation teaching method

[21] Even though feedback may be considered a feature of MALL materials and therefore it could be included in the third category of the framework developed by this researcher (Features and usability), it was decided to include it in the category of Pronunciation teaching method, as feedback is also considered essential in every step of the framework for teaching pronunciation proposed by Celce-Murcia, Brinton, and Goodwin (2010).

2.1 Does the app present phonetic transcription?

2.2 Does the app present description and analysis[22] of segmental features?

2.3 Does the app present description and analysis of connected speech?

2.4 Does the app present description and analysis of word and sentence stress?

2.5 Does the app present description and analysis of prominence?

2.6 Does the app present description and analysis intonation and meaning?

2.7 Does the app provide listening discrimination of segmental features?

2.8 Does the app provide listening discrimination of connected speech?

2.9 Does the app provide listening discrimination of word and sentence stress?

2.10 Does the app provide listening discrimination of prominence?

2.11 Does the app provide listening discrimination of intonation?

2.12 Does the app provide controlled practice of segmental features?

2.13 Does the app provide controlled practice of connected speech?

2.14 Does the app provide controlled practice of word and sentence stress?

2.15 Does the app provide controlled practice of prominence?

2.16 Does the app provide controlled practice of intonation?

2.17 Does the app provide guided practice of segmental features?

2.18 Does the app provide guided practice of connected speech?

2.19 Does the app provide guided practice of word and sentence stress?

2.20 Does the app provide guided practice of prominence?

2.21 Does the app provide guided practice of intonation?

2.22 Does the app provide communicative practice of segmental features?

2.23 Does the app provide communicative practice of connected speech?

2.24 Does the app provide communicative practice of word and sentence stress?

2.25 Does the app provide communicative practice of prominence?

2.26 Does the app provide communicative practice of intonation?

2.27 Is the app equipped with ASR in order to provide feedback (score, rewards, % of correct answers, right/wrong)?

2.28 Does the ASR recognize different language varieties?

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[22] Regarding consonants, description and analysis may include information about voicing, place of articulation, manner of articulation, and distribution within the syllable. With respect to vowels, it may include information about height, frontness/backness, tenseness, and duration (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

2.29 Does the ASR ignore noises?

2.30 In case of mispronunciation, does the ASR indicate the type of mispronunciation?

2.31 Does the app provide the learner with feedback on what to do in order to repair the mispronunciation?

The following and last category, Features and usability, is related to the area of MALL and is concerned with the features and usability resources incorporated by the apps in order to promote pronunciation development (CHINNERY, 2006; GARRET, 2011; KRUG, 2008; KUKULSKA-HULME; SHIELD, 2008; MAYER, 2009; STOCKWELL, 2013; STOCKWELL; HUBBARD, 2013). Therefore, it seeks to analyse whether features such as variety of input, selection of user's L1 and level of difficulty are embedded in the pronunciation apps analyzed, as well as their usability. All items under this category are presented below:

3. Features and usability

3.1 Does the app provide variety of input (different accents, male/female voices)?

3.2 Does the app ask for the users' L1?

3.3 Does the app provide a test in order to identify users' level or main difficulties?

3.4 Can the user select the level of difficulty?

3.5 Does the app make use of illustrations, pictures, and videos at any stage?

3.6 Is the media used relevant to what is proposed?

3.7 Does the media have good quality?

3.8 Does the voice sound natural?

3.9 Does the app have push feature?

3.10 Is all the app available offline?

3.11 Is the length of each lesson within the recommended time for MALL materials?

3.12 Is the quantity of information per screen balanced?

3.13 Is the information per screen well hierarchized?

3.14 Does the app have a good use flow, presenting clear icons and directions for the user?

In sum, the framework developed to analyze the four pronunciation apps includes the pronunciation features to be taught (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001), and the steps expected to be taken in order to teach such features. The steps are: description and analysis, listening discrimination, controlled practice, guided practice, and communicative practice, as well as feedback (CELCE-MURCIA; BRINTON; GOODWIN, 2010). These items are based on pronunciation teaching literature discussed on 2.2 of this study and are included in categories 1 and 2 - Content and Pronunciation teaching method - of the framework developed by the researcher.

Similarly, items related to MALL and usability (CHINNERY, 2006; GARRET, 2011; KRUG, 2008; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL, 2013; STOCKWELL; HUBBARD, 2013) were included in category 3 - Features and usability -, and aim at investigating what features of MALL and usability resources are incorporated by the apps to promote pronunciation development.

With this in mind, it was expected to better understand the content, pronunciation teaching method, and features and usability of the four apps analyzed in this study.

3.3 SELECTION OF THE APPS

According to Goh and Burns (2012) activities must be applied focused on specific knowledge, skills, and strategies to be developed. That was the reason for choosing apps focused specifically on the core skill of pronunciation.

Initially, a search was carried out on App Store and Google Play[23], which are currently the two most popular app stores, with the following key-words: *English pronunciation, learn pronunciation, and English accent.* A total of two hundred fifty apps were found.

Among all apps found in the search, the ones which fell under the categories below were excluded:

- Reference apps - dictionaries and translators;
- Apps which have not been designed specifically for pronunciation instruction;

[23] Google Play is a digital distribution platform operated and developed by Google Inc.. It serves as the official app store for the Android operating system.

- Apps which present only the International Phonetic Alphabet (IPA);
- Apps which have been developed for learners of a specific L1;
- Apps which presented problems after being downloaded and installed;

Four[24] apps remained and were selected to be analyzed, namely: *English Pronunciation Tutor, Elsa, EnglishPronunciation*, and *Juna*. All of them have been developed for pronunciation instruction and are either free or freemium apps, that is, they have either some of its content available for free, being necessary to pay in order to have access to all the content; or they provide free access to all the content for a period of free trial, which is usually a week time, requiring the user to pay in order to have access to any of its content after the end of the free trial.

The apps were downloaded and installed in the researcher's mobile phone. Considering this research proposed to analyze all features available in the apps, the researcher purchased them when necessary, in order to have full access to their available content. Finally, it is important to mention that all data was collected from the apps in the period between May and October, 2019.

3.4 DATA COLLECTION AND DATA ANALYSIS

By using the framework which was developed by the researcher and earlier presented and explained in this chapter, the researcher explored all content available in each of the four apps, and each item in the framework received a score of 0 (when the app did not present the item) or 1 (when it presented the item)[25]. This way, the score obtained by each app in the three categories (Content, Pronunciation teaching method, and Usability and features) was analyzed and translated into graphs, allowing the reader to visualize the performance of every app in each of these categories.

The researcher also took notes and screenshots as evidence regarding each of the items in the three categories of the framework: Content, Pronunciation teaching method, and Features and usability, in order to carry out the qualitative analysis. This way, it was possible

[24] As it was expected to provide a detailed analysis of each app, it was decided to analyze a small number of them.
[25] The framework with the score for each of the apps is found in Appendix 1.

to deeply understand how the pronunciation features were included in the apps, the sources for presentation and practice for such features, if and how the apps provided feedback, and the features and usability resources incorporated by them.

3.5 SUMMARY OF THE CHAPTER

In this chapter, the methodological decisions made in order to carry out the research were explained. It presented the characterization of the study (section 3.1), the development of the framework which was used to analyze the apps (section 3.2), the selection of the apps (section 3.3), and the process of data collection and data analysis (section 3.4). Next chapter, Analysis, brings the individual analysis of the apps, as well as a general discussion regarding such findings.

4 ANALYSIS

This chapter brings the analysis of four pronunciation apps according to the framework developed by the researcher, presented in the previous chapter. Initially, a brief description of each app is given. Following this, the analysis discusses a) whether the content of each app includes the most relevant segmental and suprasegmental features of pronunciation, b) whether each app follows the five steps for teaching pronunciation, also providing feedback, and c) the features and usability resources incorporated by the apps to promote pronunciation development.

Finally, a summary regarding each individual analysis is presented along with graphs illustrating how much the given app scored in each of the categories: Content, Pronunciation teaching method, and Features and usability. The chapter ends with a general discussion regarding the findings.

4.1 *ENGLISH PRONUNCIATION TUTOR*

English Pronunciation Tutor was developed in 2017 by a community of teachers and students called *Language Arts Press*, and is currently available for download on Google Play and the App Store. On its official website[26], it is described as including engaging tutorials and four types of interactive exercises to develop students' confidence and accuracy. According to M. Berman, Chief education officer of *Language Arts Press,* the app is "corpus based, which means that every example word, in addition to being chosen for its target phoneme and spelling variation of that phoneme, was also selected based on its frequency" (verbal information)[27].

4.1.1 Content

English Pronunciation Tutor is divided into ten units, namely: *The front vowels, The central vowels, The back vowels, Combination vowels, The schwa, Consonant stops, Consonant continuants, Grammatical endings, Word stress,* and *Sentence Stress*. Its content presents all the segments of the English language individually and in contrast, the positional variation of some sounds, and the suprasegmental features of stress in words and sentences.

In order to develop intelligible pronunciation, which should be the goal of pronunciation teaching (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017), the content must include the segmentals and suprasegmental features which are more relevant to meet the needs of specific groups of learners. As *English Pronunciation Tutor* focuses mainly on segmentals, the app does not provide balanced content regarding this matter and would assist learners to develop intelligibile pronunciation if it also presented other suprasegmental features, such as connected speech, prominence, and intonation.

[26] www.languageartspress.com
[27] Information provided by *English Pronunciation Tutor* chief education officer M. Berman, on May 26, 2019, by email.

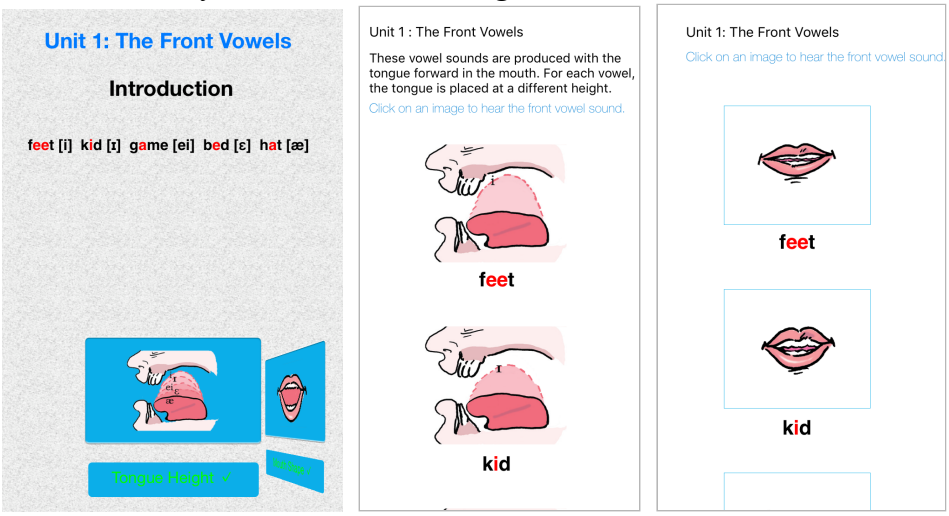
4.1.2 Pronunciation teaching method

In order to understand whether the app follows the five steps[28] of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), the units *The front vowels, Word Stress* and *Sentence Stress* are discussed with more details in this section.

All ten units available in *English Pronunciation Tutor* may present up to five sections, namely: *Introduction, Practice, Contrast, Listening Quiz,* and *Speech Recognition.* Once the user selects one of the units, for instance, there is an introduction section presenting all the sounds which follow under the category. In the case of first unit, *The Front vowels,* the sounds are: /ɪ/, /i/, /eɪ/, /ɛ/, /æ/, which are also presented next to a word containing them, in this case: kid, feet, game, bed, and hat. The description and analysis of the vowel sounds include information regarding tongue height and mouth shape. By selecting the option *Tongue height*, the user finds a written text which is narrated and supported by illustrations, explaining how the tongue must be positioned in order to produce each sound. By selecting *Mouth shape*, the user is able to click and listen to each sound, supported by illustrations containing the corresponding mouth shape. In the case of consonant sounds, the description and analysis include information regarding the air flow and the vibration of the vocal cords, also supported by aural and written information, and illustrations. This introductory lesson of the units in *English Pronunciation Tutor* is illustrated below, on Figures 2, 3 and 4.

[28] The five steps for teaching pronunciation proposed by Celce-Murcia, Brinton, and Goodwin (2010) are discussed on section 2.2. of this study. They include description and analysis, listening discrimination, controlled practice, guided practice, and communicative practice.

Figures 2, 3 and 4 - The front vowels. These figures illustrate the introductory lesson of *The front vowels* unit in *English Pronunciation Tutor.*

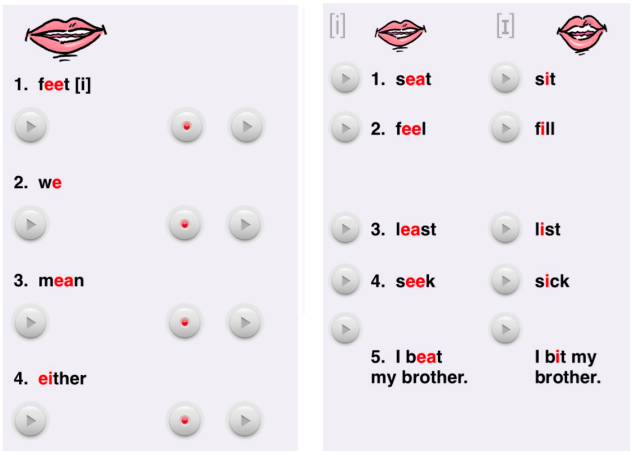


Source: *English Pronunciation Tutor*

As *The schwa* is the only unit of vowel sounds in which the introduction calls attention to positional variation (being the sound usually shorter at the beginning and end of words), the unit offers a more complete description and analysis of this sound. As for the consonants, the introduction of *Consonant stops* also presents the difference of aspiration between initial voiced and voiceless stops (pace - base, for instance) and the difference of vowel length before voiced and voiceless stops (lap - lab, for instance).

In addition to the introductory lesson that provides description and analysis regarding all the sounds within the group, all units concerned with sounds present four sections to work with each of the sounds within the category individually through *Practice, Contrasts, Listening quiz*, and *Speech Recognition*. In *Practice*, the user listens to five different words and one sentence containing the targeted sound, being able to record and compare both audios. As self-feedback, this is an opportunity for the learner to self monitor his/her production. In *Contrast*, the app presents different words and one sentence containing the targeted phoneme next to a minimal-pair where the user is able to listen to both and compare. *Contrast* does not allow the user to record his/her own production, therefore being only a way of raising awareness of the different sounds. Figures 5 and 6 illustrate *Practice* and *Contrast* of /i/ in *The Front Vowels* unit:

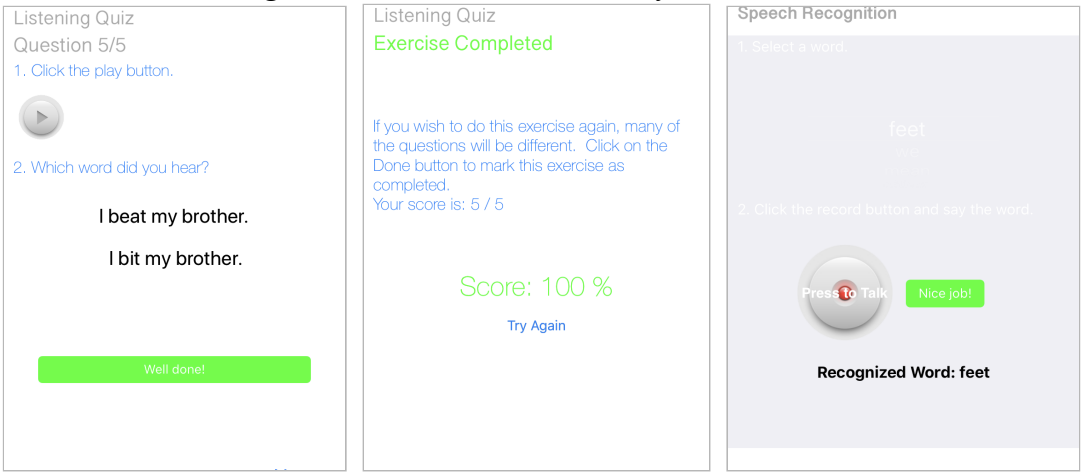
Figures 5 and 6 - The front vowels II. These figures illustrate *Practice* and *Contrast* of /i/ in *The front vowels* unit.



Source: *English Pronunciation Tutor*

For *Listening quiz*, the user listens to different pairs of words and one sentence containing that sound and clicks on the corresponding word, receiving feedback from the app. In *Speech Recognition*, the app presents different words containing the targeted sound, where the user practices production in order to get feedback. From all the lessons in the ten units, *Speech Recognition* is the only one which does not present the targeted sounds beyond word level. Also, *The schwa* is the only unit of vowel sounds which brings *Practice* and *Speech Recognition*, missing *Contrasts* and *Listening quiz*. The explanation for this may be due to the fact that this sound does not have minimal-pairs in English. Figures 7, 8, and 9 below illustrate *Listening quiz* and *Speech Recognition* for the /i/ sound in *The front vowels* unit, along with feedback:

Figure 7, 8, and 9 - The front vowels III. These figures illustrate *Listening quiz* and *Speech Recognition* of the /i/ sound, in *The front vowels* unit.



Source: *English Pronunciation Tutor*

English Pronunciation Tutor does not present a chart with the whole phonetic alphabet. However, the lessons of all units have the phonetic transcription of the specific sound which is being presented, as well as the ones which are put in contrast to them. As it has been discussed, the use of phonetic symbols is considered of great help for teaching and learning pronunciation, as it not only allows pronunciation to be visualized, but also contributes for learners to become more autonomous in their learning (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015). As any other pronunciation feature, the decision of whether using phonetic alphabet or not should be based on specific groups of learners taking into account their level, difficulties, and pronunciation goals (CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA, 2004). By presenting the phonetic symbols of the targeted sounds in every lesson, *English Pronunciation Tutor* gives teachers and learners the opportunity to work with the symbols, if it is relevant for them.

As aforementioned, the only suprasegmental features covered by *English Pronunciation Tutor* are present in the units *Word stress* and *Sentence stress*. As all other lessons in the app, *Word stress* and *Sentence stress* lessons offer the introductory section, with a written text which is also narrated, explaining the levels of stress within words and sentences and their importance for carrying meaning. Besides the introduction, the *Word Stress* unit is divided into *Compound nouns, Numbers, Two syllable nouns and verbs,* and *Reflexive pronouns,* all of them with different number of sections. Whereas *Compound nouns* and *Reflexive pronouns* only have *Practice*; *Two syllable nouns and verbs* have *Practice* and

Listening quiz; and *Numbers* have *Practice, Listening quiz* and *Speech recognition.* It is not clear why the app offers unbalanced sections for each of them, however. Regarding *Sentence Stress,* the only section besides the introductory one is *Practice,* which brings examples of sentences where the stressed words are highlighted, accompanied by their audio. The user then, like in all sounds and word stress lessons, is able to listen to the recording, record his/her own production, and compare both.

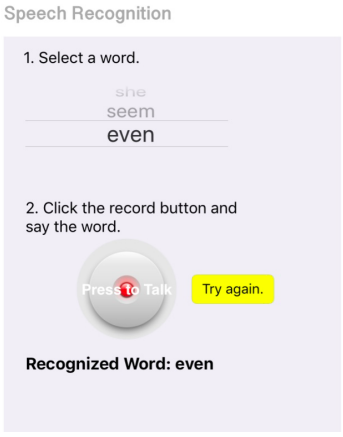
Hence, the app offers description and analysis of all English language sounds and the suprasegmental features of word and sentence stress, covering the first step of the framework for teaching pronunciation proposed by Celce-Murcia, Brinton, and Goodwin (2010). This is done through the use of written text, narration, and illustrations, as it has been previously described and illustrated. Listening discrimination is also available in all the lessons, as listening activities are available to raise awareness and check comprehension of the given features. As the users of *English Pronunciation Tutor* have the possibility to record the words and sentences they read aloud in *Practice* and *Speech Recognition,* they are also enabled to have controlled practice of the features of pronunciation. However, the app does not provide opportunities for guided and communicative practice of pronunciation, as that would require practice with activities focused on meaning and exchange of information, such as cued dialogues, simple information-gap exercises, sequencing tasks such as strip stories, interviews, storytelling, and debate.

Feedback, which is considered by Celce-Murcia, Brinton, and Goodwin (2010) to be essential at every stage of the framework, is available for the *Listening Quiz* and *Speech Recognition*. In *Practice* the user gives him/herself feedback by comparing both recordings, and in *Contrasts* no feedback is provided. In *Listening Quiz* and *Speech Recognition* feedback is provided with motivational commands such as "Try again" when the user is incorrect, and with compliments such as "Good Job", "Nice Work", and "Excellent", when production is considered correct.

Varieties which deviate from the native norm are not identified by the ASR feature in *Speech Recognition*. This could be a limitation for users who are aiming to achieve intelligibile pronunciation rather than a native speaker's accent, and that may not be understood by the ASR. Feedback is given with the written form of the word identified by the app, either correct or incorrectly, and with the same motivational sentences of *Listening quiz,*

aforementioned. In case of a mistake, however, the app is not able to tell the user what to do in order to improve, as it has been suggested by researchers (GONZALEZ, 2012). It has also been noticed that the ASR has limitations, such as identifying the production of the user correctly but giving negative feedback, as can be seen below, on Figure 10:

Figure 10 - ASR in *English Pronunciation Tutor*. This figure illustrates one of the limitations of the ASR feature.



Source: *English Pronunciation Tutor*

4.1.3 Incorporating features and usability

The variety of input provided in *English Pronunciation Tutor* is quite limited. Even though it has male (1) and female voices (2), which sound natural and may convey a sense of social presence, they are only available in North American English. The app neither asks for users' L1 in order to identify possible cross-linguistic influences, nor provides a test with the purpose to identify user's main difficulties in English, so that he/she would know what units to prioritize. One more limitation is that it is not possible to select the level of difficulty, meaning that all users - beginners to advanced - go through the same lessons. These features, if embedded in the app, would make it possible for users to focus their attention on issues that would genuinely assist them to develop their pronunciation and, consequently, improve their communication skills.

The illustrations present in the app are supportive for the users to understand how the organs articulate and what the mouth should look like for producing the sounds, and to have examples of words in English containing them. This may have advantages compared to the

simple audio files in traditional classroom context, contributing to develop learners' autonomy and motivation. In spite of this, some choices of illustrations may lead to confusion, such as the one which illustrates the intro lesson of simple past -ed endings in the *Grammatical Endings* unit, which has the illustration of the back of an animal, as it can be seen below:

Figure 11 - Grammatical endings. This figure shows the illustration chosen for the intro lesson of *Grammatical Endings* unit.

Source: *English Pronunciation Tutor*

The app does not have the push feature, one feature of MALL materials (CHINNERY, 2006; STOCKWELL; HUBBARD, 2013) which sends notifications for the user in order to remind him/her to take a lesson. This feature could encourage users to engage in language learning activities, helping them to develop their pronunciation on a daily basis, either at pre-set or random times. The app offers the first lesson - introductory one - of every unit for free, but in order to have full access to its content, the user is charged. When offline, all content is available except for *Speech Recognition*, which makes the app especially relevant for students who do not have full access to internet , but have a mobile phone which can be used for improving L2 speaking, including pronunciation (BRINTON, 2018).

It is not possible to affirm that every lesson has the same duration, as some of them offer unbalanced amount of practice. However, each lesson takes an average of five minutes to be completed, being in agreement with the size format of the lessons in materials developed for MALL (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL; HUBBARD, 2013). This way, users are able to engage in activities for developing their English pronunciation without previously planning it - during a break, while commuting - or even in the classroom context, if required by the teacher.

English Pronunciation Tutor saves users progress and recordings for the *Practice* and *Listening Quiz,* enabling users to review what has already been done and also to reset and start all over again, contributing to develop their learning autonomy. The screen layout has an adequate amount of information, that is, the user is not likely to be confused with the amount of information and those are also well-hierarchized. The app also presents clear icons for selecting options, returning, and quitting, providing the good use flow expected to be found in apps (GARRET, 2011; KRUG, 2008), and which may encourage learners to use *English Pronunciation Tutor* to develop their English pronunciation.

4.1.4 Score and summary - English Pronunciation Tutor

English Pronunciation Tutor enables the user to practice all segments of English language, individually and in contrast, as well as to be aware of the differences resulted by the positional variation in some of them (*The Schwa* and *Consonant Stops)*. The only suprasegmental features covered by the app are word and sentence stress, however. For this reason, the app scored 63% under the category Content.

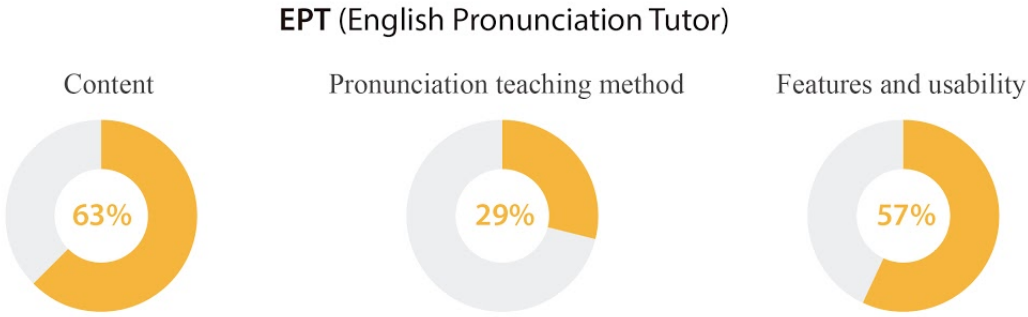
In what it concerns to the pronunciation teaching method adopted by the app, all units in *English Pronunciation Tutor* offer description and analysis of the features through varied ways, by using textual information, narration, and visual representations, being the description and analysis of *The Schwa* and *Consonant Stops* more complete, as they also explain the positional variation of the sounds under these categories. Listening discrimination is also present in all lessons, as users are able to raise awareness of the pronunciation features presented and in some lessons may also discriminate different sounds in *Listening Quiz.* Controlled practice of pronunciation is present in all lessons as well, through *Practice* and in some lessons through *Speech Recognition,* sections where users are able to record their production of words and sentences. Having said that, it is concluded the app does not go beyond the third step of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), as it focuses mainly on accuracy and does not provide guided or communicative practice of the pronunciation features. Even though feedback is provided by the ASR feature, it has limitations, such as not recognizing varieties which deviate from

the native form, or ignoring external noises. Hence, the app scored 29% in pronunciation teaching method category, as illustrated by the graph presented in the end of this section.

English Pronunciation Tutor scored 57% in the third category, named Features and usability. Some features incorporated by the app to promote pronunciation development are, for instance, the use of illustrations in order to explain the articulation of the organs and to illustrate words containing the targeted sounds. Some variety of input is provided by the app, and its lessons are within the time recommended for MALL materials. In what concerns the usability of the app, its quantity of information per screen is balanced and well hierarchized, and the app presents clear icons and directions for the user, who should be able to navigate through it without effort.

The score obtained by *English Pronunciation Tutor* for the categories of Content, Pronunciation teaching method, and Features and usability is illustrated in the Graphs 1, 2, and 3, below:

Graphs 1, 2, and 3 - *English Pronunciation Tutor* score.



Data generated by this researcher

4.2 *ELSA*

Elsa was developed by Elsa Corp, a startup founded in San Francisco, USA, and is available on the App Store and Google Play. On its official website[29] it is defined as "the world's best English pronunciation app", where users can learn English with short fun dialogues getting instant feedback from artificial intelligence technology.

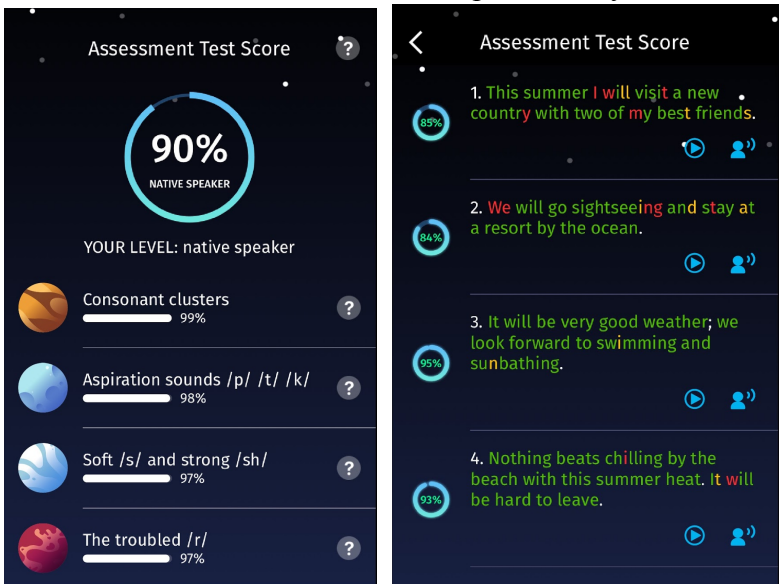
[29] www.elsaspeak.com

According to its developers, the mission of the app is to enable everyone to speak foreign languages fluently and with full confidence, helping to reach a better life and career opportunities. Elsa is divided into what is called 13 different *skills* which sum up over 1200 lessons covering 42 different topics, such as education, business, food and drinks, and travel. The app is often updated, having new content released every two weeks, with about 10-15 new lessons per release, across multiple topics.

4.2.1 Content

Once the app has been downloaded, *Elsa* asks for the user's L1 and invites him/her to take the *Assessment Test Score*, in order to find out the main difficulties and identify what the user needs to learn. The test consists of 13 sentences the user must read aloud and record. After recording the sentences, the app provides the score through percentage (0%-100% native speaker), and the user is able to check the feedback of his/her recording, where all sounds assessed are highlighted in green, yellow, and red. Figures 12 and 13 below illustrate the *Assessment Test Score* and feedback provided by the app:

Figures 12 and 13 - *Assessment Test Score.* These figures illustrate the *Assessment Test Score* available in *Elsa* and the feedback provided by it.



Source: *Elsa*

After the assessment test, the app directs the user to start practicing the 13 *skills* available, which are named: *consonant cluster; /p/, /t/, /k/; /s/, /sh/, /z/; the /r/ sound; the dreaded TH; ending sounds; /ʃ/, /ʒ/, /tʃ/, /dʒ/; /w/, /v/, /b/; Schwa sound; Short and long /i/; /l/, /r/; mixed skills;* and *welcome.* Every *skill* has lessons targeting the specific sounds aforementioned, covering words, phrases, sentences, and sometimes short dialogues, containing them.

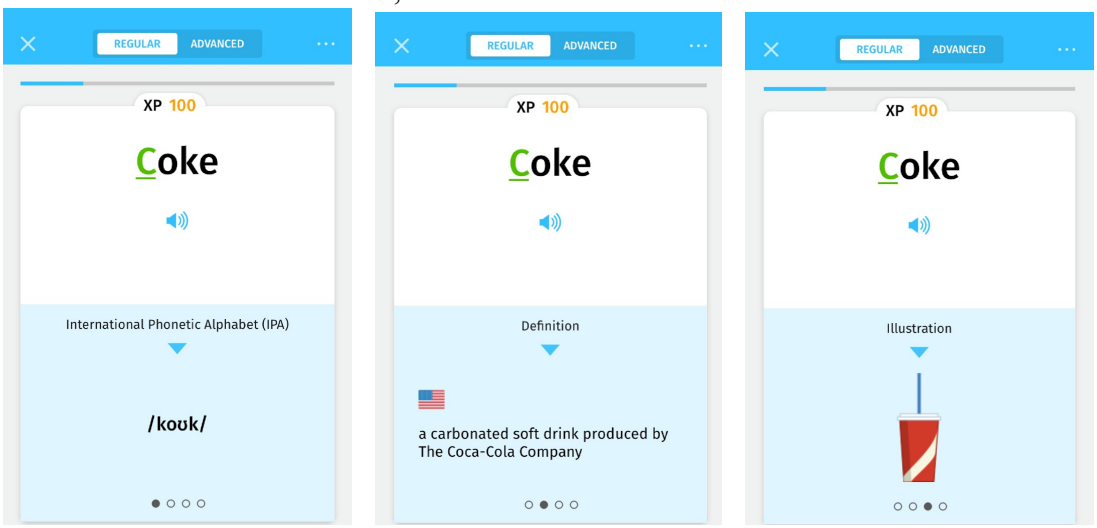
The lessons in *Elsa* enable the user to practice the segmental features individually and in contrast, their positional variation within words (initial, medial, final stops, clusters, vowel length, r + l coloring, vowel reduction) and the suprasegmental features of word stress, sentence stress, connected speech, prominence, and intonation, where the user is able to listen, record, and get feedback from the app.

Considering that in order to reach intelligible pronunciation, which should the goal of pronunciation instruction (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017), it is necessary to practice the most relevant segmental and suprasegmental features of pronunciation, *Elsa* could be considered an effective resource to assist users, given that its content covers all of these features.

4.2.2 Pronunciation teaching method

Once one of the 13 *skills* of the app has been selected, the user is presented with lessons containing words, phrases, and sentences, containing the targeted sounds included in that *skill.* Besides the written and audio form of words, phrases, and sentences, their presentation may also include the phonetic transcription, meaning, example in a sentence, and sometimes, illustrations and video tutorials on how to produce them. This variety of presentations, which is one of the features of pronunciation instruction digital materials (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015) is illustrated by the figures below:

Figures 14, 15, and 16 - Presentation in *Elsa*. The figures illustrate how the app *Elsa* provides description and analysis of words by giving their phonetic transcription, definition, and illustration, besides its aural and written form.

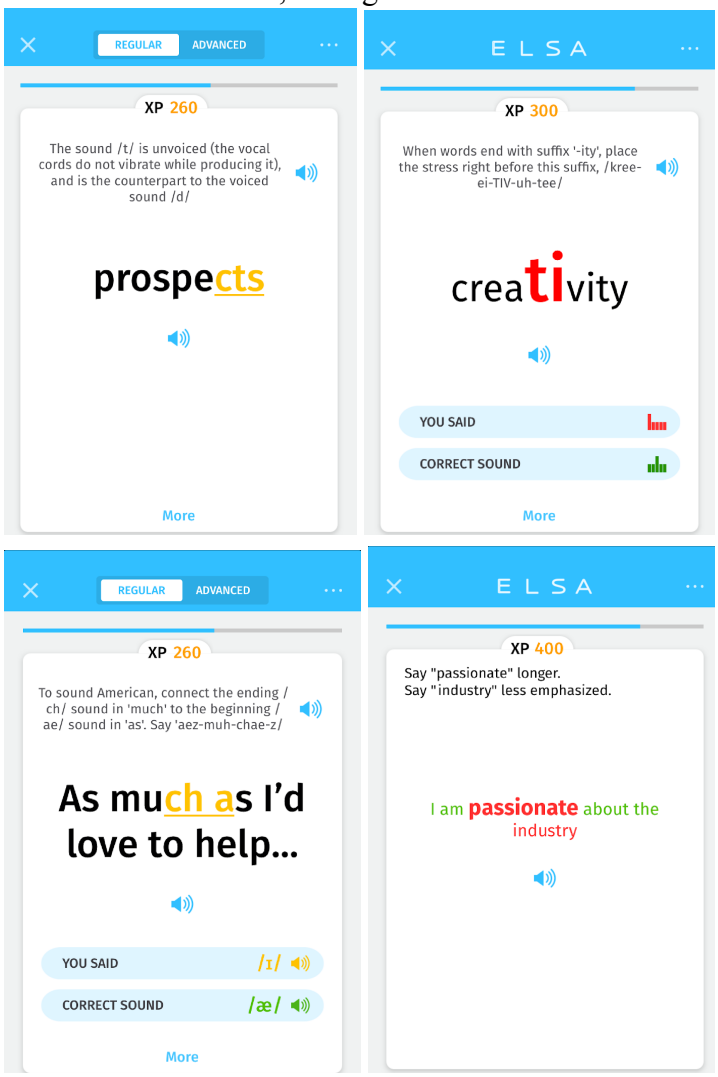


Source: *Elsa*

Even though the app does not provide any articulatory information of the targeted sounds in the first place, this information is provided after user's practice, along with feedback. Depending on the difficulty the user may have regarding his/her production on segmentals, *Elsa* gives different directions on voicing, place of articulation, manner of articulation, height, frontness/backness, tenseness, and duration of the sound. For the suprasegmental features however, more detailed description and analysis is given for word stress, sentence stress, and linking. For the features of prominence and intonation, only commands are given to the user on how to improve his/her production, without explaining why. Therefore, the lack of explanation of such features may cause the learners to not understand why they received such commands along with the feedback, and why they should follow them in order to improve production.

Figures 17, 18, and 19 illustrate how *Elsa* provides description and analysis of the features of pronunciation through instructional feedback, according to the user's needs for segmental features, word stress, sentence stress, and linking. Figure 20 illustrates the commands provided in order to improve production on prominence and intonation, lacking explanation of such features:

Figures 17, 18, 19, and 20 - Presentation in *Elsa* II. The figures illustrate how the app *Elsa* provides description and analysis on how to produce segmentals and some suprasegmental features, through feedback.

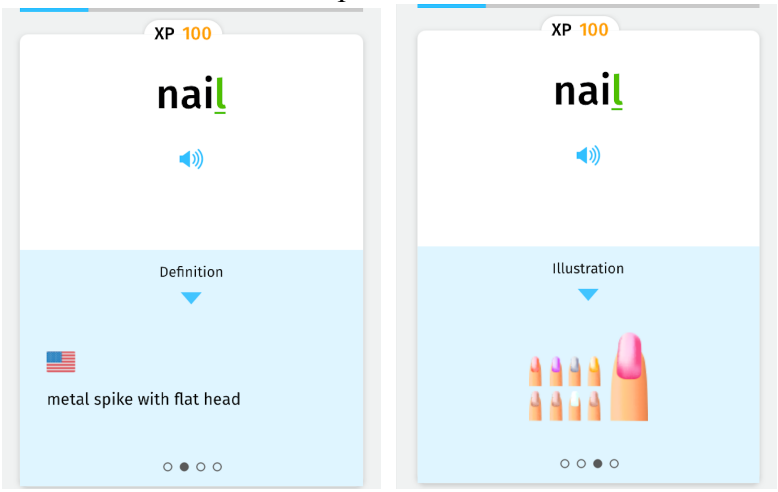


Source: *Elsa*

Therefore, it is possible to affirm that the first step for teaching pronunciation suggested by Celce-Murcia, Brinton, and Goodwin (2010), which is description and analysis, is available for all segments, word and sentence stress, and linking. There is no explanation on the features of intonation and prominence, despite the practice enabled by the app. One more limitation which has been identified regarding description and analysis in some lessons is that sometimes, the definition given by the app for a specific word is not under the proposed topic. The lessons under the topic *Make up*, for instance, present words such as *nail* by giving a definition which is related to the topic of construction instead, as illustrated by

Figures 21 and 22. This can be confusing for learners, who sometimes may not be aware that the given word has two different meanings in English.

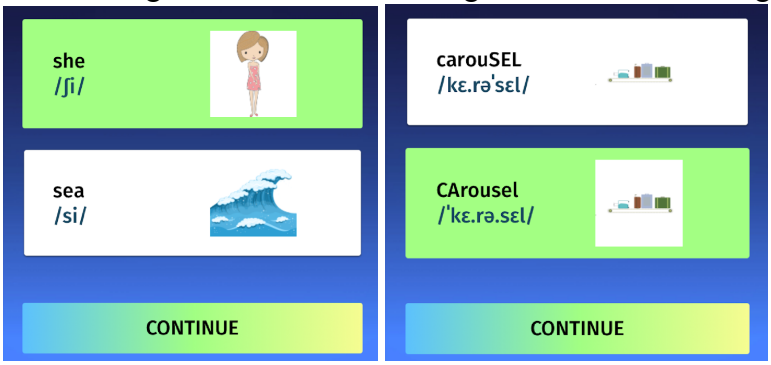
Figures 21 and 22 - Presentation in *Elsa* III. The figures illustrate how the app *Elsa* provides a definition which is not related to the topic of the lesson and/or to the illustration used.



Source: *Elsa*

The user is able to listen to the audio of every word, sentence, and short dialogue before recording and receiving feedback in *Elsa*. Thus, listening discrimination, which is the second step for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), is available through all the app, as users are able to raise awareness of the targeted pronunciation features. In addition to this, there are specific exercises in which the user listens to a word and then selects the correct minimal-pair shown on the screen, or the correct stress of the word, as evidenced in the figures below:

Figures 23 and 24 - Listening Practice in *Elsa*. The figures illustrate listening practice in *Elsa*.



Source: *Elsa*

For listening discrimination which focuses on word stress however, *Elsa* sometimes provides one of the two word options which does not exist in the English language, despite the fact that there are many words in the English language which have two different types of word stress. In this case, the user may be confused whether the incorrect option of the practice does not exist in the English language, or it is just not the correct answer for the exercise.

Controlled practice (CELCE-MURCIA; BRINTON; GOODWIN, 2010) is also present through all the app, as the user is able to record his own production of words, phrases, sentences, and short dialogues after listening to them. This practice aims not only on specific sounds, but also on word stress, sentence stress, linking, prominence, and intonation. In addition to this, there are short dialogues in which the user reads sentences aloud in order to talk to *Elsa* about a specific topic.

Having said that, it is possible to affirm that the app *Elsa* goes through the first three steps for teaching pronunciation suggested by Celce-Murcia, Brinton, and Goodwin (2010) in order to teach segmentals and suprasegmental features of pronunciation. It does not enable its users to practice guided and communicative practice of pronunciation, the other two steps for teaching pronunciation which are necessary to focus on fluency, which is said to be the focus of the app on its official website.

Elsa is equipped with ASR. However, the feature is not able to identify different language varieties, what could be a problem for learners who have intelligible pronunciation but are not understood by the app. Some of the limitations concerning ASR identified in *Elsa* are related to feedback for specific sounds such as /θ/, /ð/, /v/, /b/, /p/, which have been produced by the researcher but were not correctly identified by the app. This may have a negative impact on learners who may not be aware of the limitations of the ASR feature and may feel discouraged to engage in pronunciation activities due to a wrong feedback. On the other hand, the ASR feature of *Elsa* can ignore subtle noises there may be during practice, therefore contributing for learners to engage in pronunciation learning without previously planning, anytime and anywhere, as it is proposed by MALL (CHINNERY, 2006; STOCKWELL; HUBBARD, 2013). In addition to this, feedback provided by the app indicates the type of mispronunciation the user may have, and gives clear directions on what he/she should do in order to improve production, as recommended by scholars (GONZALEZ, 2012) and previously illustrated on Figures 17, 18, and 19.

The different types of feedback provided by *Elsa* include: scores from 0% to 100% native speaker, stars, phrases and sentences such as "nice try", "nice job", "you're a pro", and "excellent", as a way to motivate its users. As it has been illustrated by figures 12 and 19 however, *Elsa*'s feedback encourages its users to target native like pronunciation, which may be an unrealistic goal for most English learners (CELCE-MURCIA; BRINTON; GOODWIN, 2010), once it is incongruent with empirical evidence (SILVEIRA et al., 2017). For this reason, some learners may be frustrated by the feedback provided by the app, as well as by the target production it encourages them to reach.

In spite of some limitations, *Elsa* provides feedback for every practice throughout the app, and as previously mentioned, feedback is considered crucial for pronunciation teaching and learning (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

4.2.3 Incorporating features and usability

Regarding variety of input, *Elsa* does not provide phonological varieties other than North American English in the audios. On its official website, it is said that the app helps the user to speak English in a neutral and global American accent, without explaining what that means. Throughout all the lessons, which are over 1200, there are mainly two female voices; two male voices have been identified as well, however in just three short dialogue lessons. Even though the voices sound natural and convey a social presence to the user, the recordings do not offer the variety of input which is necessary to increase communicative flexibility and respect for accent diversity (CELCE-MURCIA; BRINTON; GOODWIN, 2010) over the 1200 lessons available in the app.

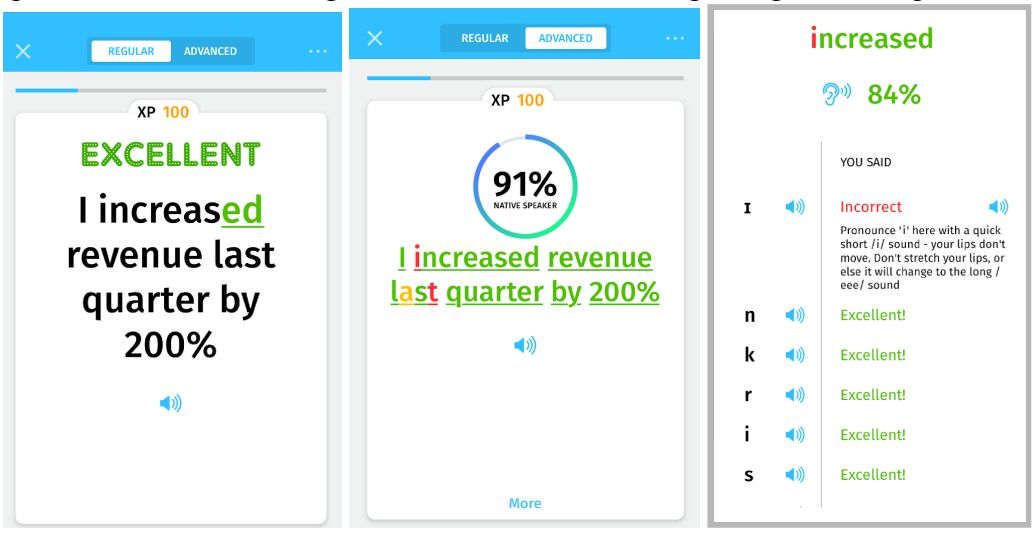
The app asks for the user's L1 when registering however, it is not clear why it does that. It is not clear if the lessons available under the 13 *skills* are selected taking into consideration the user's L1 and his/her *Assessment Test Score,* nor if the L1 information is somehow used in order to provide a more effective feedback for the user in case of mispronunciation. In addition to this, inside some *skills*, there are some lessons which focus on Vietnamese culture and provide translation of the dialogues into Vietnamese language, despite the selected L1 being Brazilian Portuguese. This may be somehow confusing for a

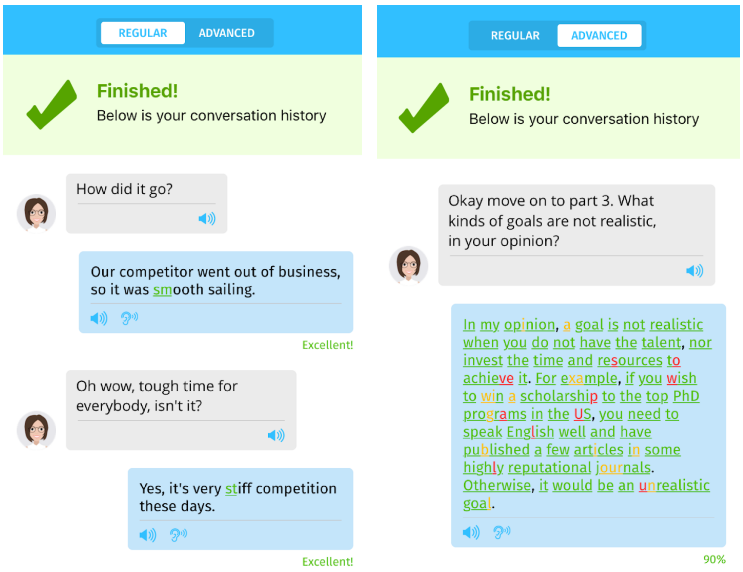
user whose L1 background is not Vietnamese and who did not select it as the L1 when registering the app.

As aforementioned, the *Assessment Test Score* enables the user to identify his/her main difficulties in English before starts using the app, as by the end of the test *Elsa* provides the score (0%-100% native speaker) and also a score at the end of each *skill* practice. This feature allows the user to check his/her progress under the specific pronunciation features he/she is more concerned about, contributing to develop learners' autonomy.

Users with different proficiency levels have the opportunity to choose between regular and advanced levels for practice. While the practice is the same for both levels, feedback differs. For regular users, it focuses only on specific sounds, and feedback for advanced users focuses on all sounds of the word, phrase, or sentence. This feature may overcome what is considered by Munro and Derwing (2015a) one of the biggest problems in the use of much currently available digital technology for L2 pronunciation instruction: the absence of priority-setting features, thus allowing users to focus on pronunciation features that seem more relevant to them.

Figures 25, 26, 27, 28, and 29 - Feedback in *Elsa*. The figures illustrate how the app *Elsa* provides feedback for regular and advanced users, regarding the same practice.





Source: *Elsa*

As illustrated in the figures above, the colors green and red demonstrate whether the targeted sounds have been produced properly or not by the user. However, the use of the yellow color, also illustrated in Figure 26 of the *Assessment Test Score,* is not clear. Therefore, it may be difficult for users to understand the feedback regarding this specific color, as there are no instructions on its website or app explaining its use.

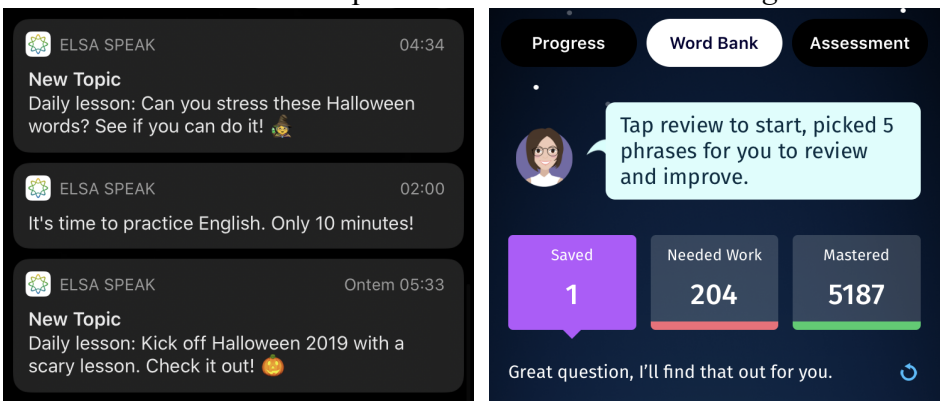
The illustrations and videos present in *Elsa* are relevant to illustrate words and show the articulation of the sounds, for instance. They can be confusing for learners, however, when they are used as a reference to a different meaning of the word which is not the focus of the lesson, as it has been previously mentioned in this chapter and illustrated by figures 21 and 22. As reported by Kukulska-Hulme et al. (2017) and Pires (2018b), a bad choice of illustrations may have a negative impact for learners, who may be confused by them.

An interesting feature of *Elsa* is its push feature. It encouraged the user to access the app daily and to take a minimum of five lessons, receiving messages such as "Don't give up!" and "Two more lessons to go", until the lessons are completed. The five daily lessons recommended by the push feature sum up an average of 10 minutes, depending on how much feedback the user may need, being in agreement with the duration of lessons in MALL materials (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL; HUBBARD, 2013) and allowing learners to engage in pronunciation activities in small amounts of time, anytime, anywhere, without previously planning it (CHINNERY, 2006;

KUKULSKA-HULME; SHIELD, 2008). Users may also edit this feature for more or less than the 10 minutes recommended by the app, thus offering them some control over the feature. Besides the push feature for daily practice, *Elsa* sends notifications inviting the user to learn pronunciation related to a specific topic which is trendy or related to a festive date coming soon, for instance, as illustrated by Figure 30.

In addition to this, the app has a section named *Progress*, where the user can save words he/she might want to review, a list of words which needed work, that is, the user needed feedback in order to improve pronunciation, and the list of words which have been mastered during the lessons, again, contributing to develop learners' autonomy.

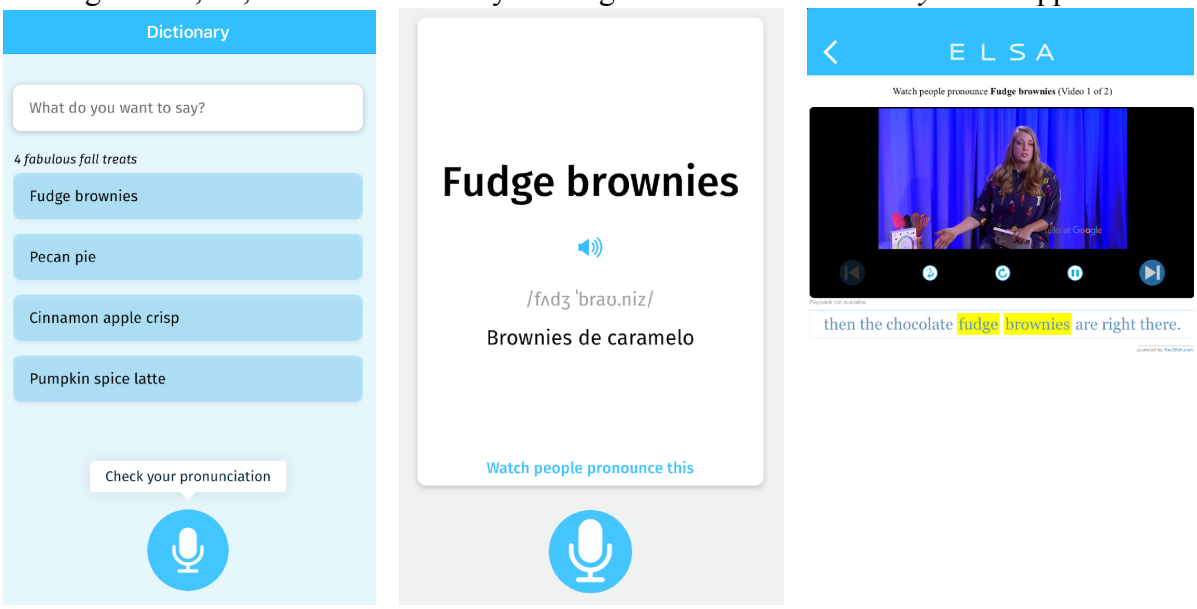
Figures 30 and 31 - Features. The figures illustrate some features of the app *Elsa,* such as the notifications of the push feature and the section *Progress.*



Source: *Elsa*

In the section *Dictionary*, the user is able to type a word in order to get its definition and access videos from *Youtube* in which the word has been used by several different speakers. Instead of the little variation of input offered by the studio recorded audio present in the lessons throughout the app, in *Dictionary* users may have access to the greater variety of input which is expected to be found in digital materials for pronunciation instruction.

Figures 32, 33, and 34 - Dictionary. The figures illustrate *Dictionary* in the app *Elsa.*



Source: *Elsa*

The *skill Welcome* of the app is available for free for a week as a free trial, and in order to have access to all 1200 lessons, the user can choose to pay a monthly or annual fee. This could be a limitation for many English learners, as well as the fact that *Elsa* is not available offline. Regarding its usability, the quantity of information per screen is balanced and well hierarchized throughout all lessons in *Elsa*. The app also presents clear icons for the users to select, start, and finish the activities, providing a good use flow and allowing users to profit from the app.

4.2.4 Score and summary - Elsa

The content available in Elsa includes all segmental and suprasegmental features expected to be included in pedagogical resources for pronunciation instruction (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001), therefore, the app scored 100% in this category, as illustrated by the graph at the end of this section.

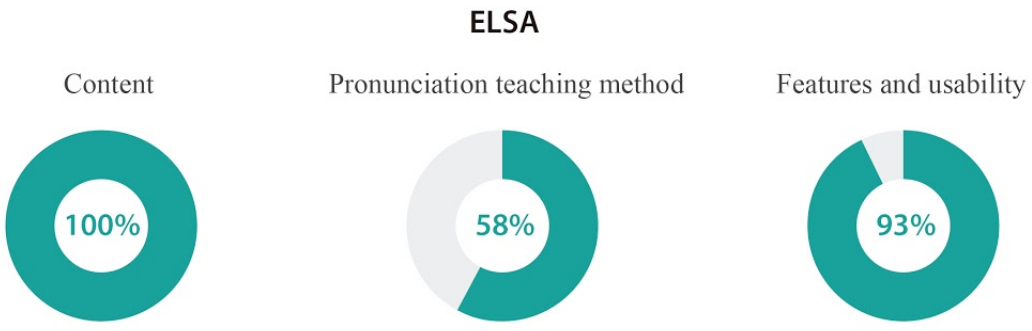
Regarding the pronunciation teaching method adopted by *Elsa,* the app provides the user with description and analysis related to the characteristics of all sounds, and the suprasegmental features of connected speech, word stress, and sentence stress. However, it lacks explanation regarding prominence and the relationship between intonation and meaning.

Listening discrimination and controlled practice are available for all features of pronunciation covered by the app, but *Elsa* does not provide its users with opportunities to practice guided or communicative practice of pronunciation. Despite the description on the official website that *Elsa* helps to develop learners' fluency, it has been concluded the activities available in the app do not enable that, as they focus only on accuracy. Feedback is available in *Elsa* and despite some limitations it can be effective, as it is able to ignore noises, to tell the users what the mispronunciation is and to provide them with guidance on what to do in order to improve production. For this reason, Elsa scored 58% in the category pronunciation teaching method.

In what concerns to the features and usability resources incorporated by the app, *Elsa* scored 93% in this category. The app provides some variety of input, asks for the users' L1, provides a proficiency test, and allows users to select the level of proficiency during the exercises. The presentation of pronunciation features is done through a variety of ways, such as with the illustrations, videos, and voices. In addition to this, *Elsa* is embedded with the push feature, and its lessons are within the recommended time for MALL materials. These features embedded by the app are relevant, as they contribute to avoid the called one-size-fits-all approach (DERWING; MUNRO; 2015) commonly found in pronunciation instruction digital materials. Thus, the app may be appealing for learners to use it in order to develop their English pronunciation, as it enables them to focus on specific goals and needs they may have.

Graphs 3, 4, and 5 illustrate how much *Elsa* scored in each of the categories analyzed:

Graphs 3, 4, and 5 - *Elsa* score



Data generated by this researcher

4.3 *ENGLISHPRONUNCIATION*

EnglishPronunciation was developed in 2017 by Yobimi Learning English, and it is available in Portuguese, Hindi, English, and Vietnamese languages. The app does not have an official website, but on Google Play and App Store it is described as an app which aims at assisting learners who may have difficulties or questions on how to pronounce English correctly or distinguish its sounds, providing lessons for learners of all levels, from basic to advanced.

4.3.1 Content

The lessons offered by *EnglishPronunciation* are divided into *Basic, Advanced*, and *Pronunciation tips*. Throughout all lessons, it is possible for the user to practice all segments of English language individually and in contrast, their positional variation (initial, medial, and final stops, flap, clusters, vowel length, r + l coloring, nasalization, vowel reduction), and suprasegmental features of connected speech, word and sentence stress, prominence, and intonation. Therefore, the app covers all features of pronunciation which are necessary to be practiced by learners in order to develop intelligible pronunciation, being in agreement with the goal of pronunciation instruction nowadays (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017).

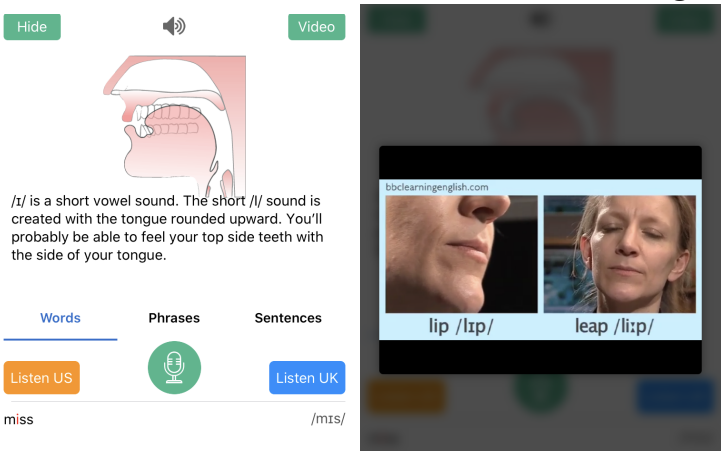
4.3.2 Pronunciation teaching method

Once the user selects *Basic, Advanced,* or *Pronunciation tips*, he/she is presented to the different segmental and suprasegmental features or tips which are available in the app. In *Basic*, the user finds a lesson for every individual sound and diphthong of the English language. In *Advanced*, there are lessons for linking, syllable stress, sentence stress, and intonation. In *Pronunciation tips*, the user is able to find lessons about silent letters, homophones, pronunciation of specific words (have, do, are), pronunciation of specific spelling (ough, o, wor, oo, se endings, al sound, unusual ed endings, ex sound, ng sound, s

endings, vowel + w, schwa), and other lesson (nasal assimilation, nasal sounds, and glottal stop).

For every sound lesson in *Basic*, the user is presented with an illustration of the articulatory system followed by a written text on the characteristics of each sound and instructions on how to produce it. In addition to this, the user is able to listen to the sound and watch a video of about two minutes on its articulation, giving examples of words containing them, inviting for a listen and practice exercise, and calling attention to some of the minimal-pairs of words containing the targeted sounds. As an example, *Basic* lesson of the /i/ sound is illustrated in the figures below:

Figures 35 and 36 - Basic Lesson. Basic lesson of the /i/ sound in *EnglishPronunciation*.



Source: *EnglishPronunciation*

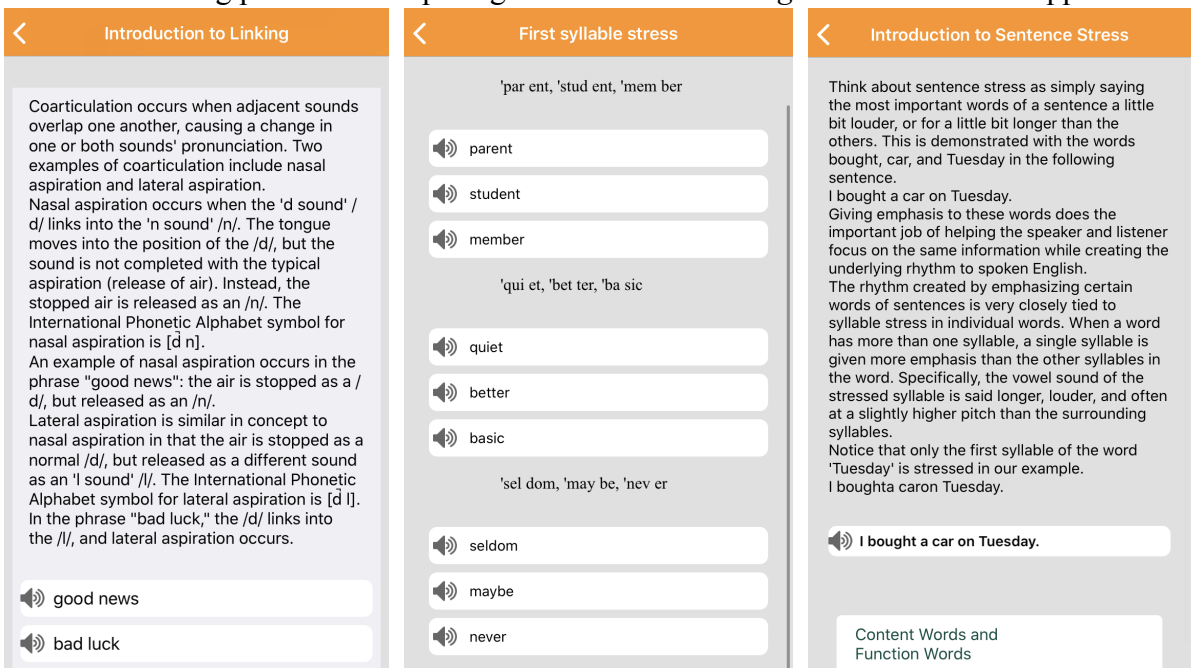
When selecting lessons in *Advanced* and *Pronunciation Tips,* description and analysis regarding the suprasegmental features is also provided, however only in written text, without narration, illustrations, or videos as it is the case of *Basic Lessons*. It can be affirmed, then, that *EnglishPronunciation* covers the first step for teaching pronunciation, description and analysis (CELCE-MURCIA; BRINTON; GOODWIN, 2010), for all features of pronunciation in English, however in an unbalanced manner, as the presentation of individual sounds to the users include narration, illustrations, and videos, and the ones for suprasegmental features do not.

Phonetic symbols of the targeted sounds and the phonetic transcription of words containing them are present in *Basic*, where lessons also enable the users to choose to write given words in phonetic transcription, or write their phonetic transcription. In *Advanced* and

Pronunciation tips, phonetic transcriptions are used as well, thus, allowing learners to comprehend the elements of pronunciation visually and aurally and to promote learning autonomy (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015).

Basic lessons enable users to raise awareness of the targeted sounds through listening to words containing them in either North American English or British English, and through the narrations and videos, as previously illustrated on Figures 35 and 36. In *Advanced* and *Pronunciation Tips* lessons it is also possible to listen to some examples of the suprasegmental features in words and sentences, however, not having access to narration and videos, or being able to select the English variety. The exercises available for the listening practice regarding the suprasegmental features can be seen in the figures below:

Figures 37, 38, and 39 - Listening Practice in *EnglishPronunciation*. The figures illustrate listening practice for suprasegmental features in *EnglishPronunciation* app.



Source: *EnglishPronunciation*

It is possible to affirm, then, that the app provides listening discrimination, which is the second step suggested for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), for all features of pronunciation, as it enable its users to raise awareness of all targeted pronunciation features.

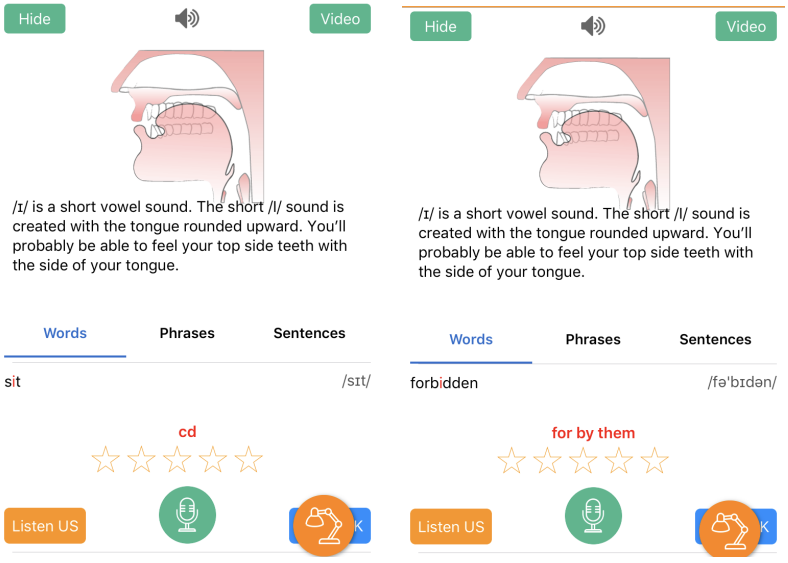
Controlled practice is available in all *Basic* lessons, where the user can record his/her production and get feedback from the app, as previously illustrated by Figure 35. One limitation of this feature of *EnglishPronunciation*, however, is the different number of words, phrases, and sentences available for each sound. The /i/ sound lesson, for instance, presents 40 words, five phrases, and four sentences for the user to record and get feedback. The /ʊ/ sound, on the other hand, presents 12 words, seven phrases, and four sentences. It is not clear why this number is different for all sounds, thus, offering unbalanced practice for users. In *Advanced* and *Pronunciation tips* the user is also able to listen to the words, phrases, and sentences provided by the app, however, without the possibility of recording the production and, consequently, not receiving any feedback from the app.

Thus, it is possible to affirm that *EnglishPronunciation* app enables the user to go through the first three steps for learning pronunciation suggested by Celce-Murcia, Brinton, and Goodwin (2010), with description and analysis and listening discrimination for all segmental and suprasegmental features. However, controlled practice is available for the segmental lessons only, as users are not able to record their production regarding suprasegmental features of pronunciation in *Advanced* and *Pronunciation Tips*. Guided and Communicative practice are not available in the app for any pronunciation feature, as users are not able to practice activities focused on meaning or exchange information.

As a developing technology, the ASR feature present in *Basic Lessons* in *EnglishPronunciation* cannot identify language varieties which deviate from the native norm. This may be negative for users who sound intelligible but are possibly not understood by the app. The ASR cannot ignore noises either, being necessary for the user to be at a silent place to use this feature of the app. This can be a limitation for users who may want to practice English anywhere, without planning ahead of time (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008), a feature expected to be found in MALL materials. In case of correct answers, the ASR provides a feedback from one to five stars. Whenever a mispronunciation occurs, the app transcribes what it has identified, however without providing the user with feedback on what to do in order to improve his/her production. According to researchers, learners should always be told what to do in order to repair the mispronunciation (GONZALEZ, 2012). One more limitation of *EnglishPronunciation* ASR is the inaccurate feedback. As earlier discussed, inaccurate feedback has been reported to be one

of the main limitations regarding the ASR features of language learning apps (LEVIS, 2007; PAIVA, 2017), possibly having a negative impact on learners who may not be aware of such limitations and thus, may feel discourage to use the app or to engage in pronunciation activities at all. The inaccurate feedback is illustrated in the figures below, occasions where the researcher did not pronounce the words which were identified by *EnglishPronunciation*:

Figures 40 and 41 - Feedback in *EnglishPronunciation*.



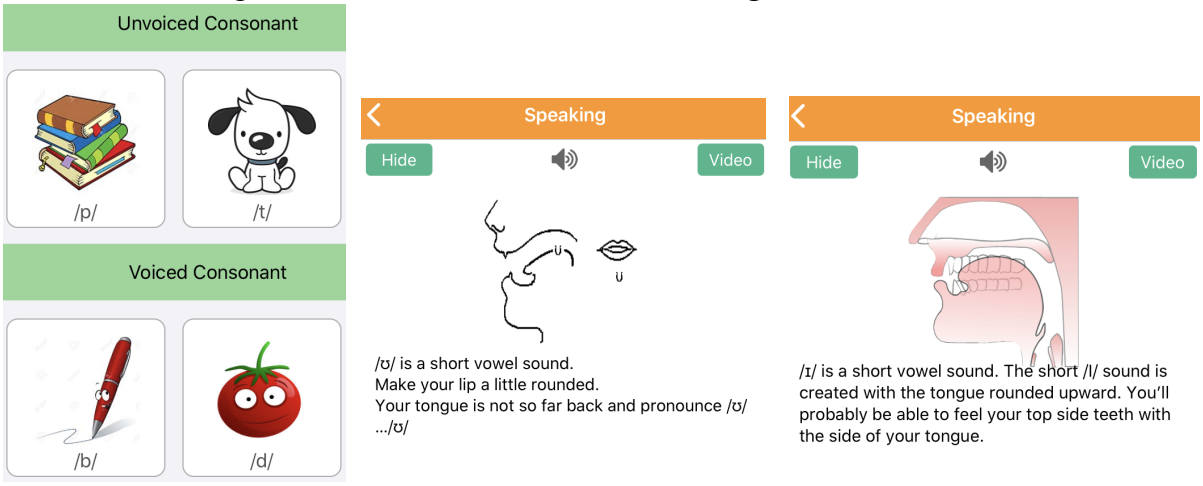
Source: *English Pronunciation*

4.3.3 Incorporating features and usability

Regarding the variety of input, *EnglishPronunciation* offers North American English and British English varieties for the user to choose in *Basic*, whereas in *Advanced* and *Pronunciation tips* lessons the user is not able to choose between the varieties. There are male and female voices which do not sound natural, mainly on *Basic lessons*. This is considered one of the current challenges in digital pronunciation teaching materials (HINKS, 2015), as artificial voices do not convey the sense of a social presence (MAYER, 2009). The app neither asks for user's L1 nor provides a test in order to identify his/her level or possible cross-linguistic influences. However, the user is able to choose taking any lessons available in *Basic, Advanced,* and *Pronunciation tips*, without any pre requisite such as completing levels within lessons, allowing every user to select what he/she is willing to practice.

EnglishPronunciation makes use of illustrations in the front page of *Basic, Advanced*, and *Pronunciation tips* and also inside the lessons for individual sounds and diphthongs, as a way to demonstrate how to articulate the English sounds (as illustrated by Figures 35, 40, and 41). It has been identified however, that the illustrations in the front page of *Basic lessons* are switched. For instance, books are used in order to illustrate the lesson about /p/ sound, whereas a pen is used to illustrate the lesson concerned with the /b/ sound. Similarly, a dog has been used to illustrate the lesson regarding the /t/ sound, while a tomato has been used in order to illustrated the lesson about the /d/ sound. This mistake concerning the illustrations and their related sounds could be a problem for learners (KUKULSKA-HULME et al., 2017; PIRES, 2018b), as it may lead to misunderstanding. In addition to this, the illustrations for articulation throughout the different sound lessons are not always the same, being some of them less sophisticated (/ʊ/ sound lesson, for instance) than the others (/i/ sound, for instance). If they all followed the same pattern it could be easier for the users to understand.

Figures 42, 43, and 44 - Illustrations in *EnglishPronunciation*



Source: *English Pronunciation*

All content of *EnglishPronunciation* is free of cost, making it especially relevant for learners who cannot afford subscribing it. Regarding its availability offline, the only content of the app which can be accessed without internet connection is listening to the audios. That is, learners are not able to record, watch videos, or get feedback from the app being offline, possibly being a limitation for learners who have limited or no internet access, but own a

mobile phone that can be used in order to develop L2 pronunciation (BRINTON, 2018; CHINNERY, 2006).

The length of the lessons vary, but it has been identified that the lessons are within the time recommended for MALL materials, which should last from thirty seconds to ten minutes (KUKULSKA-HULME; SHIELD, 2008; STOCKWELL; HUBBARD, 2013). This allows learners to engage in pronunciation activities in small amounts of time, anytime, anywhere, without previously planning it (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL; HUBBARD, 2013).

Regarding the usability of the app, it presents clear icons and directions for the user to navigate through it, that is, the learner is not likely to face challenges regarding the selection and completion of the lessons (GARRET, 2011; KRUG, 2008). However, whereas in *Basic* the quantity of information per screen is balanced and well hierarchized (GARRET, 2011; KRUG, 2008), in *Advanced* and *Pronunciation tips* lessons, there is often too much textual information (as illustrated in Figures 37, 38, and 39). This may hinder its use and also cause learners to take more time than the recommended to complete a lesson.

4.3.4 Score and summary - EnglishPronunciation

As *EnglishPronunciation* content includes all segmental and suprasegmental features of pronunciation expected to be included in pedagogical resources for pronunciation instruction (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001), the app scored 100% in this category.

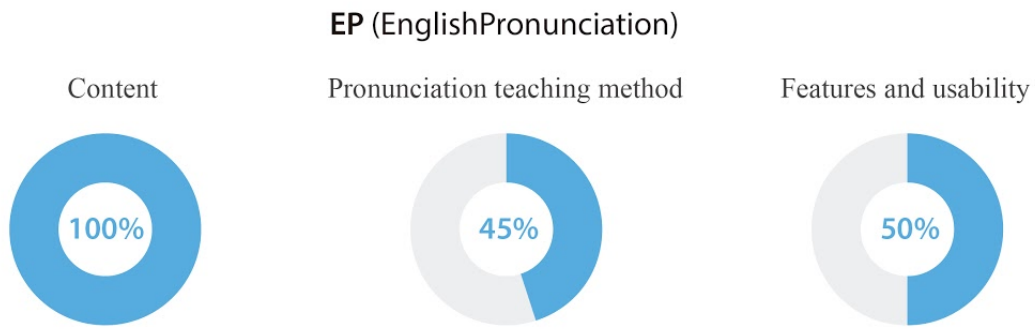
In relation to its pronunciation teaching method, it has been concluded that *EnglishPronunciation* offers description and analysis for all features of pronunciation. For the segmentals, this is done through the use of illustrations, videos, textual and aural information, whereas for the suprasegmentals only textual information is provided. Listening discrimination is also available for all features present in the app, as users have opportunities to raise awareness of the pronunciation features through listening. Controlled practice is available for lessons regarding the segmental features, once users are able to record their production and get feedback from the app. However, this practice is not available for any of

the suprasegmental features. Guided and communicative practice, which should enable learners to engage in activities that focus on meaning and exchange of information, developing their pronunciation communicatively (CELCE-MURCIA; BRINTON; GOODWIN, 2010), are not allowed by *EnglishPronunciation.* The app provides feedback through the ASR, however this feature presented limitations. For these reasons, *EnglishPronunciation* scored 45% in Pronunciation teaching method category.

With respect to the features and usability resources incorporated by *EnglishPronunciation* to promote pronunciation development, the app presented half of the possible items, having scored 50% in this category. The app offers some variety of input, allows its users to choose the level of the lessons they would like to take, and uses different media such as illustrations and videos to present the pronunciation features. The length of the lessons are within the time recommended for MALL materials. Finally, the information presented throughout *EnglishPronunciation* is well hierarchized, and the icons and directions for the users to navigate through the app, that is, to start and complete the lessons selected are clear, thus providing a good use flow for its users.

The graphs below demonstrate the score obtained by *EnglishPronunciation:*

Graphs 7, 8, and 9 - *EnglishPronunciation* score



Data generated by this researcher

4.4 *JUNA*

English teacher Ann Bartholomew created *Juna* inspired by her students, who know English well, but have difficulty being understood when they speak, and whose accents may

affect personal and professional lives. The app is available on the App Store and as informed by the official website[30], by using Juna users are able to understand what happens inside their mouths, allowing them to have more control over the words they want to say. Juna was developed in 2016 and is translated into eight languages: Arabic, Chinese, French, Japanese, Korean, Portuguese, Spanish, and Thai.

4.4.1 Content

The app *Juna* is divided into *Sound lessons, Practice I, Practice II, Quiz,* and *Dictionary. Sound lessons* provide presentation regarding all English segmental features as well as their positional variation (initial, medial, final stops, flap, syllabic consonants, clusters, vowel length, /l/ + /r/ coloring, nasalization, vowel reduction), which are put into practice with words containing the specific sounds in *Practice I, Practice II,* and *Quiz.* In *Dictionary*, the user is able to type any word to get its phonetic transcription, definition, and add it to a list of words.

Hence, the app *Juna* focuses on all segmental features of English pronunciation, but none of the suprasegmentals. As it has been earlier mentioned, in order to develop intelligible pronunciation, which is the goal of pronunciation teaching nowadays (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017), pedagogical resources should enable learners to practice the most relevant features of English pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010). Therefore, *Juna* would be more efficient assisting learners to achieve this goal if it also included suprasegmental features in its content.

4.4.2 Pronunciation teaching method

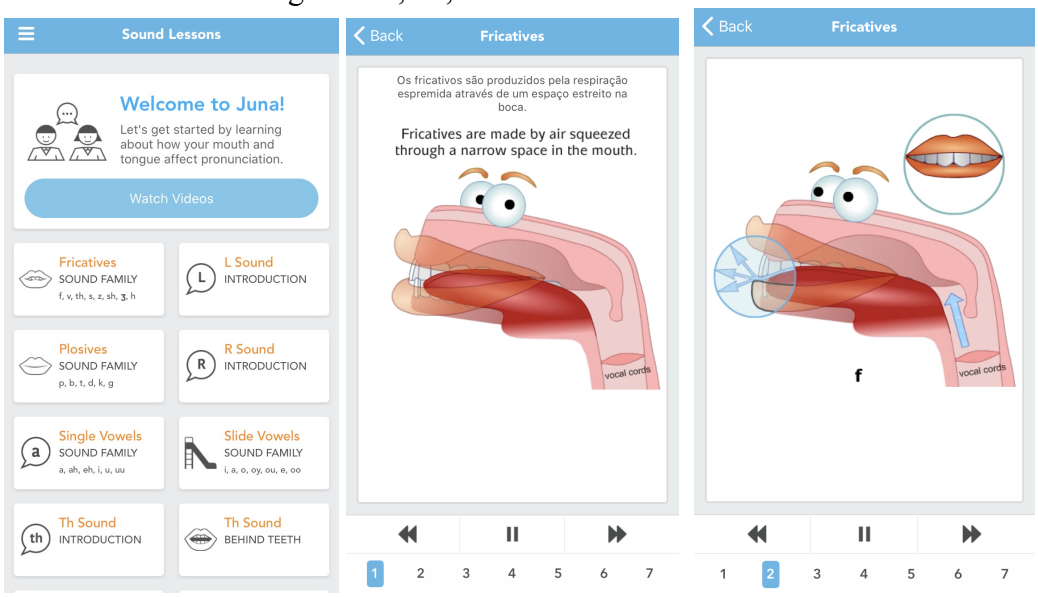
Once the user selects *Sound Lessons* in *Juna*, he/she is presented with an introductory lesson about the sounds in English, where the app coach *Juna*, an animation, explains the difference between voiced and unvoiced sounds, the characteristics of the tongue such as relaxed, tense, high, low, front, back, and middle, and talks about the different groups

[30] www.junaaccentcoach.com

of sounds in English, which may be, for instance: fricatives, plosives, glides, slide vowels, nasals, or affricates. *Juna*'s animation encourages the user to practice a little bit at a time, so that he/she will be able to see results in his/her English pronunciation. In addition to this, the animation gives instructions for the user on how to use the app, that is, starting with *Sound Lessons,* going to *Practice I* and *II*, followed by *Quiz* and finally *Dictionary,* if necessary. This first part of the app may be interesting for users, once it not only provides a good introduction regarding English pronunciation, but also enable users to understand how the app works.

After the introductory lesson aforementioned, *Sound lessons* is divided into *Fricatives, Plosives, L sound, R sound, Single vowels, Slide vowels, Th sound introduction, Th sound behind, Th sound between, Affricates, Glides, Nasals, Schwa,* and *Vowel + R.* All the lessons start with *Juna* providing explanation on the articulation of the specific group of sounds. For the first lesson, for instance, which is about fricative sounds, *Juna* explains the air flow characteristic for the fricatives, shows the different fricative sounds, which are produced from the front to the back, and the difference between the vocal cords for the different sounds among the same group. This explanation is given through the use of *Juna*'s animation, which moves in order to show the user how the sounds articulate and gives examples of words containing the sound. The animation is supported by different colors, arrows, and illustrations in order to call user's attention, as well as aural and written text, which may be translated into seven different languages. Overall, the *Sound Lessons* in *Juna* provide a very detailed presentation of all English sound groups and their sounds, therefore, covering the first step for teaching pronunciation proposed by Celce-Murcia, Brinton, and Goodwin (2010), which is the description and analysis of the pronunciation features. The figures below illustrate the initial page of *Sound Lessons* and the presentation provided by *Juna* regarding the fricative sounds:

Figures 45, 46, and 47 - *Sound Lessons*

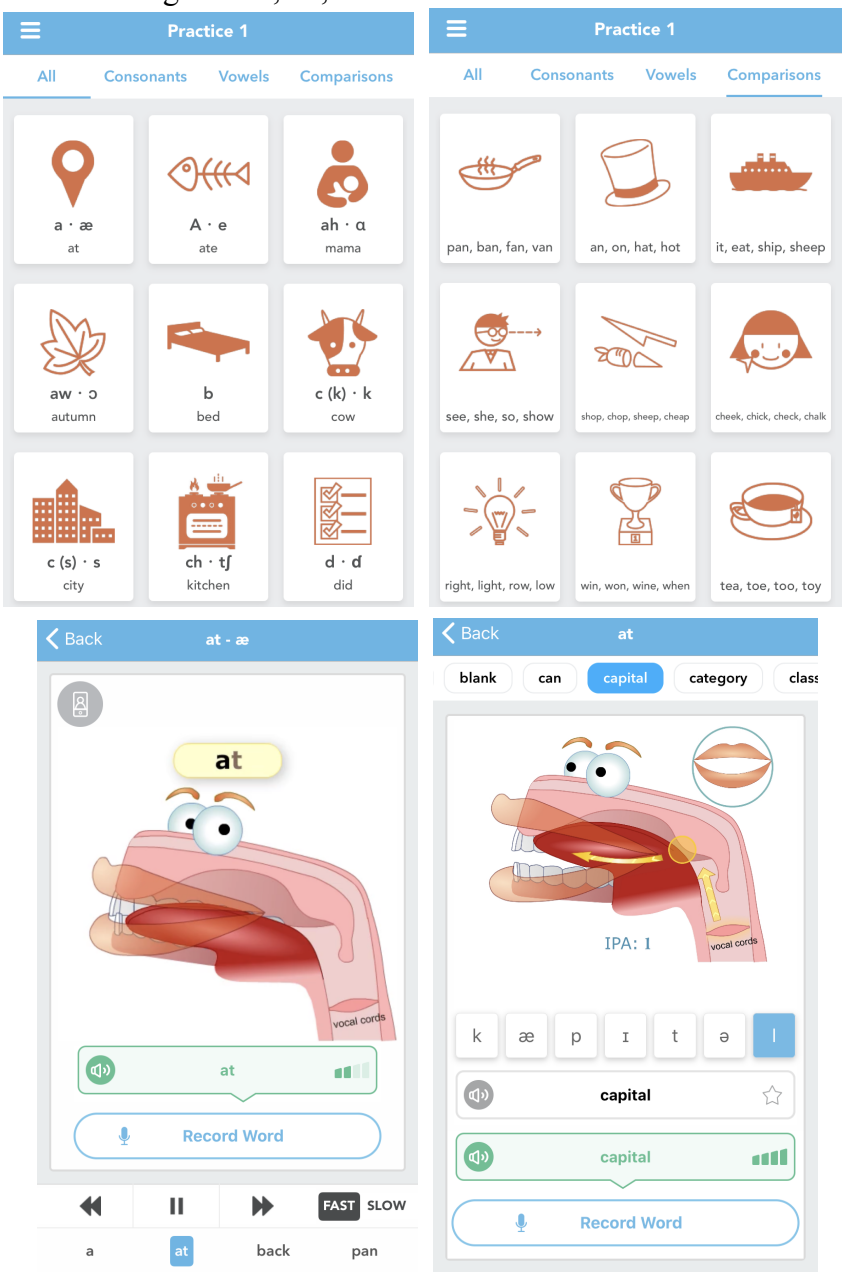


Source: *Juna*

Practice I in the app is divided into vowels, consonants, and comparisons. For vowels and consonants practice, the animation of *Juna* explains how to articulate the targeted sound, and the user is able to listen to examples of three words containing the sound, record, and get feedback for the production. In comparisons, the user does not receive explanation regarding the articulation, being only able to listen to examples of minimal pairs, record, and get feedback for each one of them.

*Practice II r*esembles *Practice I*, however, presenting the user with more words for listening, practice, and feedback, also including their phonetic transcription. This way, *Juna* enables users to get familiar with the phonetic symbols, which may allow them to comprehend the elements of pronunciation visually and aurally and to promote learners' autonomy (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015). The initial page of *Practice I*, where users can select to work with individual sounds or comparisons is illustrated by Figures 48 and 49. *Practice I* and *II* regarding /æ/ sound are illustrated in Figures 50 and 51:

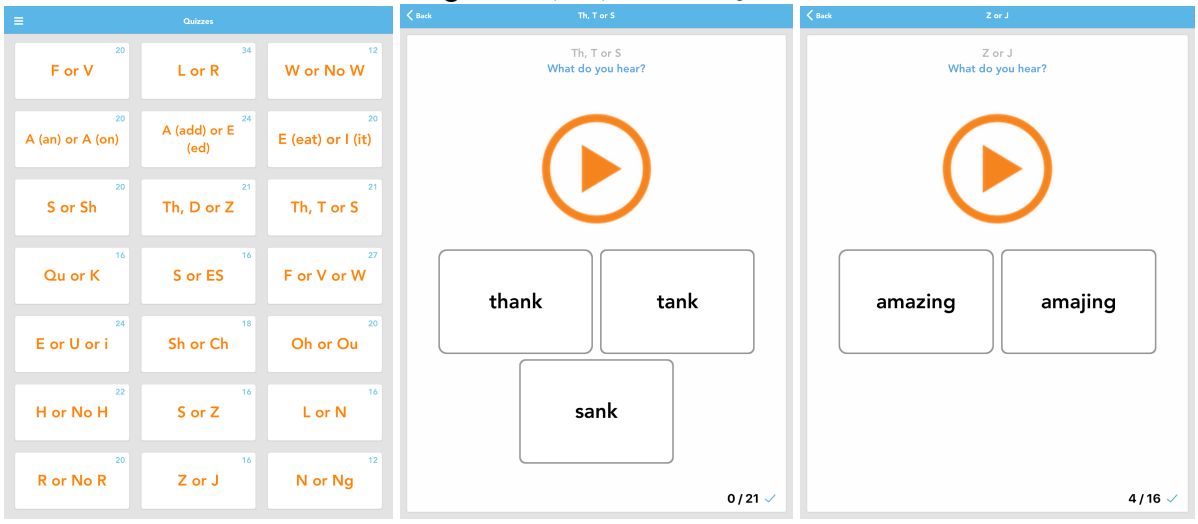
Figures 48, 49, 50 and 51 - Sound Lessons II



Source: *Juna*

Listening discrimination, which is the second step suggested by Celce-Murcia, Brinton, and Goodwin (2010) for teaching pronunciation, is available at word level in all lessons of *Juna,* as the user is able to listen to examples of words during the *Sound Lessons, Practice I, Practice II*, thus, raising awareness of the targeted sounds, and also to select the correct minimal-pairs in *Quiz*. Figures 52, 53, and 54 illustrate *Quiz,* in *Juna:*

Figures 52, 53, and 54: Quiz.



Source: *Juna*

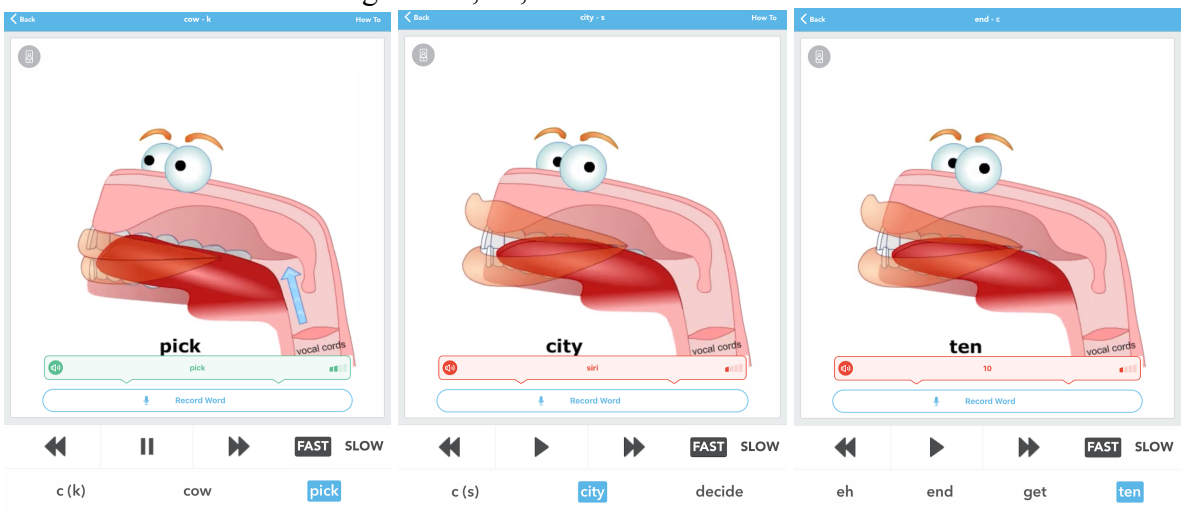
One limitation identified in *Quiz* section, however, is the fact that there are word options presented to the user which are not real words in the English language, as it is the case of *amajing*, illustrated in Figure 54. It would be interesting if such activities included only real words, so that learners may focus on listening discrimination exclusively, instead of questioning themselves whether the given word exists or not in the English language.

Controlled practice (CELCE-MURCIA; BRINTON; GOODWIN, 2010) is also available at word level for the *Sound Lessons* and *Practice I* and *II* previously described, as users are able to record their own production of words and minimal-pairs containing the targeted sounds. However, it is not possible for the users of *Juna* to have guided or communicative practice, as the app does not offer activities focused on meaning or exchange of information.

Juna is equipped with ASR technology to provide feedback. Nevertheless, this feature is not able to recognize different language varieties. Feedback from ASR is provided in *Practice I* and *II* in *Juna*, where the user records his/her own production for the words that have been listened. The ASR then transcribes the words which have been identified, as either correct or incorrect also presenting four different levels of score, which are colored in green or red, depending on the result obtained. However, as illustrated in Figure 55, the app transcribed the production correctly, but provided two levels of green without mentioning the cause for the production not having received 100%. As *Juna* does not tell the user where the mistake is, he/she cannot identify the cause of mispronunciation and consequently, improve

his/her production. According to Gonzalez (2012), the user should always know why he/she made a mistake, and if possible, be given suggestions on what to do in order to repair it. ASR in *Juna* also identified words which had not been pronounced by the researcher, as it has been the case of Paiva (2017) and is illustrated on Figure 56. One more limitation of the ASR was, for instance, when the app asked the user to pronounce "ten", it identified "10", but considered the production incorrect. These situations are illustrated in the figures below:

Figures 55, 56, and 57 - Feedback in *Juna*



Source: *Juna*

As previously mentioned, the negative impact of wrong feedback as this one provided by *Juna*, may be enormous (LEVIS, 2007). Unaware of the ASR limitations, users may feel discouraged to practice pronunciation once they receive a negative feedback and do not understand why.

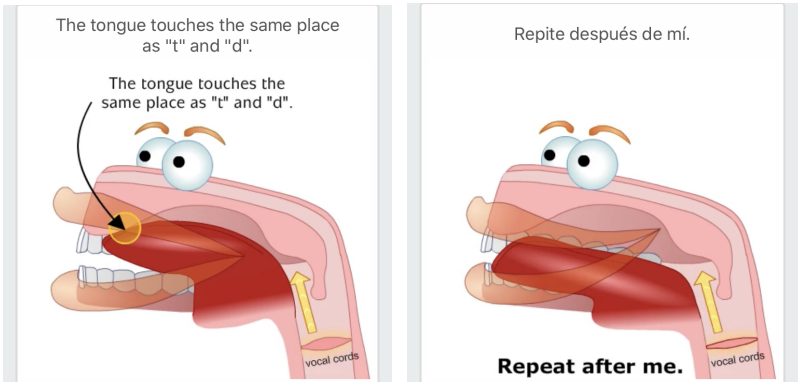
4.4.3 Incorporating features and usability

Regarding the variety of input provided by *Juna,* the app counts with fifteen different narrators, males and females whose voices sound natural, therefore, conveying a sense of social presence for users and enabling the increase of communicative flexibility which is necessary for learners (CELCE-MURCIA; BRINTON; GOODWIN, 2010). Despite being a different gender and sounding to belong to a different age, therefore, providing some variety of input, they all sound native American speakers of English, as *Juna* focuses specifically in

American sounds, as its official website states. The app then, could discourage learners who are willing to achieve a pronunciation goal which is not a Native American accent.

The app does not ask for the user's L1 when registering, nor provides a test in order to identify user's level or main difficulties. *Juna* is translated into eight different languages, meaning that the lessons containing the written text are translated into one of the languages. It has been identified, however, that sometimes even though the phone of the researcher had been set for Portuguese, the translation of the written text in *Juna* was given in Portuguese, Spanish, and English, which may lead learners to a confusion.

Figures 58 and 59 - Translation



Source: *Juna*

The only opportunity the user has to select a level of difficulty in *Juna* is in *Quiz*, where he/she can select between *Level 1*, where sounds are paired together, or *Level 2*, where sounds are randomized. Even though *Juna* does not offer a selection for user's level besides this one, the app has an introductory lesson, which guides the user on how to use the app, allowing him to have more control over his use and maybe selecting some lessons which are more related to what he/she is aiming at (DERWING; MUNRO, 2015a).

Juna uses relevant animations and illustrations in order to explain the articulation of the sounds in *Sound Lessons, Practice I* and *II*. In addition to this, Juna enables the users to use the camera embedded in their mobiles to watch themselves and verify whether the sounds are being properly articulated. According to Celce-Murcia, Brinton, and Goodwin (2010, p. 358), "learners often better understand which areas they need to improve after viewing their video performance", and, as due to issues such as limited time and large classrooms teachers are rarely able to record learner's performance, this feature of *Juna* may be used to assist

pronunciation development. *Juna* does not have the push feature related to MALL materials (STOCKWELL; HUBBARD, 2013), so the user is not encouraged or invited by the app to take a lesson at pre-set or random times. It does not work offline either, which could be a limitation for some users, given that not all learners may have internet connection, despite having a phone that can be used to improve L2 pronunciation (BRINTON, 2018; CHINNERY, 2006). On the other hand, all content in *Juna* is free of costs, so learners who are not able to afford the app may use it when internet connection is available.

The length of each lesson in *Juna* is within the time recommended for MALL materials (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL; HUBBARD, 2013), what may encourage learners to take pronunciation lessons during a short period of time, such as commuting or during a break (CHINNERY, 2006; KUKULSKA-HULME et al., 2017).

Regarding its usability, the quantity of information per screen in *Juna* is balanced and the app has a clean layout, being the information per screen also well hierarchized. In addition to this, the app present clear icons and directions for the user to start and complete the lessons, so he/she should be able to navigate through the app without problems (GARRET, 2011; KRUG, 2008).

4.4.4 Score and summary - Juna

Juna enables its users to work with all the sounds of English language individually and in contrast, and in different positions within words. Therefore, the app focuses exclusively on segmentals, as it is described on the App Store and on its official website. The score obtained by *Juna* in the category content, then, was 50%, as it does not cover any of the suprasegmental features which are expected to be included in pedagogical resources for pronunciation instruction (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001).

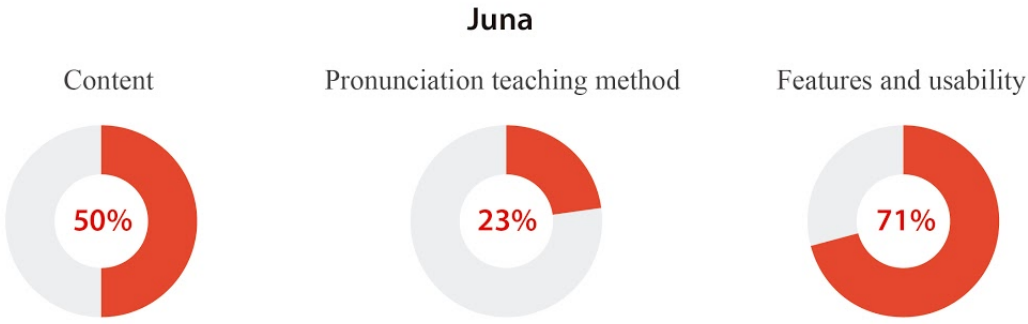
Description and analysis, listening discrimination, and controlled practice of the segmental features are available, so it has been concluded that *Juna* goes up to the third step for teaching pronunciation suggested by Celce-Murcia, Brinton, and Goodwin (2010). Therefore, the app only enables practice focused on accuracy, with no opportunities to focus

on meaning and exchange of information, which would be the goal of activities within guided and communicative practice (CELCE-MURCIA; BRINTON; GOODWIN, 2010). The ASR in *Juna* provides feedback on user's production, and this feature is also able to ignore noises, possibly encouraging learners to use the app anywhere, without previously planning. For this reason, the app obtained a score of 23% in the category of pronunciation teaching method.

The score obtained by *Juna* in features and usability category was 71%, higher than the ones obtained in categories related to content and pronunciation teaching method. The app offers some variety of input to its users and is embedded with a feature that allows them to select the level of activities in certain lessons, thus, being able to focus on pronunciation aspects which are most relevant to them. The illustrations and animations used by the app are relevant to what has been proposed and may contribute to L2 pronunciation development. The lessons in *Juna* are also within the recommended time for MALL materials. Finally, regarding the usability of the app, the quantity of information is balanced throughout the lessons and also well hierarchized. The app has clear icons and directions for the users, who may probably navigate through it without effort, focusing on developing their pronunciation instead of trying to understand how the app works.

The graphs below demonstrate how much *Juna* scored in each category:

Graphs 10, 11, and 12 - *Juna* score



Data generated by this researcher

4.5 GENERAL DISCUSSION

Regarding the content of the apps analyzed, it is possible to affirm that *Elsa* and *EnglishPronunciation* are the only ones to include all of the content expected to be found in pedagogical resources for pronunciation instruction, covering the most relevant segmental and suprasegmental features (CELCE-MURCIA; BRINTON; GOODWIN, 2010; KELLY, 2001). *English Pronunciation Tutor* works with all segmental features and covers the suprasegmental features of word and sentence stress, whereas *Juna* is the only app analyzed which focuses exclusively in segmentals. Therefore, in terms of content, *Elsa* and *EnglishPronunciation* would be considered the apps which enable learners to develop intelligible pronunciation the most, as they work with all features of pronunciation which, according to Celce-Murcia, Brinton, and Goodwin (2010), are pedagogically relevant to be taught in order to achieve intelligibility.

With respect to the pronunciation teaching method, which aimed at investigating whether the pronunciation apps follow the five steps for teaching pronunciation proposed by Celce-Murcia, Brinton, and Goodwin (2010), it is possible to affirm that all of them offer description and analysis, listening discrimination, controlled practice, as well as feedback. That is, they go up to the third step suggested by Celce-Murcia, Brinton, and Goodwin (2010), including the presentation of the given pronunciation features in a variety of ways, listening practice - through awareness raising and listening discrimination activities -, and controlled practice - through activities that focus on accuracy. None of the apps analyzed in this study enable guided or communicative practice of the pronunciation features, which as any other steps of the framework, are considered crucial to develop intelligible pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010). This limitation may be related to technological constraints, which may be soon overcome with the advancement of technology. Or, perhaps, it may be because it is not the focus of the given apps to promote guided and communicative practices for the development of pronunciation, following a more traditional methodology.

Even though it has been affirmed that nowadays pronunciation instruction is moving away from a segmental/suprasegmental debate towards a more balanced view (CELCE-MURCIA; BRINTON; GOODWIN, 2010), this analysis identified that the

description and analysis, listening discrimination, controlled practice, and feedback regarding the suprasegmentals - when these pronunciation features are approached by the apps - are not as complete as the ones found for the segmentals. The description and analysis and feedback are often less detailed or limited to written information, and there is a smaller number of activities for listening discrimination and controlled practice regarding suprasegmentals. Thus, the pronunciation apps analyzed in this study seem to focus more on segmental features of pronunciation, differently from what has been recommended by scholars (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

In what concerns the feedback provided by the ASR feature, this feature is present in all the apps analyzed. However, none of them is able to identify varieties which deviate from the native norm, thus, contributing to the nativeness principle which still permeates within the field of pronunciation instruction (DERWING; MUNRO, 2015b), and which may be an unrealistic goal for the majority of learners (CELCE-MURCIA; BRINTON; GOODWIN, 2010). This also sometimes causes the ASR feature to provide wrong feedback, as already reported by scholars (GONZALEZ, 2012; GUO, 2014; PAIVA 2017), possibly having negative consequences for users (LEVIS, 2007). In addition to this, the ASR feature in *Elsa* is the only one able to inform learners the reason of their mispronunciation and thus, offer suggestions on what to do in order to improve production. Moreover, the ASR feature of *Elsa* and *Juna* are the only ones that can ignore noises, allowing users to practice pronunciation anywhere (CHINNERY, 2006; KUKULSKA-HULME; SHIELD, 2008; STOCKWELL, 2013), as they would not need to previously plan to be in a quiet place, for instance. These are aspects which we believe can be reviewed regarding the content, pronunciation teaching method, and feedback provided by the apps analyzed in this study.

Regarding the features and usability resources incorporated by the apps to promote pronunciation development, *Elsa* and *Juna* are the apps which included more items within this category. Also, *Juna* is the only app analyzed in this study which obtained a higher score regarding its features and usability than in the categories related to the content and pronunciation teaching method.

This analysis has identified that all the apps use either male and female voices or different accents, thus offering some of the input variety which is expected to be found in pronunciation instruction digital materials (CELCE-MURCIA; BRINTON; GOODWIN,

2010; LEVIS, 2007). However, this variety is limited to either native speakers of North American English or British English. As it has been earlier discussed, scholars agree that aiming at native like pronunciation may be an unrealistic goal for the majority of learners, once it is incongruent with empirical evidence (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA et al., 2017). Having said that, it would be interesting if apps considered other language varieties for input as well as improved their ASR feature so that they could tackle or approximate from the variety spoken by their different users.

The only app which has the feature of asking for users' L1 or provides a test in order to identify user's level or main difficulties is *Elsa.* In spite of this feature, it is not clear whether the lessons provided by the app take this information into account, as during the use information regarding other language which was not the selected L1 was presented by the app.

All apps allow users to select the level of difficulty, such as by choosing between basic or advanced lessons, except for *English Pronunciation Tutor.* Not enabling learners to choose pronunciation priorities has been affirmed to be one of the biggest problems in the use of much currently available digital technology for L2 pronunciation instruction, as the common one-size-fits-all approach unhelpful to teachers and students who need to focus their attention on issues that will genuinely improve their communication skills (MUNRO; DERWING, 2015a). For that reason, most of the apps analyzed in this study could be considered an effective pedagogical resource for developing pronunciation among different groups of learners, as they somehow allow users to select the level of difficulty of the lessons.

Despite the fact that most voices in *EnglishPronunciation* do not sound natural, and that a few images and animations used by *English Pronunciation Tutor* and *EnglishPronunciation* may not be clear or lead users to confusion, it has been concluded that all apps make use of several media such as illustrations, animations, videos, written and aural information, in order to provide description and analysis, listening discrimination, practice, and feedback for its users (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015). The sophisticated practice level and the gamelike atmosphere the pronunciation apps may have advantages that simple audio files in traditional classroom context do not (CELCE-MURCIA; BRINTON; GOODWIN, 2010), thus, motivating learners to use the

pronunciation apps to develop their pronunciation, and contributing to increase learner's autonomy (MARTINS, 2015).

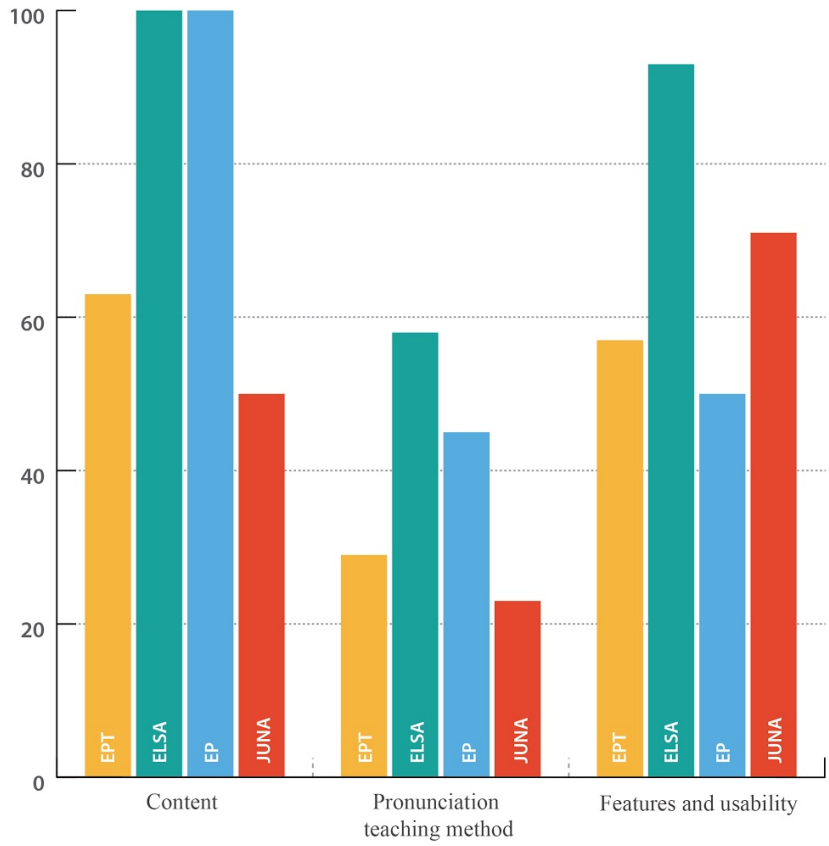
The push feature, which allows the app to send notifications to encourage the user to practice pronunciation (SARAN et al., 2009; STOCKWELL; HUBBARD, 2013) was only found in the app *Elsa*. Even though none of the apps are completely available offline, some of their functionalities, except for *Elsa*, work without internet connection. This feature makes the pronunciation apps analyzed in this study especially relevant for learners who have limited internet connection (CHINNERY, 2006) but have a mobile phone which can be used for improving their L2 pronunciation (BRINTON, 2018).

Regarding the length of the lessons, all apps analyzed have lessons within the recommended time for MALL materials (CHINNERY, 2006; STOCKWELL; HUBBARD, 2013), so users could engage in pronunciation activities without previously planning, such as while commuting, during a break, in the classroom context, or out of it.

Finally, *EnglishPronunciation* is the only app that does not provide balanced quantity of information on the screen throughout the lessons. All of the apps analyzed presented well hierarchized information as well as clear icons and directions, so that users are able to navigate through them without difficulties. This may contribute for learners to feel motivated to use such apps, since when they are using them, learners are able to focus on pronunciation activities only, and probably do not need to worry about figuring out how to navigate through the apps.

In order to provide a better visualization of the scores obtained by all the apps analyzed in each of the three categories of the framework, a graph containing all the data presented in the previous sections (4.14, 4.2.4, 4.3.4, and 4.4.4) is displayed below:

Graph 13 - General score



Data generated by this researcher

The graph shows that *Elsa* is the app which had the highest score in all categories analyzed in this study. Besides including all of the content expected to be found in pedagogical resources, it is the app which scored the most in relation to the pronunciation teaching method and also offers the biggest variety in terms of features and usability resources. However, the qualitative analysis presented in this study also concluded that *Elsa* is not embedded with features which may be relevant for specific groups of learners and which can be found in the other three apps analyzed. One of them is the availability of some of the content offline, for instance. That is, even though *Elsa* had the best score in all categories, it may not be a relevant app for learners who are expected to use it in places where connectivity is limited or unavailable. This leads to the conclusion that every app analyzed in this study has its own particularities, and may be more or less suitable for specific groups of learners.

One more example that corroborates with that is related to the description and analysis provided by the apps. Even though all of them presented this item, each of them do it in a particular way. In *English Pronunciation Tutor, English Pronunciation,* and *Juna,* the description and analysis on segmentals is provided through written and aural information, illustrations and videos, and it precedes practice. On the other hand, *Elsa* provides this information mainly in written form, after learners' practice, and only in case of mispronunciation. In addition to that, every app uses different types of illustrations and more or less detailed written information regarding such features, using for instance, more or less technical terms in order to describe them. Therefore, it is necessary that learners' level, goals, needs, and even their age or learning style are taken into account before choosing to use of any apps analyzed here, so their use can be indeed effective.

To conclude, it is important to mention that it was not within the scope of this research to appoint which of the apps analyzed is the best one, but to demonstrate the content, pronunciation teaching method, and resources presented in each one of them. We acknowledge not only the potential of using apps such as the ones analyzed in this study in order to promote L2 pronunciation development, but also the essential role language teachers play on providing guidance on how to select and use such pedagogical resources, as well as to set priorities related to the pronunciation aspects which are more relevant to specific groups of learners (CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA, 2004). We expect, thus, that this study has enlighten the discussions within the areas of pronunciation teaching and MALL, and that its results may also contribute for language teachers to make informed choices regarding the use of apps to promote learner's L2 pronunciation development, and consequently, successful communication in the L2.

4.6 SUMMARY OF THE CHAPTER

This chapter presented an analysis of four apps developed for pronunciation instruction. Each individual analysis started by providing a brief description of the app for later discussing the content, pronunciation teaching method, and features and usability resources incorporated by them to promote pronunciation development. Moreover, a summary

of the individual analysis was provided, along with the score obtained by each app, illustrated by graphs. Finally, a general discussion regarding the findings of the four apps was presented.

The next chapter, named Final Remarks, brings the conclusions of the study providing answers for the research questions, discussing the pedagogical implications and the limitations of the study, and finally, giving suggestions for further research.

5 FINAL REMARKS

This research aimed at analyzing the content, pronunciation teaching method, and the features and usability of four pronunciation apps. With the results obtained from the analysis, it is now possible to provide conclusions for the study. In order to do so, the research questions are now readdressed, with explanations given in an attempt to provide answers to them.

With regards to (RQ1) - *Do the apps include content related to segmental and suprasegmental features of pronunciation?* - The apps *Elsa* and *EnglishPronunciation* present all segmentals and suprasegmental features of pronunciation which should be included in pedagogical resources for pronunciation instruction (CELCE-MURCIA; BRINTON; GOODWIN, 2010), whereas *English Pronunciation Tutor* works with all segmentals, word stress and sentence stress. *Juna* is the only app which focuses only and specifically on segmentals. All of the apps present the phonemes individually and in contrast, work with their positional variation, and make use of phonetic transcription, as also recommended by literature on pronunciation teaching (CELCE-MURCIA; BRINTON; GOODWIN, 2010; MARTINS, 2015). However, the apps would assist learners' to develop their intelligibility, which is the goal of pronunciation instruction (ALVES, 2015; CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA, 2004), if they provided balanced content concerning all pronunciation features, once all of them influence oral communication (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

Regarding the pronunciation teaching method of the apps, which is related to (RQ2) - *Do the apps work with the five steps of the framework for teaching pronunciation: description and analysis, listening discrimination, controlled, guided, and communicative practice of the features of pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010),*

also providing feedback?- The four pronunciation apps analyzed in this study provide description and analysis of the features of pronunciation through a variety of ways, such as with illustrations, animations, videos, written and aural information. All apps also provide listening discrimination, guided practice, and feedback. In spite of this, none of the apps go beyond the third step of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010), as they do not provide guided or communicative practice. Therefore, the activities available in the apps analyzed in this study enable the users to practice pronunciation with a variety of activities that focus on accuracy, such as by pronouncing and getting feedback on the production of words, phrases, sentences, and short dialogues. None of them enable practice focused on meaning and exchange of information, which would assist learners to develop fluency. Activities such as these ones would include cued dialogues, simple information-gap exercises, strip stories, interviews, storytelling, and debate, for instance, and are also considered crucial to develop intelligible pronunciation. The fact that the apps do not go beyond the third step of the framework for teaching pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010) may be because the app themselves were not developed with this purpose, or due to technological constraints, which may be easily overcome with the advancement of technology.

In relation to the description and analysis and feedback provided by the apps, they are usually more detailed regarding the segmental lessons. The listening discrimination and guided practice lessons also outnumber the ones related to the suprasegmentals, when these pronunciation features are approached by the apps. It is possible to identify, hence, that there is a trend in the apps to focus more on segmentals, practice which permeated throughout many language teaching methods (CELCE-MURCIA; BRINTON; GOODWIN, 2010). Even though scholars affirm that pronunciation instruction is moving away from a segmental/suprasegmental debate towards a more balanced view nowadays (CELCE-MURCIA; BRINTON; GOODWIN, 2010), it seems that it is not the case of the apps analyzed in this study. Therefore, pronunciation apps might follow the conclusions of researchers and provide balanced content and practice regarding all features of pronunciation, once that all of them may affect intelligible pronunciation (CELCE-MURCIA; BRINTON; GOODWIN, 2010).

Feedback was provided by all the apps since they are embedded with ASR feature. Nevertheless, the ASR feature has limitations. For instance, none of the apps recognize varieties which deviate from the native norm, and two of them, *English Pronunciation Tutor* and *EnglishPronunciation*, are not able to ignore external noises, making it difficult for users to use these apps anywhere, as it is proposed by MALL (CHINNERY, 2006; STOCKWELL, 2013). Furthermore, the ASR feature sometimes identifies a correct production of the user, but provides a negative feedback, or it is simply not able to identify what has been said. As pointed out by Levis (2007), the negative consequence of wrong feedback for language learners may be enormous, as unaware of this limitation, learners may be confused and discouraged to engage in pronunciation activities. Even though the ASR offers the immediate feedback usually not possible in classroom contexts, it is important for teachers to make learners aware this is a developing technology in apps, which has limitations.

Concerning (RQ) 3 - *What are the features and usability resources incorporated by the apps and how they promote pronunciation development?* - Some features of MALL are provided by the pronunciation apps, such as the variety of input through different narrators (LEVIS, 2007), with male and female voices. However, the lessons within the apps do not bring phonological variations beyond North American English or British English (except the section *Dictionary*, in the app *Elsa*). *Elsa* is the only app which presents features such as asking for users' L1, provides a test in order to identify user's level or main difficulties, and sends notifications for encouragement to the learners through the push feature (SARAN et al., 2009; STOCKWELL; HUBBARD, 2013). The user is able to select the level of the lessons such as basic or advanced, in all apps analyzed, except for *English Pronunciation Tutor.* This feature is important to overcome what has been recognized a challenge in current pronunciation instruction digital materials, the lack of priority setting (DERWING; MUNRO, 2015a). This way, learners are able to choose to work on pronunciation activities which are most relevant to them. All the apps analyzed in this study make use of images, illustrations, animations, videos, textual and aural information, being most media relevant for what it has been proposed (KUKULSKA-HULME et al., 2017; PIRES, 2018b). Also, most voices found in the apps sound natural, thus, conveying the idea of a social presence for the users (MAYER, 2009).

Bringing more phonological variations than it is usually found in traditional ESL classrooms, allowing the users to have personalized lessons according to their L1, main difficulties, and goals, as well as encouraging them to take at least a short pronunciation lesson every day are features that may contribute not only for developing learner's autonomy, but to increase their motivation and reduce the anxiety which may be related to speaking and pronunciation in an L2. Therefore, pronunciation apps that include such features may be considered an efficient pedagogical resource for promoting the development of L2 pronunciation.

Acknowledging that ML and MALL materials refer to either classroom context or out of it, it is important to keep in mind that even though all apps analyzed in this research probably do not require any prior training to use it, guidance and training for learners are required, regardless if they already use mobile phones in their personal life (CHAPELLE; JAMIESON, 2008; KANG; KERMAD, 2017; MARTINS; BORGES; LEVIS, 2016). Teachers must provide guidance on how learners can select and use the apps, what are the lessons which are more relevant regarding difficulties and goals a specific group of learners may have (CELCE-MURCIA; BRINTON; GOODWIN, 2010; SILVEIRA, 2004), and to make sure learners receive balanced content and practice regarding the segmentals and suprasegmental features most relevant to them.

Despite some limitations of the apps identified in this analysis, they seem to be a helpful pedagogical resource for working with presentation, awareness raising, listening, controlled practice, and providing feedback regarding all segmental and suprasegmental features of English language, contributing to develop English pronunciation.

In order to provide guided and communicative practice, which are not provided by any of the apps analyzed in this study, their use can be supplemented by other activities which can be delivered or done using mobile phones through other apps which enable communication among learners or are embedded with artificial intelligence such as *WhatsApp*, *Instagram, Facebook, Siri, Google Assistant,* and *Alexa,* for instance. This way, users may enhance the use of the apps which seem to follow a more traditional methodology focused on form, by engaging in activities which are focused on expressing meaning and allow exchange of information (CELCE-MURCIA; BRINTON; GOODWIN, 2010), either by communicating with each other or with the app itself. Some of these activities include

cued-dialogues, simple information-gap activities, strip stories, storytelling, debates, and interviews.

5.1 PEDAGOGICAL IMPLICATIONS

The pedagogical implications of this study involve institutions, teachers, and learners who are interested in developing L2 speaking, more specifically pronunciation, through the use of mobile apps.

Institutions may use the results presented here to offer pedagogical support for teachers such as training regarding pronunciation teaching and learning with pronunciation apps. This way, teachers may use the apps in order to improve their knowledge base in the area, their own pronunciation, and perhaps feel more confident about teaching pronunciation to their students. With this analysis, teachers may raise awareness regarding the benefits and limitations of pronunciation apps, and may be able to analyze other pronunciation pedagogical resources themselves. Moreover, they may be able to provide learners with opportunities to practice the features which are most relevant to the specific groups they are teaching by using the apps, perhaps supplementing their use with other materials, when the content or practice of a given feature is not covered by the app. The use of such apps may be during classroom context, or out of it. Finally, teachers might also provide their students with guidance on how to choose and use pronunciation apps that can assist them to improve their pronunciation, and make them aware of the limitations and strengths of such materials.

Learners may be benefited by the use of the pronunciation apps, developing their pronunciation at the most suitable time and place for them. This way, they may also spend more time engaged in pronunciation activities, focus on their specific goals and difficulties, and receive immediate feedback from the apps, overcoming some common challenges found in most language classrooms and pedagogical resources. By using the apps, learners may increase their motivation and learning autonomy, as well as decrease the anxiety which may be related to pronunciation in L2.

5.2 LIMITATIONS OF THE STUDY

There are limitations already recognized in this study, for instance, the small number of apps analyzed. Considering the large number of apps available today, research could include other apps which are not part of this study, especially because new ones are developed on a constant basis.

It is important to consider that the data collected from the four apps analyzed in this study refer to a specific period of time, and that the apps may be updated by the developers, having an impact on the findings reported here.

In addition to this, we acknowledge that the quantitative analysis was based exclusively in the presence or absence of the items in the framework developed by the researcher, not including an analysis of the quality of the given items.

5.3 SUGGESTIONS FOR FURTHER RESEARCH

As a suggestion for further research, more pronunciation apps could be analyzed, where the quantitative analysis could also include the quality of the items present in each app, instead of its presence or absence only.

The framework developed by this researcher may also be improved, as new pronunciation apps are released and technology evolves requiring more features to be analyzed.

Finally, it would be interesting to analyze participants' perceptions regarding the use of the apps, or their motivation towards it. In addition to this, research could investigate a possible increase in intelligibility levels in participants after an intervention with some of the apps.

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APPENDICES

APPENDIX 1 - FRAMEWORK FOR APPS ANALYSIS AND APPS SCORES

	EPT[31]	Elsa	EP[32]	Juna
Content				
1.1 Does the app work with the consonant system and consonant contrasts?	1	1	1	1
1.2 Does the app work with positional variation (initial, medial, and final stops; flap; syllabic consonants; clusters)?	1	1	1	1
1.3 Does the app work with vowel system and vowel contrasts?	1	1	1	1
1.4 Does the app work with positional variation (vowel length; r + l coloring; nasalization; vowel reduction)?	1	1	1	1
1.5 Does the app work with connected speech (C to V and V to V linking; consonant assimilation; palatalization)?	0	1	1	0
1.6 Does the app work with levels of stress within a word and hierarchy of stress within an utterance?	1	1	1	0
1.7 Does the app work with prominence (new or important information/special emphasis/contrast)?	0	1	1	0
1.8 Does the app work with the relationship between intonation and meaning?	0	1	1	0
2. Pronunciation teaching method				
2.1 Does the app present phonetic transcription?	1	1	1	1
2.2 Does the app present description and analysis of segmental features?	1	1	1	1
2.3 Does the app present description and analysis of connected speech?	0	1	1	0
2.4 Does the app present description and analysis of word and sentence stress?	1	1	1	0
2.5 Does the app present description and analysis of prominence?	0	0	1	0
2.6 Does the app present description and analysis of intonation and meaning?	0	0	1	0
2.7 Does the app provide listening discrimination of segmentals?	1	1	1	1
2.8 Does the app provide listening discrimination of connected speech?	0	1	1	0
2.9 Does the app provide listening discrimination of word and sentence stress?	1	1	1	0

[31] *English Pronunciation Tutor*
[32] *EnglishPronunciation*

2.10 Does the app provide listening discrimination of prominence?	0	1	1	0
2.11 Does the app provide listening discrimination of intonation?	0	1	1	0
2.12 Does the app provide controlled practice of segmental features?	1	1	1	1
2.13 Does the app provide controlled practice of connected speech?	0	1	0	0
2.14 Does the app provide controlled practice of word and sentence stress?	1	1	0	0
2.15 Does the app provide controlled practice of prominence?	0	1	0	0
2.16 Does the app provide controlled practice of intonation?	0	1	0	0
2.17 Does the app provide guided practice of segmental features?	0	0	0	0
2.18 Does the app provide guided practice of connected speech?	0	0	0	0
2.19 Does the app provide guided practice of word and sentence stress?	0	0	0	0
2.20 Does the app provide guided practice of prominence?	0	0	0	0
2.21 Does the app provide guided practice of intonation?	0	0	0	0
2.22 Does the app provide communicative practice of segmental features?	0	0	0	0
2.23 Does the app provide communicative practice of connected speech?	0	0	0	0
2.24 Does the app provide communicative practice of word and sentence stress?	0	0	0	0
2.25 Does the app provide communicative practice of prominence?	0	0	0	0
2.26 Does the app provide communicative practice of intonation?	0	0	0	0
2.27 Is the app equipped with ASR in order to provide feedback (score, rewards, % of correct answers, right/wrong)?	1	1	1	1
2.28 Does the ASR recognize different language varieties?	0	0	0	0
2.29 Does the ASR ignore noises?	0	1	0	1
2.30 In case of mispronunciation, does the ASR indicate the type of mispronunciation?	1	1	1	1
2.31 Does the app provide the learner with feedback on what to do in order to repair the mispronunciation?	0	1	0	0
3. Features and usability				
3.1 Does the app provide variety of input (different accents, male/female voices)?	1	1	1	1
3.2 Does the app ask for the users' L1?	0	1	0	0

3.3 Does the app provide a test in order to identify users' level or main difficulties?	0	1	0	0
3.4 Can the user select the level of difficulty?	0	1	1	1
3.5 Does the app make use of illustrations, pictures, and videos at any stage?	1	1	1	1
3.6 Is the media used relevant to what is proposed?	0	1	0	1
3.7 Does the media have good quality?	1	1	1	1
3.8 Does the voice sound natural?	1	1	0	1
3.9 Does the app have push feature?	0	1	0	0
3.10 Is all the app available offline?	0	0	0	0
3.11 Is the length of each lesson within the recommended time for MALL materials?	1	1	1	1
3.12 Is the quantity of information per screen balanced?	1	1	0	1
3.13 Is the information per screen well hierarchized?	1	1	1	1
3.14 Does the app have a good use flow, presenting clear icons and directions for the user?	1	1	1	1