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**RESOURCE-BASED ELECTRONIC FEEDBACK AND ITS EFFECT ON
THE PRODUCTION AND PERCEPTION OF THE ENGLISH CONSONANTS
<r> AND <h>**

Florianópolis
2019

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Orientadora: Profa. Dra. Rosane Silveira.

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O presente trabalho em nível de mestrado foi avaliado e aprovado por banca examinadora composta pelos seguintes membros:

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Certificamos que esta é a **versão original e final** do trabalho de conclusão que foi julgado adequado para obtenção do título de “Mestre em Inglês: Estudos Linguísticos e Literários” e foi aprovado em sua forma final pelo Programa de Pós-Graduação em Inglês.

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To all English teachers who have Brazilians as learners.

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“Some human beings do have God within. We can see it,
when particles of their actions reverberate and overbrim.”

(Karine Pinto Manfé, 2019)

RESUMO

Considerando as dificuldades que os brasileiros aprendizes de inglês têm em produzir e perceber /ɹ/ e /h/ como duas consoantes distintas, vinte aprendizes do nível um de inglês foram avaliados com o uso de um teste de produção, um teste de discriminação e outro de identificação, realizados em um laboratório. Dez alunos formaram um grupo de controle e dez alunos formaram o grupo experimental. Inicialmente, os pré-testes foram aplicados para identificar o desempenho dos alunos em cada um dos testes. Em seguida, o grupo experimental recebeu *feedback* corretivo incluindo recursos áudio/vídeo/ortográficos enviados por e-mail, a fim de verificar o efeito dessa intervenção nos resultados pós-teste. Os dados obtidos nos pré-testes revelaram que ambos os grupos foram bem sucedidos em discriminar /ɹ/ e /h/ como dois segmentos diferentes. No entanto, mais de 90% dos participantes produziram e identificaram /ɹ/ e /h/ incorretamente. Além disso, os resultados do pós-teste revelaram que o grupo que recebeu *feedback* sobre a pronúncia obteve melhora substancial nas médias de produção e de identificação, com resultados estatisticamente significativos para produção. Além disso, as respostas dos questionários dos participantes revelaram que o *feedback* com recursos foi considerado útil e apreciado pelos alunos do grupo experimental.

Palavras-chave: Feedback. Produção. Percepção. Consoantes /ɹ/ e /h/ do inglês.

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ABSTRACT

Considering the fact that many Brazilian learners of English display difficulties in producing and perceiving /ɹ/ and /h/ as two distinct English consonants, twenty level-one learners of English as a Foreign Language (EFL) were assessed with the use of a word reading production test, a same/different discrimination test, and an identification test in a laboratory setting. Ten learners were assigned to a control group, and ten to an experimental group. Initially, pretests were administered in order to identify learners' performances on each test. Then, the experimental group was provided with corrective feedback including audio-video-orthographic resources sent by e-mail in order to verify the effect of this intervention in their posttest outcomes. The data obtained from pretests revealed that both groups were successful in discriminating /ɹ/ and /h/ as two different segments. However, more than 90% of the participants misproduced and misidentified /ɹ/ and /h/. Moreover, post test results revealed that the group receiving feedback obtained the largest mean improvement in the production and in the identification mean scores, showing significant differences for production in statistical tests. In addition, the answers from participants' questionnaires revealed that feedback including self-study resources was considered useful and it was appreciated by learners from the experimental group.

Keywords: Feedback. Production. Perception. English consonants /ɹ/ and /h/.

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LIST OF ABBREVIATIONS

ASR – Automatic Speech Recognition

BP – Brazilian Portuguese

CALL – Computer Assisted Language Learning

CAPT – Computer Assisted Pronunciation Training

CF – Corrective Feedback

COCA – Corpus of Contemporary American English

EFL – English as a Foreign Language

ESL – English as a Second Language

FONAPLI – Laboratório de Fonética e Fonologia

L1 – First Language

L2 – Second Language

P – Participant

RBF – Resource-based Feedback

SD – Standard Deviation

SPSS – Software Package Statistics Analysis

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CHAPTER I

INTRODUCTION

Apart from Sign Languages, the idea of communication is deeply related to the presence of sounds either produced (spoken) or perceived (heard) by their language users. Despite the variations inherent to all languages, once speakers communicate by using the same first language (L1), different pronunciations rarely cause miscommunication. However, this is not the case when speakers need to use a second language to interact, for instance, when people who speak different L1s use English as the main international language worldwide for communication (JENKINS, 2001). Since most English speakers are non-native, understanding and being understood can sometimes be troublesome when certain mispronunciations occur during oral interactions. Very often, these mispronunciation patterns may result from learners carrying certain features from their L1 phonetic-phonological system to the second language (L2)¹ being spoken (FLEGE, 1995; MAJOR, 1999; ODLIN, 1989).

Regarding the mispronunciation patterns Brazilian learners of English as a Foreign Language (EFL) are more likely to produce, there have been some previous studies (e.g., Baptista, 2001; Walker, 2010) and even books (eg., GODOY, GONTOW & MARCELINO, 2006; ZIMMER, SILVEIRA & ALVES, 2009) highlighting their most probable challenges concerning the English phonological system. Some of the cases explained by these researchers are phonological processes such as consonant substitutions (e.g., saying <shop>²/ʃɑ:p/ when attempting to say <chop> /tʃɑ:p/ or <hug> /hʌg/ when attempting to say <rug> /rʌg/) and epenthesis (e.g., saying /tʃɑpi:/ when attempting to say /tʃɑp/ or by saying /hʌgi:/ when attempting to say /hʌg/). My experience as an English teacher has also shown that Brazilian learners frequently misproduce and misperceive the contrasts of the initial consonants /ɹ/ and /h/, and that is the reason these consonants were selected in this study.

The pronunciation of the English consonants /ɹ/ and /h/ are certainly distinct³. However, when Brazilians attempt to produce words having the retroflex /ɹ/ onset, more than often they produce the glottal fricative /h/. The problem is that English has many lexical items

¹ In this study the term L2 is used to refer to any language acquired after one's L1. Moreover, the terms L2 and foreign language are used interchangeably.

² Written forms will appear between angled brackets, whereas phonetic forms will appear between slashes.

³ Variations on the realizations of the consonants <r> and <h> in English, as well as in BP, are explained in detail in section 2.1.

which contrast by replacing /ɹ/ by /h/ (e.g., ‘rose’ and ‘rabbit’ will become ‘hose’ and ‘habit’). The fact that in Brazilian Portuguese (BP) the orthographic <r> is mostly produced as glottal fricative /h/ in onset position can explain how L1 knowledge affects L2 production (OSBORNE, 2008, 2010) and also how it affects L2 perception (OSBORNE, 2015) of the English consonants /ɹ/ and /h/. Therefore, when teachers notice learners display difficulties distinguishing /ɹ/ and /h/, it is a priority planning ways of assisting them.

Learners can also become responsible for improving their production and perception of English segments, in case they are provided with feedback of their performance. Feedback can be used as a tool for bringing awareness of where to concentrate efforts. There have been several studies showing that feedback is beneficial for learners (Bitchener, 2008; Evan et al., 2011; Leki, 1991, as cited in PETCHPRASERT, 2012) and that corrective feedback is associated with L2 learning because it leads learners to notice L2 forms (Bitchener & Knoch, 2010; Loewen & Erlam, 2006; Lyster & Mori, 2006; Varnosfadrani & Basturkmen, 2009, as cited in PETCHPRASERT, 2012). The effectiveness of Corrective Feedback (CF) is confirmed in experimental studies which deliver feedback during oral interactions in classrooms (eg., Lyster & Saito, 2010; Mackey, 2006; Saito & Lyster, 2012), as well as in investigations on which pronunciation feedback is delivered individually, out of the classroom setting, with the use of computers to mediate this action (e.g., AI, 2015; Hincks, 2003, 2015; Neri, Cucchiaroni & Strik, 2008).

The massive use of computers and access to internet has also enabled learners to practice English outside the classroom setting. The World Wide Web offers innumerable sites with videos, audios, texts, apps, and podcasts freely available to any user. With regard to the use of internet for EFL learning purposes, the results of some studies revealed that: a) learners’ pronunciation developed better when they took part in a web-based training course (Sadeghi & Heidari, 2016); b) students approved the use of teacher-selected websites for EFL learning (Kung & Chuo, 2002); and c) YouTube can be a valuable tool in EFL teaching (Watkins & Wilkins, 2011).

Based on the discussion above and in an effort to incorporate some of those ideas, Brazilian EFL learners’ perception and production of the English consonants /ɹ/ and /h/ were accessed through a production test, a same/different discrimination test and an identification test in a laboratory setting. Then, the experimental group was provided with an intervention plan named Resource-based Feedback (RBF), which included written corrective feedback and

audio visual resources sent by e-mail. The intervention plan was an attempt to guide learners to more accurate productions and perceptions of the English consonants /ɹ/ and /h/.

1.1 Significance of the research

There have been studies attesting that the tendency BP learners have in confusing the English consonants /ɹ/ and /h/ occurs due to transfer from their native language (BAPTISTA, 2001; CRISTÓFARO-SILVA, 2005; OSBORNE, 2008; SILVEIRA, 2008; WALKER, 2010). Within that scope, a few investigations addressed issues concerning BP learners' production of the English consonants /ɹ/ and /h/ in initial position (DEUS, 2009; MORGAN, 2016; OSBORNE, 2010; SCHADECH, 2013); and only two studies focused on the perception of /ɹ/ and /h/ (OSBORNE, 2015; MANFÉ et al., 2018) in initial position. Therefore, due to the lack of research including /ɹ/ and /h/ perception and production tests administered to the same population sample, this study first aim was to reveal how participants performed on both types of test and also how the results relate to language transfer findings from previous studies.

The second aim of this study was concerning the use of feedback to test whether this intervention could assist BP learners in achieving more accurate production and perception of /ɹ/ and /h/ English consonants. Although there have been pronunciation instruction investigations having Brazilian Portuguese EFL learners as participants including feedback as part of their method (e.g., see ALVES, 2004; MARIANO, 2009; RUHMKE-RAMOS, 2009; SILVEIRA, 2016), from the best of my knowledge, none of them tested ways of diminishing novice learners' misunderstandings concerning English consonants /ɹ/ and /h/ with the provision of corrective feedback including audio-video-facial-orthographic input resources sent by e-mail. Thus, the research design adopted here will contribute to enrich literature concerning the issues aforementioned.

1.2 Objectives and Research Questions

The present study objective was two-fold. First, Brazilian learners' perception and production regarding the contrasts of the initial English consonants /ɹ/ and /h/ were verified with the use of three tests. 1) The word-reading production test was administered in order to verify learners' production of /ɹ/ and /h/; 2) the same/different discrimination test tapped into

learners' abilities in perceiving /ɹ/ and /h/ as two distinct sounds; and 3) the identification test examined learners' abilities in identifying /ɹ/ and /h/ phonemes and mapping them to their respective graphemes. The results of those tests would reveal whether the production, the discrimination or the identification test would pose more difficulties to the participants. Moreover, the results of these tests were analyzed in order to verify if production and perception tests display any correlation.

The second objective was to analyze the effects of electronic feedback on the perception and production of the target consonants. Thus, an experimental group received the RBF intervention plan, including the following information: a) written corrective feedback provided via e-mail; b) audio-video-orthographic input with the use of YouTube videos; c) facial-audio-video from the website <http://soundsofspeech.uiowa.edu>; and d) audio input activities adapted from the book *Pronunciation Instruction for Brazilians* (ZIMMER et al., 2009).

Based on the information presented so far, the following four research questions guided the study:

1. How do Brazilian EFL learners' from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the pretests?
2. How do Brazilian EFL learners' from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the posttests?
3. How do Brazilian EFL learners' from the experimental and control groups differ in performance in the production and perception from pre to posttests regarding the English consonants /ɹ/ and /h/?
4. Is there a correlation between the perception and production of the English consonants /ɹ/ and /h/ in pre and posttests?

1. 3 Organization of the Study

With the research questions stated above, the following chapter will present the theoretical framework in the review of literature. Chapter III outlines the research method describing the materials, the procedures used to collect the data and also details concerning

the participants. The data obtained is reported and discussed in Chapter IV. At last, Chapter V draws on the main findings of the present study and brings discussions regarding its limitations, as well as some pedagogical implications and suggestions for further research.

CHAPTER II

2. REVIEW OF LITERATURE

This chapter comprises two major sections. On the first, the concept of language transfer is discussed by interconnecting it to previous studies regarding BP learners' production and perception of the English consonants /ɹ/ and /h/. Moreover, the Brazilian Educational system regarding the teaching of English as a foreign language is explained in order to illustrate how its structure relates to language transfer implications. On the second section, feedback is broadly explained in order to demonstrate its uses as an effective EFL teaching and learning tool. Within that section, the notions of noticing and its relation to corrective feedback (CF) will be addressed. Furthermore, there is a subsection including a review of previous studies on which computers were used for providing pronunciation feedback outside the classroom setting. Initially, the discussions include studies based on Computer Assisted Language Learning (CALL) systems, and later the focus is on the use of web resources and the types of input they can provide in terms of pronunciation learning.

2.1 Language Transfer and the Consonants /ɹ/ and /h/ in Onset Position

For the purpose of this investigation, the concept of language transfer facilitates interpretations of the outcomes Brazilian EFL learners displayed in the experiments. Language transfer is defined by Odlin (1989) as “the influence resulting from the similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired” (p.27). Sometimes learner's difficulties may appear because the phoneme is not even part of the learner's L1 inventory (e.g., the dental fricatives [θ] and [ð] are not part of BP). Other times the L1 and L2 have the same sounds; however, they differ in their status (phonemes or allophones) and/or in the way they are graphically represented and this can cause the confusion (further explained below). On that account, when analyzing the sound inventory of two languages it is essential to have in mind that vowels and consonants can be produced, perceived, and orthographically represented by relying on learner's L1 prior knowledge of these items (FLEGE, 1995; MAJOR, 1999; ODLIN, 1989).

In BP, as well as in English, there are words beginning with the consonants <h> and <r>. However, in BP the consonant grapheme <h> in onset position is always silent (e.g.,

hora /ɔrɐ/ (hour), *honra* /ɔɐ/ (honor), *hospital* /ospitaw/ (hospital)), while in English, although it can sometimes be silent (e.g., ‘hour’ /aʊər/, ‘honor’ /ənər/), it is most of the time pronounced as a glottal fricative (e.g., ‘hello’ /hələʊ/, ‘hospital’ /hɒspɪtəl/). When attempting to produce English words such as ‘home’ and ‘hospital’, Brazilian speakers do not seem to show major difficulties pronouncing them accurately as a glottal fricative. The difficulty is when Brazilian EFL learners encounter the retroflex /ɻ/, which is often mispronounced as the glottal fricative /h/ (BAPTISTA, 2001; CRISTÓFARO-SILVA, 2005; OSBORNE, 2010; WALKER, 2010).

While in BP the most common pronunciation of the <r> grapheme is glottal fricatives [h, h̥]⁴, in English it is majorly produced as a retroflex approximant /ɻ/ in onset position⁵ (CRISTÓFARO-SILVA, 2005; DELATTRE & FREEMAN, 1968; YAVAS, 2011). In other words, Osborne (2015, p. 158) explained that “whereas in English the phonemes /h/ and /ɻ/ are represented by the two graphemes <h> and <r>, respectively, in BP the two sounds are conventionally represented with the same grapheme <r>” when in onset position. The tendency that Brazilian speakers have of producing the glottal fricative instead of producing a retroflex may be justified by the fact that /h/ is the most common pronunciation of the <r> grapheme in word-initial position in BP.

As previously mentioned, these two phonemes have a high functional load (BROWN, 1988), since many pairs of words in English will differ in meaning only by replacing /ɻ/ by /h/ (e.g., hat/rat, hay/ray, home/Rome, hose/rose, hug/rug)⁶, what may justify the reason for quite a few studies investigating the tendency BP learners have in confusing these consonants. Within the studies addressing issues concerning /ɻ/ and /h/, most researchers focused on BP learners’ productions (DEUS, 2009; MORGAN, 2016; OSBORNE, 2010; SCHADECH, 2013) and two other studies on their perceptions (OSBORNE, 2015; MANFÉ et al., 2018).

With the use of a reading task including cognates and non-cognate words, Deus (2009) conducted a study to investigate whether there would be more transfer in the case of cognates. The participants were thirty Brazilian English language university students classified according to ALTE framework as A2, B1 and B2. Their production, in Portuguese and

⁴ Christófaró-Silva (2010) explains that the most common Brazilian pronunciation of the orthographic <r> in onset position is glottal fricatives [h, h̥], but a trill [r̄], as well as a flap [ɾ] can also be found in some dialects.

⁵ Apart from the voiced post alveolar approximant [ɻ], which is the most common realization of the <r> grapheme in onset position, other regional variants realizations, such as a trill [r̄] is often considered typical of some Scottish types of English, and also a tap [ɾ] occurs in Liverpool and Newcastle (Cruttender, 2008).

⁶ Corresponding Phonetic transcription: (hæt/ræt, heɪ/reɪ, hoʊm/roum, hoʊz/rouz, hʌg/rʌg)

English, were analyzed auditorily and the results revealed that 40% of the participants' outcomes indicated transfer in 40% of the words. From those words, 33,34% were cognate words and 6,66 were not. The researcher reported expecting a higher percentage of transfer in the results; however, he stated that the findings may be attributed to the facility of the task.

Likewise, Morgan (2016) used a sentence reading task in English and Portuguese in order to investigate the production of rhotic sounds in onset position. Her research counted with 10 beginners and 10 intermediate students. The results of her research showed that Brazilians learners have difficulties pronouncing the rhotic sounds in English, mainly beginners, who had displayed more non-target productions than the intermediate students. Moreover, she reported observing that the participants produced the rhotic as both retroflex approximants and fricative variants in English.

The objective of Schadech's study (2013) was to investigate how Brazilians non-target productions of /ɹ/ could affect intelligibility and comprehensibility when they were heard by other Brazilians and by native speakers of English. The participants read some sentences including target and non-target productions of words beginning with /ɹ/. The overall results revealed that the replacement of /ɹ/ by /h/ hindered intelligibility and comprehensibility according to both listeners. Furthermore, the researcher reported that the words "rug" and "rated" were most frequently pronounced with a non-target pronunciation of /h/ in onset position.

Osborne (2010) carried out a study to verify the production of /ɹ/ by three Brazilian students of English who were living in New York from 45 days to 6 years. Differently from the previous studies on production reported above, in Osborne's research participants were asked to speak freely about any subject and were recorded while speaking. The aim of her study was to relate the findings of different pronunciation patterns displayed by participants to possible theoretical explanations (the Markedness Differential Hypothesis (Eckman, 1977), the Structural Conformity Hypothesis (Eckman, 1991) and The Speech learning Model (Flege, 1995)). Osborne (2010) concluded that The Speech learning Model (Flege, 1995) appeared to explain much of the participants' difficulty, since learners were not able to separate their L1 and L2 phonetic subsystems. Moreover, the data obtained revealed that 3 out of 4 occurrences were produced as a fricative.

Another research by Osborne (2015) examined whether Brazilians (English learners and monolinguals) perceived the distinction between the English /h/ and /ɹ/ in onset position. The study included discrimination, identification and cross-language assimilation tests. The

results of the study revealed that a) in the discrimination test, both high and low proficiency learners managed to successfully distinguish between the two English phonemes; b) in the identification test, the high-proficiency learners outperformed low-proficiency learners; and c) in the cross-language assimilation test, high-proficiency learners and the monolinguals matched the target English sounds to two different categories in Portuguese, thus indicating that they perceive the English /h/ and /ɹ/ as different categories. However, low-proficiency learners assimilated both /h/ and /ɹ/ to Brazilian Portuguese /h/ and /ɹ/ without distinction. According to her, the fact that lower learners performed worse can be explained by the difficulty that beginners have in associating a familiar sound in their L1 to a new phonetic environment in the L2 being learned.

With the use of a picture elicitation L1 production task, a background questionnaire and an L2 Transcription Perception Task, Manfé et al. (2018) investigated fifteen Brazilian learners of English from different levels. The aim of the study was to analyze whether participants L1 rhotic production variations in onset position had a possible Cross Linguistic Influence in their perception of the English glottal fricative /h/. Participants' experience with English and its correlation with their perception of the English glottal fricative /h/ were also verified. The data obtained revealed that all of them produced L1 rhotics as glottal fricatives, and more than 70% of them transcribed the English words beginning with <h> using <r>. Furthermore, results showed that there was a positive correlation between experience with the L2 and correct perception of the glottal fricative as a rhotic in onset position.

2.2 Language Transfer and English Teaching in Brazil

Another important key for understanding learner's outcomes and basic needs is to take into account their EFL context of learning. Most Brazilians are late L2 learners, since Brazilian laws establish that FL studies should be introduced in public schools when students are approximately 10 years old (BRASIL, 1998). As a consequence, it seems that L1 transfer is more likely to happen because these learners' L1 is already fully acquired and stable at the time FL studies begin, making it harder for them to detect phonetic and phonological differences between both languages (FLEGE, 1995). Regarding learners' age, Schmidt (2010) emphasized that adults seem to require some level of conscious attention in order to acquire some aspects of a foreign language, justifying this way the need for explicit instruction in the case of the pronunciation component.

Only very recently, Brazilian educational regulations have emphasized that the practice of oral skills in the EFL being learned should be prioritized (BRASIL, 2017). However, for the past years emphasis has been given to reading and writing skills. Consequently, this high contact with English orthography without relating it to the pronunciation of what is written may have influenced Brazilian learners to rely on L1 transfer to pronounce English words (ZIMMER, 2004). Concerning the English textbooks adopted in schools, there is no specific instruction informing learners to focus on the segments which Brazilians are more likely to misproduce and misperceive. In this regard, Silveira (2016) argues that the books for teaching EFL classes should take into account the L1 of the country where it will be used, since “literature in the field of second/foreign language acquisition shows that the learners’ L1 is a major factor in the acquisition of the L2 phonetic-phonological system (e.g., Flege 1987; Baptista, 1992)” (p.33).

Having briefly discussed the concept of language transfer and how it may relate to BP learners outcomes and their EFL learning context, I shall now turn the discussion to the use of feedback as a learning tool.

2.3 Feedback as a Learning Tool

Feedback is defined by Hattie and Timperley (2007) as “information provided by an agent with respect to one’s performance or understanding” (p.81). Therefore, feedback can be given and received in any field which involves performance, and a basic idea is that upon receiving effective feedback, an individual could improve future performances. Feedback processes include: a) receivers, b) providers, c) feedback itself, d) the receivers’ stage before feedback is given, e) the receivers’ stage after feedback is given, and f) the outcomes (Boekaerts Simons, 1995; Mory, 2003; Scheeler, Ruhl & McAfee, 2004; as cited in THURLINGS et al., 2013, p. 3)

Regarding feedback and its relation to learning theories, Thurlings et al (2013) conducted a study to determine to what extent behaviorism, cognitivism, social cultural theory, meta cognitivism and social constructivism influence characteristics of effective feedback. According to them,

From social cultural theory, meta cognitivism, and social construtivism, it is important that feedback supports learners *to become familiar with the standard aimed for, to know the gap between their actual and the desired performance, and then to close this gap* (Gibbs & Simpson, 2004; Nicol &

McFarlane-Dick, 2006; Pomoky & Pickford, 2010; Sadler, 1989). *This reflects the learning to learn ideas from meta cognitivism.* [emphasis added]. (p.8)

Moreover, Thurlings et al (2013) argue that on “meta cognitivism teachers guide learners in their (self-regulated) learning processes, such as planning and *monitoring, and the learners are responsible for their own learning* [emphasis added] (p.4). As explained by those authors, it is noted that in order for feedback to be effective learners need to have a clear understanding of what language component they need to improve, and they also need to be given examples of desired performances, as well as be given opportunities for self-study initiatives towards the specific aspect on which improvement is needed.

According to Hattie and Timperley (2007) Corrective Feedback (CF) is the most common type of feedback, and it is often called feedback about a task. They highlight that CF or knowledge of results can relate to correctness, neatness, behavior, or some other criterion related to task accomplishment. The term CF was also defined by Lightbown and Spada (1999) as “an indication to the learners that their use of the target language is incorrect” (p. 171). CF can be delivered in an explicit or in an implicit way. Basically, in the former learners are aware of what is being learned, while in the later they are not (DeKeyser, 2003; Norris & Ortega, 2000; Schmidt, 1994; as cited in LYSTER & SAITO, 2010).

Still according to Lyster & Saito (2010), Spada and Tomita (2010) made a Meta analysis comparing 41 studies and the results showed that the effects of explicit instruction were more effective than implicit instruction on the acquisition of simple language features and also on the acquisition of complex language features in English. Moreover, the effectiveness of explicit instructional treatment over implicit instructional treatment was confirmed not only in laboratory studies but also in classroom studies (Dekeyser, 2003; Goo et al, 2009; Norris & Ortega, 2000; Spada, 1997; as cited in LYSTER & SAITO, 2010).

The availability of CF (be it implicit or explicit) directs learners’ attention to what needs to be modified in their performances regarding the target language in use. Since providing CF is a way of making learners attentive to particularities of their task performances, it is deeply related to the noticing hypothesis by Schmidt (2010), on which he emphasizes that “attention must be directed to whatever evidence is relevant for a particular learning domain” and that “noticing is necessary for second language learning”. In addition, he defines “noticing as a technical term limited to the conscious registration of attended specific instances of language” (p.725). Furthermore, De Vries et al. (2011) also make considerations about the connection between CF and noticing:

While the level of conscious awareness for noticing is debated (Ellis, 2005), the assumption that noticing a feature in the input is a first step in language acquisition shared by several researchers (for an overview see Cross, 2002). This suggests a potentially important role for CF to facilitate noticing and focusing learner attention on errors and correct L2 forms. (p.5)

Mackey (2006) conducted a study to investigate whether feedback promoted noticing of L2 forms in a classroom context and whether there was a relationship between learners' reports of noticing and their outcomes. The results indicated a positive relationship between interactional feedback in the classroom, learner's reports about noticing and their subsequent L2 development. Furthermore, Saito and Lyster (2012) have tested the effects of CF on L2 pronunciation development of the consonant /r/ by Japanese EFL learners in their investigation and their findings revealed that a communicative focus on phonological form can benefit L2 pronunciation development. Their investigation showed that the impact on learners' interlanguage development was apparent at a controlled and at a spontaneous speech level.

There have been studies reporting a positive relationship between various types of feedback and L2 production and learning (e.g., Oliver, 200; Ellis et al.2001a, 2001b; Mackey et al.2003, as cited in MACKEY, 2006, p.406). When comparing CF which is delivered in group classrooms with CF which is delivered in individual settings, the latter has two advantages: Firstly, it focuses on each learner's individual needs and his/her understanding of what aspect exactly is being corrected (HAN, 2001). Secondly, when CF is delivered in private it prevents possible embarrassment on the learner's part, who may dislike being corrected and interrupted in public (STRIK et al., 2009) during interactions.

2.4 Pronunciation Feedback outside the Classroom Setting

Giving individualized attention in a classroom with many learners is certainly time-consuming. Fortunately, the use of computers allied with the access to internet can assist educators in implementing a more viable plan. There are few studies which emphasize the provision of pronunciation feedback delivered individually, and the majority makes use of Computer Assisted Language Learning (CALL) to mediate this action (e.g., AI, 2015; HINCKS, 2003; NERI, CUCCHIARINI & STRIK, 2008). Hincks (2015) explains the benefits of using computers for pronunciation purposes: “[They] can allow training to be individualized and maximized. Specific exercises can be selected to meet a learner's

particular problems. The opportunity to practice is not limited to the time a teacher is available, and since a computer is infinitely patient, the time on the task can be increased” (p. 505).

According to Hincks (2015), the field of pronunciation training has a long tradition of embracing new technologies. Automatic Speech Recognition (ASR) in Computer Assisted Pronunciation Training (CAPT) systems has delivered automatic feedback on the quality of phoneme production since the 90’s. The following extract adapted from Hincks (2015), brings a brief explanation about these systems:

In a typical ASR-based CAPT system, a prompt will be given to the student, who can then choose a response from a limited set. One way to do this is to present a number of alternatives that the student basically can read up, and another is to design questions that can be answered only in very limited ways. ... A well-designed CAPT system (Cucchinari, Neri & Strik, 2009) has predetermined pedagogical priorities as to what sounds are most important to give feedback on, based on their functional load within the language. (p.512).

Undoubtedly, computer programs can successfully provide feedback on the perception and production of learners, in the form of telling whether a response is correct or not. This is a first step for assisting learners. However, knowing an answer is incorrect may not be enough to make learners act towards the necessary changes for improving their performances.

Another relevant piece of research, which investigated the effectiveness of computer-based speech corrective feedback for improving segmental quality in L2 Dutch, was conducted by Neri, Cucchiari and Strik’s (2008). Their research included 30 immigrants who were adult beginner learners of Dutch, with different mother tongues. The participants were assigned to three groups: one used ASR-based CAPT system with automatic feedback, another used ASR-based CAPT system without feedback and the other used no CAPT system. The training procedure for the two groups of CAPT system included four individual sessions (one per week), lasting from 30 minutes to 1 hour. The feedback provided consisted in displaying on the screen, the orthographical transcription of the utterance pronounced by the learner together with a smiley and a short written comment: either saying “you had a problem with the red sound(s), listen again to the example and try again!” or “well done! Try the next utterance.” Although the groups’ mean improvements did not differ significantly, results showed that the group receiving ASR-based feedback made the largest mean improvement.

More recently, a new method of automatic error detection in CAPT (AI, 2015) targeted German learners of British English. In the method, learners try to imitate a sentence

after they listen to a model. In case the system detects phoneme errors, it classifies if the phone errors occur due to a phoneme deletion, insertion, substitution or distortion. Then, learners are provided with feedback displayed in the form of a text informing the learner how to improve their pronunciation. For instance, “tongue needs to be slightly further forward”. The results of the research showed very high accuracy in detecting error types as deletion, insertion and substitutions. However, according to the researcher, feedback still needs to be improved in many aspects. For instance, the importance of distinguishing beginners from advanced learners, since each level needs different feedback approaches. Moreover, the researcher recognized that the availability of video tutorials for showing learners how to articulate difficult sounds would benefit them.

In order to be more effective, it seems that feedback must be accompanied with a variety of input types (e.g. textual, auditory, visual-articulatory). The importance of providing videos as a way of assisting learners in improving their pronunciation with the availability of feedback is also reinforced in Hattie’s (1999) synthesis of 74 meta-analyses. His database included information about feedback across more than 7,000 studies, and it demonstrated that the most effective feedback about a task performance included instruction providing cues in the form of video, audio, or computer-assisted instructional (as cited in HATTIE & TIMPERLEY, 2007, p.84).

For the time being, ASR-based CAPT systems seem to be a promising field for the learning of second language pronunciation where CF is provided individually. Yet, the technology employed is costly and it will certainly demand much time from linguists and professionals from speech technology in order to find ways to create a more optimal learning condition that includes a variety of languages to feed these systems, as well as, a variety of input types to better guide learners to desired pronunciation performances. As Hincks (2015) concludes “Until the research challenges for automation are solved, teachers are encouraged to work with students individually or in small groups, using proven methods to raise pronunciation awareness.” (p.516)

2.5 The World Wide Web for EFL Learning Purposes

Shifting discussion to the access to internet, the World Wide Web is another source of resources that has enabled learners to practice English outside classrooms. In Brazil, according to a 2016 census by the Brazilian Institute of Geography and Statistics (IBGE) more than 64% of the population has access to the internet. And since the internet offers

innumerable sites with videos, audios, texts, apps, and podcasts freely available, the Web can become educators' ally in providing a variety of input types as resources for improving pronunciation.

Kung and Chuo (2002) carried out a study to evaluate a program aimed at familiarizing students with English as a Second Language (ESL) websites already available on the internet. 49 students majoring in French and minoring in English at a technological college of languages in Southern Taiwan filled out an anonymous questionnaire in their native language inquiring how they perceived learning English through the teacher-selected websites. The results showed that students considered the Internet a useful tool to supplement in-class instruction and also that learning English through teacher-recommended ESL websites was deemed appropriate.

Another research that focused on the use of websites for pronunciation purposes was Sadeghi and Heidar's (2016). They investigated the effect of using phonetic websites on Iranian EFL students' pronunciation and knowledge of phonemic symbols. Thirty pre-intermediate learners from control and experimental groups were asked to answer the question of phonemic symbols in 10 minutes, and were supposed to write the phonetic transcription of 20 underlined words. Then, they were asked to read 20 words and were evaluated by two raters. The experimental group took part in 10 sessions of website-based teaching of pronunciation, while the control group received no training. The results of statistical analysis comparing pre and posttests revealed that the experimental group did not outperform the control group concerning the knowledge of phonemic symbols; however, they had a much better pronunciation performance in comparison with the control group. According to the authors,

The results seem to indicate that students were able to see the correct way of pronouncing the letters through web-based learning and were able to articulate them in the best way[, suggesting that]... learning via internet is an alternative... [that]... encompasses a significant and unlimited amount of educational material that remodels teaching methodology. It is a means to shift from traditional teacher-centered classroom to learner-oriented environment. (SADEGHI & HEIDAR, 2016, p. 36)

The research aforementioned did not include detailed information of the specific web-based teaching materials used. Nevertheless, concerning the use of web-resources which include phonemic symbols to assist learners in their pronunciation learning of EFL, there is the website Sounds of Speech designed by the University of Iowa⁷. The site illustrates the

⁷ <http://soundsofspeech.uiowa.edu>

features of consonants and vowels in American English with the use of animations, flash videos depicting the mouth of a person producing sounds, audio samples and examples of words with the segments in different syllable positions with the possibility of clicking on a button to listen to the words. Moreover, APP paid versions for Android & IOS are also available for learners.

A further online resource which is popular, user friendly and costless is YouTube. This online video repository can serve as an educational supply. It has the advantage of providing different input types, such as audio, image and text of the features being studied. In a paper addressing ways teachers can use YouTube as a vast online EFL audiovisual resource that can enhance conversation, listening, and pronunciation skills, Watkins and Wilkins (2011, p. 113-115) highlight this media's advantages:

- 1) Its videos can be utilized as realia to stimulate cultural lessons;
- 2) It can promote a way of exposure to World Englishes;
- 3) Authentic vocabulary development is provided;
- 4) It stimulates learners' autonomy, since learners can determine which pronunciation and conversation skills are desired and in their own time attempt to acquire them by choosing to view a clip; and
- 5) YouTube could supply a particular kind of clip or channel that is interesting or useful for the topic being developed in the learners' EFL class.

Additionally, Watkins & Wilkins (2011) advise that “given the vastness of the YouTube library, a certain amount of structuring and guidance from teacher might be necessary in order to prevent students from spending unproductive hours perusing the site (p.118).”

As previously explained, the use of costless online resources can motivate self-study initiatives. And, the fact that learners will learn how to find these resources may also instigate them to search for other online sources that provide additional learning regarding English pronunciation.

2.6 Summary of the chapter

It was seen in this chapter that the tendency that Brazilian speakers have of producing the glottal fricative instead of producing a retroflex may be justified by the fact that /h/ is the most common pronunciation of the <r> grapheme in word-initial position in BP. Moreover,

previous studies addressing BP learners' productions and perceptions of /ɹ/ and /h/ were discussed in order to show how their findings relate to language transfer issues. In addition, the context of the Brazilian Educational system regarding the teaching of English as a foreign language was explained and related to language transfer implications.

Furthermore, the focus shifted to discussing previous studies on pronunciation feedback delivered outside the classroom setting in order demonstrate its uses as an effective EFL teaching and learning tool. It was pointed out that YouTube can be used as an online EFL audiovisual resource that can enhance pronunciation skills, since it has the advantage of providing different input types, such as audio, image and text of the features being studied. The following chapter presents the method adopted in order to carry out the present investigation on the effect of resource-based feedback on the production and perception of the English consonants /ɹ/ and /h/.

CHAPTER III

3. METHOD

This chapter presents respectively, a) a brief overview of the instruments used in this study and the research questions; b) the pilot study; c) information regarding the participants and their context of investigation; d) data collection procedures; f) words selection criteria g) Resource-based Feedback intervention; and h) data analysis.

3.1 Instruments and Procedures Overview

The following instruments were used to collect data from participants from the control and experimental groups: 1) a questionnaire to obtain personal and linguistic information from the participants; 2) a word-reading production test in order to verify learners' abilities in producing /ɹ/ and /h/; 3) a same/different discrimination test, which tapped into learners' abilities in perceiving /ɹ/ and /h/ as two distinct sounds; and 4) an identification test, which examined learners' abilities in identifying English /ɹ/ and /h/ and mapping them to their respective graphemes.

The tests were always presented in that same order: production test, discrimination test, and identification test, respectively. There were two reasons for this procedure. Firstly, since the main interest was in verifying the need of feedback regarding the production of /ɹ/ and /h/ in the pre-tests, the production test needed to be administered first in order to avoid testing effects (e.g., WHEELER, EWERS & BUONANNO, 2003). It could be that in case participants completed the perception tests before production, learning from those previous tests would promote better productions. The second reason for maintaining that same order of tests for all participants is that presenting the tests in different orders would create one more variable, which is not desirable in this study.

The experimental group has received RBF intervention (described on section 3.7). Moreover, they were given a questionnaire to verify their opinion on the feedback process received. The interval time of each of the four phases: pretest, electronic feedback, and posttest had an interval of a minimum of two days and a maximum of seven days from one to another. Therefore, the complete cycle lasted a minimum of seven days and a maximum of 28 days (mean: 17 days). This variation depended on each participant's schedule availability for pre-test, replying to feedback e-mails and posttest session.

The posttest session for the control and experimental groups included the same tests used in the pre-test session, namely the word-reading production, the same/different discrimination and the identification tests. Table 1 below shows an overview of the instruments and the following sections explain the details concerning the procedures.

Table 1 - Instruments Overview

Pre-Test Session	Feedback Intervention*	Post-Test Session
Background Questionnaire	E-mail 1	Feedback Questionnaire*
Production Test	E-mail 1 Reply	Production Test
Same/Different Discrimination Test	E-mail 2	Same/Different Discrimination Test
Identification Test	E-mail 2 Reply	Identification Test

Source: Elaborated by the author (2019)

Note: * Experimental group only

The methodological choices displayed above were designed with the purpose of answering the following research questions:

1. How do Brazilian EFL learners from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the pretests?
2. How do Brazilian EFL learners from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the posttests?
3. How do Brazilian EFL learners from the experimental and control groups differ in performance in the production and perception from pre to posttests regarding the English consonants /ɹ/ and /h/?
4. Is there a correlation between the perception and production tests of the English consonants /ɹ/ and /h/ in pre and posttests?

3.2 Pilot Study

A small-scale pilot study was conducted by the researcher in order to test: 1) whether the consent forms and questionnaires were well designed to provide and obtain the information needed for the study; 2) whether production and perception tests designed were

appropriately working and providing the expected material for the data analysis; 3) how much time each participant would need in order to complete the whole process; and 4) whether feedback and resources which would be provided to the experimental group would work properly.

Four Brazilians participated in the pilot, which was administered in February 2018 in Florianópolis. The findings of the pilot revealed that some questions from the questionnaires needed to be adapted in order to obtain the expected information. Moreover, it was observed that some participants incidentally skipped a few questions, thus the researcher would need to be attentive to prevent that from happening. Concerning production and perception tests, it was important to instruct participants orally and also to show the test in the computer screen beforehand in order to make the participants more confident and comfortable with the testing situation. The pilot also provided information about the estimated duration of the data collection: the whole process of collecting signatures, filling out questionnaires and taking the production and perception tests lasted approximately 25 minutes.

Initially, the intervention process including feedback with resources would be inserted in a PowerPoint Presentation made available on the virtual Platform Moodle. However, many errors occurred in the platform either when attempting to insert the videos or when attempting to play them. Therefore, feedback intervention was tested by sending the links and audio files via e-mail and this way proved to work properly and it was also practical. In case participants did not reply to the researcher's e-mail by sending the information required by the researcher within the time established, the research sent a reminder either by e-mail or via WhatsApp message. Since this procedure showed positive results, it was also adopted as the feedback procedure in the present study – the electronic asynchronous feedback via e-mail. The four phases of the electronic feedback intervention (two e-mails with two replies) lasted approximately 20 days.

3.3 Extracurricular Language Courses as the Context of Investigation

The Extracurricular Language Courses offered at *Universidade Federal de Santa Catarina* are open to the community as a whole, but most of the students are undergraduates and graduates. The languages offered are Arabic, English, French, Italian, German, Japanese, Portuguese for foreigners and Spanish. Each level corresponds to 60-hour classes, taught during a four-to-five-month period. The encounters happen once or twice a week with an average of three-hour-classes per week. The students who wish to attend level 1 are not

required to take a leveling test. However, some students enrolled in level 1 might have taken the leveling test in order to assess their language knowledge and according to their test results they were placed in that level.

The English course in the Extracurricular Program consists of ten semesters: basic (levels 1 to 3); pre-intermediate (level 4 to 6); intermediate (levels 7 and 8); and advanced (levels 1 and 2). Every semester the Program offers approximately 20 groups of the level 1 English class. The students enrolled in this level might be real or false beginners regarding their English proficiency. Most of these students have had previous contact with English in junior high and/or high school, since English is very often the compulsory foreign language taught in Brazilian schools. The quantity of students per class ranges from 6 to 20. Most English Classes are offered two times a week, with each encounter lasting 1 hour and 30 minutes. The material used by them is the book *Interchange 1A*, which covers units 1 to 8. *Interchange* is an American English book series by author Jack C. Richards, which has been used worldwide for more than 30 years.

3.3.1 Participants

Twenty Brazilian Portuguese learners of English participated in this study. They belonged to 14 different groups of level 1 English from the Extracurricular course. The choice of inviting beginners to participate in the study is justified by the fact that the researcher holds the opinion that pronunciation should begin in early levels, so that students would not reinforce non-target-like pronunciation over years of study (BAPTISTA, 2001; SILVEIRA, 2016). Moreover, this choice would contribute to the need for studies that investigate L2 speech learning at initial stages (ZAMPINI, 2008).

Data collection occurred between June and October of year 2018. Each participant was tested individually. By that time, all of them were over 18 years old and had been studying English in the Extracurricular courses for at least one month. The first 10 participants who generated valid data were assigned to the experimental group, since their data collection would take longer (due to the electronic feedback intervention). Then, the next 10 participants who generated valid data were assigned to the control group.

Concerning the personal information reported by the participants in the questionnaire, 15 were females and five were males. Their ages ranged from 18 to 62 years old (mean: 27.6 years). Regarding their education level status, they had already pursued or were pursuing the following degrees: high school (three participants), graduate (eight participants) and

undergraduate (nine participants). More detailed information regarding the Participants' Background is displayed in the individual difference variables subsection 4.7.

3.4 Instruments and Procedures for Data Collection

During the recruiting stage, students enrolled in level 1 of 20 English groups of the Extracurricular language program were invited to participate in the study. Upon acceptance, they received a short form with a brief summary of the research requirements and they were also asked to inform their e-mail and/or cell phone number in order to schedule a day to do the procedures at *Laboratório de Fonética Aplicada* (FONAPLI). It is important to mention that given the fact that participants were EFL beginners from the very first level, Brazilian Portuguese was the only language used when interacting with the participants and also when giving instructions regarding the tests. In this respect, Grosjean (1999) adverts on the use of two languages to do tasks, since participants could activate both their languages and hence being in a bilingual language mode, which could generate interference from codeswitches and borrowings. In an attempt to diminishing this effect, target stimuli tokens were inserted in tests only after three distractor items had been presented, to make participants more immersed in the language being tested.

On the day of data collection, first, the participants received the consent form for control or experimental Group (Appendix A or Appendix B) and the background questionnaire to be read (Appendix C) in order to clear out doubts and to be answered. After finishing this procedure, the researcher collected the data from the three tests as described below.

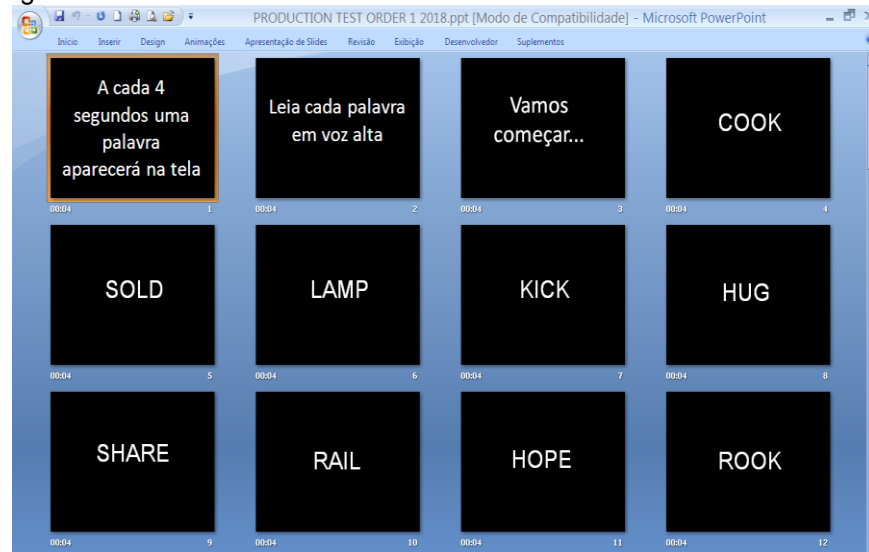
3.4.1 The Production Test

The Production word-reading test (Appendix D) provided data concerning the participants' production of the target consonants. It consisted of isolated words presented in their orthographic forms, which appeared automatically after every four seconds on the computer screen of a PowerPoint presentation. As each word appeared, the participants had to read them aloud while being audio recorded. There were a total of 60 slides in the presentation. The first three and the last one were related to instructions. Each one of the remaining 56 slides contained one word to be read aloud. Within the 56 words, four were used

to familiarize learners with the test format, 24 (12 x 2) were used as target words and 28 (14 x 2) were distracters (see Appendix E).

With the objective of minimizing ordering effect, four different PowerPoint slide orders were constructed. Apart from the instruction and familiarization slides, all words (target and distracters) were presented twice to make sure all target words were produced at least once. Figure 1 shows the screenshot of the first 12 slides of the PowerPoint presentation from which participants read to audio record the production test tokens.

Figure 1 - PowerPoint screenshot of the 12 first slides of the Production test



Source: Elaborated by the author (2019)

Before initiating the production test, the participants went through a familiarization session with the researcher. The session consisted in showing the Powerpoint presentation printed copy (Appendix E) depicting how the test works while the researcher explained that the slides would automatically change every four seconds and that participants would only have to read the words as they appeared. Once participants understood the procedures and had no doubts, the researcher invited them to the acoustic booth, adjusted the headset with the microphone and the production test began.

The specifications of the sound equipment used for recording are as follows: Regarding the hardware, the computer utilized was an iMac (model iMac9.1), version Mac OS X 10.6.8, Intel Core Duo, 2GHz, 4GB 1067MHz DDR3. The sound card model was MOTU UltraLite-mk3 Hybrid (Hybrid FireWire – USB audio interface with on-board effects and mixing) for Mac OS X systems. The microphone was an AudioTechnica PRO 8Hex hipercardioid vocal dynamic (200 - 18,000 Hz frequency). With reference to the software, the

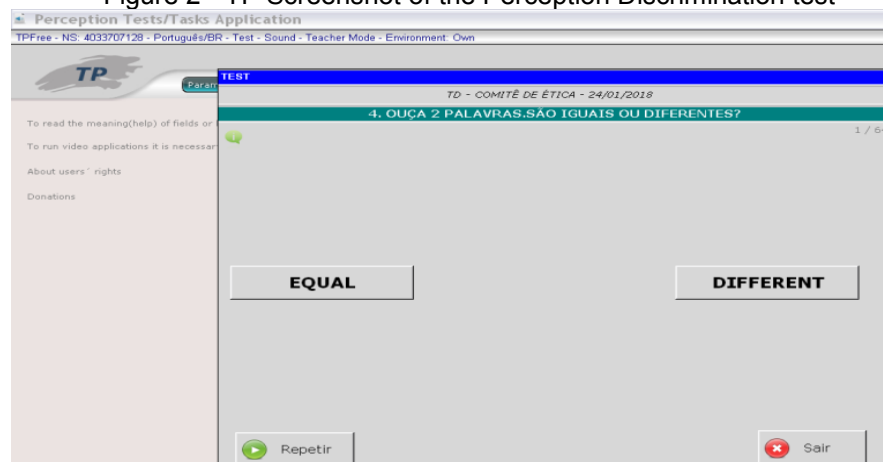
following programs were employed: Ocenaudio version 2 rc 1 (build 5141), with the sampling rate set at 44100Hz, mono, 16 bits, and CueMix version FX 1.6 57985.

3.4.2 The Same/Different Discrimination Test

The same/different discrimination test (Appendix F) was used to assess participants' auditory perception without relating the sound to orthography. It consisted of listening to two words in sequence and then selecting one out of two options to decide if both words were the same or if they were different. The test was presented on the Perception Software program TP (RAUBER et al., 2013) and it was automatically randomized by the program for each participant. The test included 56 minimal word pairs. The first 8 pairs corresponded to the tokens used in the familiarization session, 24 pairs were distracters and 24 were target words starting with /ɹ/ and /h/ (Appendix G). In the discrimination test, there were six /ɹ/ and six /h/ words presented four times each (e.g., rook/hook, hook/hook, hook/rook and rook/rook). Although each word appears four times, each pair corresponds to one stimulus (totalizing 24 tokens).

Before initiating the same/different discrimination test, the participants went through a familiarization session with the researcher. Participants were shown a printed copy depicting the first screen of the test while the researcher explained that they needed to listen to two words and after deciding if the words were 'Equal' or 'Different' they needed to click on one of the two buttons containing these options (see Fig. 2).

Figure 2 - TP Screenshot of the Perception Discrimination test



Source: Elaborated by the author (2019)

During the familiarization session, the participants were also informed that in case they had doubts, they could listen to the stimuli one more time by clicking on the button ‘Repetir’ (see Fig.2). Furthermore, they were shown another printed copy (Fig.3) of a pop out window that appears during the tests in the TP software, and they were instructed to click on the button ‘ok’ when that happened, so that the test would continue.

Figure 3 - TP Screenshot of the Perception Discrimination test pop out window



Source: Elaborated by the author (2019)

After the researcher made sure participants had no doubts concerning the test procedures, they adjusted the headphones to begin the test. On the first screen participants wrote their names (Fig.4) and after that, they clicked the button ‘ok’ and another screen showed the options of selecting Discrimination or Identification test.

Figure 4 - TP Screenshot of the test space to type Participant's name



Source: Elaborated by the author (2019)

As soon as the Discrimination test was selected, the first two words were played and the main screen of the test (Figure 2) was displayed.

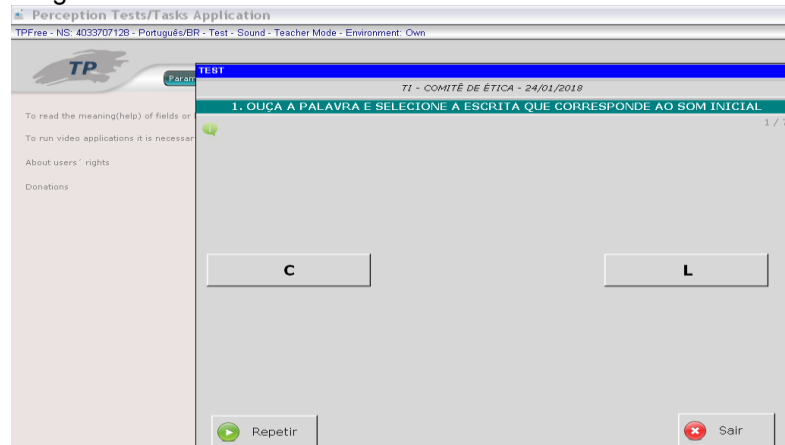
The set of equipment used to collect data for perception tests were as follows: The computer was an Acer notebook (model 4720Z), Windows 10 Pro, Intel Dual-Core T2390, 1,86 GHz, 2MB. The headphone was a Behringer HPX2000 and the mouse was a wired Microsoft model 1020. With reference to the software, the program employed was the TP (Teste/Treinamento de Percepção) Worken software, 3.1 version10. Rauber, Rato, Kluge and Santos (2013) created this free software and the tutorial that teaches how to operate it, and the program was developed by Marcos Figueiredo. The TP worken software allows the creation and application of perception tests/tasks using audio and audiovisual stimuli.

3.4.3 The Identification Test

The Identification test (Appendix H) consisted of listening to one word, and choosing from two options what spelling corresponded to the initial consonant sound. There were 56 words; the first 14 words corresponded to the familiarization session, 18 words to distracters and 24 to the target words starting with /l/ and /h/ (Appendix I). Similar to the production test, this test also included orthographic information. This test was also presented on the TP program and it was automatically randomized for each participant.

Before initiating the identification test, the participants went through a familiarization session with the researcher. The Participants were informed that the test would be on the same program used for the discrimination test. Then, they were shown a printed copy depicting the first screen (see Fig. 5) of the identification test while the researcher explained that they needed to listen to one word and then select from the two consonant options displayed on the screen, which consonant represented the initial sound of the word they had just heard.

Figure 5 - Screenshot of the first screen of the Identification test



Source: Elaborated by the author (2019)

The researcher exemplified by saying “for instance, if the audio contained the word ‘cook’, would the initial sound be orthographically represented by letter C or L? (The researcher would point to these letter options on the screen). Moreover, they were informed that there would be only two consonant options and that the options would not be only the C and L as displayed in the example given.

During the familiarization session, the participants were informed one more time that in case they had doubts, they could listen to the stimuli once more by clicking on the button ‘Repetir’. Once again they were informed about that pop out window that appears during the tests in TP, and they were instructed to click on the button ‘ok’ when that happened, so that the test would continue. After the researcher made sure participants had no doubts concerning the identification test procedures, they readjusted the headphones to begin the test. As soon as the Identification test option was selected (Figure 2), the first word was played and the main screen of the test was displayed.

As previously mentioned, the TP program is the same used in the discrimination and identification tests. Therefore, the information regarding the program and the equipment used is described in section 3.4.2.

3.5 Speech Materials

The audio-stimuli used in the same/different discrimination and the identification tests were produced by a male American talker of English aged 22, from Las Vegas (Nevada). He was instructed to read each word that automatically appeared every 4 seconds on slides of a PowerPoint Presentation. All the equipment used for this recording was the same described in section 3.4.1. After listening to both productions of each word produced by the talker, the researcher selected the best production ⁸of each word in order to construct the tests on TP. For the trials in the same/different discrimination test on which two words were the same, the word presented was duplicated by using the program Ocenaudio. Moreover, in order to verify if the stimuli were good exemplars of the words selected and also to test the reliability of both perception tests, an American speaker of English aged 54, from Erie (Pennsylvania), has taken the same/different discrimination and the identification tests and correctly identified all the test items.

⁸ The best production selection was based on an audio recording free of noises such as loud breathing, sneezing or eventual noises that occurred during the recording process.

3.6 Word Selection Criteria

The target words present in this study consisted of six minimal pairs – hail/rail, hay/ray, heap/reap, hook/rook, hope/rope and hug/rug –, phonetically transcribed as heɪl/reɪl, heɪ/reɪ, hɪp/rɪp, hʊk/rʊk, hoʊp/roʊp and hʌg/rʌg, respectively. These twelve words are present in the production test as well as in both perception tests. The criteria used to select this corpus were as follows. First, it was important to bear in mind that since participants were beginners, the use of complex language structure would be inadequate. Therefore, the use of isolated monosyllabic words was preferred over the use of longer words or phrases. Second, previous literature shows that a phonological process often employed by Brazilians when producing or perceiving /ɹ/ and /h/ is substitution of one consonant by another, and that these substitutions could result in changes in meaning. Thus, the use of minimal pairs seemed to be useful to determine how the participants would perceive and produce /ɹ/ and /h/ (LEVIS & CORTES, 2008).

Initially, an online PDF file⁹ containing 21 minimal pairs (heap/reap, hail/rail, heel/reel, hen/wren, hat/rat, host/roast, hug/rug, hose/rose, hand/rand, hash/rash, hoe/row, hook/rook, habit/rabbit, head/red, hi/rye, hole/roll, hope/rope, hush/rush, hut/rut, hot/rot, hay/ray) was selected by the researcher. From this set of minimal pairs, the following criteria were adopted to select a suitable number of items: 1) Minimal pairs with differences in spelling that were not related to the <r> and <h> graphemes were not included (e.g., hi/rye, hoe/row, hen/wren, host/roast). 2) Words which were likely to be familiar to low-proficiency learners (eg., ‘hat’, ‘hot’, ‘hand’, ‘rose’, ‘hi’, ‘red’) were avoided because the main idea was to verify what production, perception outcomes would occur once participants encountered potentially unfamiliar words beginning with /ɹ/ and /h/ consonants. The selected minimal pairs were checked for frequency of occurrence using the Corpus of Contemporary American English (COCA¹⁰). As can be seen in Table 2, the least frequent word in this study (‘reap’) occupies the rank position number 1924, while the most frequent word (‘hope’) occupies the position number 99554. 3) Lastly, cognate words, such as ‘rat’, ‘rose’, were also left out in order to minimize the influence of the L1 in the test results.

⁹ The PDF file was available on <https://www.speech-language-therapy.com/pdf/maxoppsHvsRsiwi.pdf>. Copyright 2012 © Caroline Bowen www.speech-languagetherapy.com

¹⁰ COCA is the largest freely-available corpus of American English website <http://corpus.byu.edu/coca/>. It was created by Mark Davies of Brigham Young University and it is used by researchers in order to identify word frequency.

Table 2 - Frequency of the target words according to COCA

Words	Frequency	Rank	Words	Frequency	Rank
Hail	3194	9 th	Rail	9926	4 th
Hay	4828	7 th	Ray	22163	2 nd
Heap	3157	10 th	Reap	1924	12 th
Hope	99554	1 st	Rope	9580	5 th
Hook	10894	3 rd	Rook	2023	11 th
Hug	6893	6 th	Rug	4601	8 th

Source: Elaborated by the author (2019)

The three tests taken by the participants included the twelve target words displayed in Table 2. In the production test, there were six /ɹ/ and six /h/ words presented twice (totalizing 24 tokens). In the discrimination test, there were six /ɹ/ and six /h/ words presented four times each (e.g., rook/hook, hook/hook, hook/rook and rook/rook), always combined in pairs. Although each word appears four times, each pair corresponds to one stimulus (totalizing 24 tokens). In the identification test, there were six /ɹ/ and six /h/ words presented twice (totalizing 24 tokens). Therefore, the three tests totalize 72 token stimuli per participant.

3.7 Resource-based Feedback Intervention provided to the Experimental Group

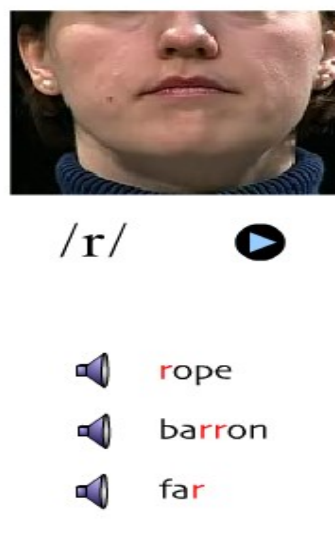
In this study, pronunciation feedback was provided via e-mail and delivered individually. Furthermore, the feedback is teacher-generated with the aid of resources available online. The focus was on the segmental level, more specifically the English consonants /ɹ/ and /h/ in onset position. Since learners were beginners, the intention was to provide feedback which was simple to understand, objective and practical. Moreover, providing it via e-mail and with resources available online would allow them freedom to practice the activities according to their availability and desire to access it as many times as they wished. The RBF intervention plan included the following information: a) written corrective feedback provided via e-mail; b) audio-video-orthographic input with the use of YouTube videos; c) facial-audio-video from the website <http://soundsofspeech.uiowa.edu>; and d) audio input activities adapted from the book *Pronunciation Instruction for Brazilians* (Zimmer et al., 2009). The feedback provided worked as follows:

1) The pre-tests served as diagnosis to verify production, discrimination and identification error percentages (control and experimental groups). In case in any of the tests a

participant scored less than 75% (corresponding to a minimum of 4 errors out of 12 tokens for production or identification tests or a minimum of 18 errors out of 24 tokens for discrimination test), they would become eligible for participating this study (see Appendix P). More specifically, participants from control and for experimental group should have at least 33.33% of room for improvement in any of the tests for at least one of the target consonants (see Appendix P for a complete list of percentages). It is important to mention that the participants who were not eligible for the control or experimental group have also received some type of feedback. However, only the procedures for the participants assigned to the experimental group will be explained.

2) Within a maximum of two days, those participants with room for improvement received the first e-mail (see appendix J) including straightforward feedback, which informed the participant that according to the tests, he/she needed to improve the pronunciation of the letters <r> and <h> in the beginning of English words. Four links were provided in order to show the pronunciation of those English sounds in the beginning of words. The first link directed participants to the page <http://soundsofspeech.uiowa.edu/resources/english/movies/r-sound.htm>, which shows a flash video depicting the mouth of a person producing the target /r/ and also brings examples of words with the consonant in different positions with the possibility of clicking on a button to listen to the words (see Fig 6).

Figure 6 - Screenshot of the website soundsofspeech.uiowa.edu regarding /r/



Source: Elaborated by the author (2019)

The second link directed to <https://www.youtube.com/watch?v=KVcc7NGIfCg>, which included the audio, image and orthography of the target consonants /r/ in words (see Fig.7).

The whole video lasts 1 minute and 31 seconds and it was posted on YouTube by Maple Leaf Learning¹¹. The words that appear in the video are rice, rocket, ruler, rabbit and radio.

Figure 7 - Screenshot of the Youtube video by Maple Leaf Learning regarding /r/



Source: Elaborated by the author (2019)

The third link is <http://soundsofspeech.uiowa.edu/resources/english/movies/h-sound.htm>, which displays information on how to produce the target consonant /h/ (Fig. 8).

Figure 8 - Screenshot of the website soundsofspeech.uiowa.edu regarding /h/



Source: Elaborated by the author (2019)

The fourth link <https://www.youtube.com/watch?v=LyMd92bpe3g> includes audio, image and orthography of the target consonants /h/ in word-initial position and it was also

¹¹ Maple Leaf Learning is a language school that has created educational materials, such as songs, games and activities for the ESL classroom and children since 1999.

posted by Maple Leaf Learning (see Fig.9). The whole video lasts 1 minute and 8 seconds. The words that appear in the video are hand, hat, horse, house and hippo.

Figure 9 - Screenshot of the YouTube video by Maple Leaf Learning regarding /h/



Source: Elaborated by the author (2019)

At the end of the first e-mail, participants were required to reply to the researcher's e-mail informing the 8 words with R and the 7 words with H which are shown in the 4 links. The email message also explained that upon sending the requested information to the researcher, they would receive the second and last e-mail including more resources for practice. This way the researcher could ensure that at least once the videos were accessed thoroughly, as the participants needed to watch the videos to gather the 8 words with /r/ and the 7 words with /h/.

3) On the second e-mail, the researcher thanked the participant for their answers and informed them that that e-mail included the further resources for practicing. It included 2 mp3 audio files (see Appendix K), each one containing 10 words. There were 9 words beginning with the consonant /r/ and 11 words beginning with the consonant /h/. The audios were extracted from the CD that accompanies the book *Pronunciation Instruction for Brazilians* (ZIMMER et al., 2009), more specifically it corresponds to unit 2, page 22, exercises 2.1 1 and 2 (see Fig.10). However, the original activity was modified. Instead of presenting the words in the sequence of minimal pairs as it was in the original file, the words were mixed up by using the editing software program Ocenaudio and in the new activity designed the participant was instructed to write if the first word heard began with letter <r> or letter <h> (see Fig.11). The words in the first audio were: hair, right, red, hat, roam, hose, hail, role, rap and rip. The words in the second audio were: hat, red, rat, head, height, role, right, hole, home and rare. Once more they were requested to reply to the e-mail with the blank spaces filled out

with their answers in order to guarantee the audios were listened to at least once. After receiving the information requested, the researcher scheduled the posttest session. The objective of this activity (with audio only) was to provide additional opportunity for practice including the target consonants.

Figure 10 - Screenshot of the page from the book Pronunciation Instruction for Brazilians

UNIT 2
TRICKY SOUNDS

2.1 /r/

Listening

1. Listen to the words below:

hat	rat	height	right	home	roam
hair	rare	hole	role	head	red

• Did you notice how the letter "r" is pronounced? In American English this letter is pronounced by raising the tip of your tongue and curving it a little. Be careful when you pronounce the letter "r" in English. It never sounds like the letter "h"!

• In American English the letter "h" is generally pronounced as [h]. To pronounce [h], imagine you are out of breath and push a lot of air out of your mouth.

• Sometimes, however, "h" is not pronounced (ex.: hour; honest).

Listening

2. Listen and circle the word you hear:

a) hair	rare	f) rose	hose
b) right	height	g) hail	rail
c) head	red	h) role	hole
d) rat	hat	i) hap	rap
e) home	roam	j) rip	hip

Source: Elaborated by the author (2019)

Figure 11 - Screenshot of audio activity sent to Experimental Group

Escute cada áudio anexado e digite se a palavra começa com a letra **H** ou **R**:

Bloco de Áudio 1

- a) _____
b) _____
c) _____
d) _____
e) _____
f) _____
g) _____
h) _____
i) _____
j) _____

Bloco de Áudio 2

- a) _____
b) _____
c) _____
d) _____
e) _____
f) _____
g) _____
h) _____
i) _____
j) _____

Source: Elaborated by the author (2019)

The posttest session (control and experimental groups) included the same tests used in the pre-test session, namely the word-reading production, the same/different discrimination and the identification tests. Pretest, RBF and posttest had an interval of a minimum of 2 days and a maximum of 7 days from one to another. Therefore the complete cycle lasted a maximum of 4 weeks (mean: 17 days). This variation depended on each participant's schedule availability for pre-test, replying e-mails with activities and posttest session (Appendix O).

3.7.1 Feedback Questionnaire

On the day the participants from the experimental group had come for the posttests, the researcher handed in a short questionnaire (see Appendix L) including seven questions to inquire about the feedback processes they had undergone. These questions intended to verify their opinion, as well as to reveal which of the resources provided were considered more relevant to them. After completing the questionnaire, each participant from the experimental group completed the production, discrimination and identification posttests.

3.8 Data Analysis

The data gathered from the instruments designed for this investigation helped the researcher to conduct a quantitative and a qualitative analysis. The former was achieved by examining the scores from the production and perception tests, and the later by examining the answers from the feedback evaluation questionnaire administered to the experimental group.

Descriptive statistics and inferential statistic tests were run using the software SPSS for Windows - version 17.0. with alpha level established at .05. The analyses included comparisons between and within the two groups in the production and identification pre and posttests¹². Moreover, skewness and kurtosis coefficients showed that the data set contained variables that were not normally distributed. Therefore, three nonparametric tests were used: a) Wilcoxon for within-group comparisons, b) Mann-Whitney U for across-group comparisons and c) Spearman for correlating production and identification tests.

¹² The discrimination test proved to be too easy to participants and the statistical analysis for the test was different for this data set, as it will be explained in section 4.1.

3.8.1 Production tests

Firstly, the researcher listened to the recordings containing the target words to transcribe the target words, with a focus on the initial consonants. After that, two experienced English teachers who had never had any contact with the participants listened to the participants' audio files and transcribed their answers. Both teachers were contacted via e-mail and after receiving explanation on the activity, they charged accordingly to the hours devoted to completing the transcription task. The American speaker of English (age = 39) is from California (West of USA), speaks Portuguese and has been living in Brazil for 4 years. The British speaker of English (age = 44), is from Winchester (South of England) and has been living in Brazil for 20 years. The intention of having three examiners from different linguistic backgrounds had the intent of minimizing the influence that the L1 might play on the perception of sounds, as well as reducing potential bias in the transcription process (Osborne, 2010).

Each audio file corresponded to one participant recording containing 24 words (approximately two minutes each). The English speakers who transcribed the target words were not aware the research was investigating the consonants /ɹ/ and /h/. The instruction was to write down the word (by using the regular orthography) or at least the initial sound/letter they heard from the files (Appendix M). The English speakers were advised to write what they understood, independently if the word existed in English or not. In case a certain production could not be understood, a question mark should be inserted in the blank space provided. Based on the analyses of the 3 transcriptions available for each target word, the researcher created a spreadsheet including the number of correct responses per participant. Since there were three examiners for judging the production test, whenever one examiner's answer differed from the other two, the answers of the majority (two examiners) prevailed. The level of agreement between the examiners reached 95% in the transcription of 960 words produced by the participants.

3.8.2 Perception Tests

For both perception tests, namely discrimination and identification tests, the TP software automatically extracts the participants' results and generates Excel spreadsheets. The spreadsheets depict the stimulus heard, the response selected by the participant, the result of

the response (correct or incorrect) and a summary comprising the total number of hits and errors.

3.9 Summary of the Chapter

In this chapter the methodological concerns of the present study have been addressed. The instruments that have been employed, the speech materials, the word selection criteria, as well as information regarding data analyses procedures were explained in detail.

In the following chapter, the research questions are restated and the results of each test administered are displayed by discussing the possible explanations for the findings.

CHAPTER IV

4. RESULTS AND DISCUSSION

In this chapter, the results obtained through the data collection instruments designed for the research are presented and discussed through two main objectives. The first objective was to verify Brazilian learners' perception and production regarding the contrasts of the initial English consonants /ɹ/ and /h/ with the use of a production test and two perception tests. The second objective was to analyze the effects of the RBF intervention plan on the perception and production of the target consonants. Moreover, production and perception tests were analyzed to verify whether they displayed any correlation. The following four questions guided the study:

1. How do Brazilian EFL learners' from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the pretests?
2. How do Brazilian EFL learners' from the experimental and control groups perform in their production and perception of the English consonants /ɹ/ and /h/ in the posttests?
3. How do Brazilian EFL learners' from the experimental and control groups differ in performance in the production and perception from pre to posttests regarding the English consonants /ɹ/ and /h/?
4. Is there a correlation between the perception and production of the English consonants /ɹ/ and /h/ in pre and posttests?

To answer the first research question, the results of the production and perception pretests are presented, with each group being seen as a sample which represents BP learners' needs regarding the consonants /ɹ/ and /h/. Therefore, section 4.1 reports relevant results towards a descriptive approach and discusses to what extent learners' outcomes corroborate previous studies and how it relates to the concept of language transfer. In section 4.2, posttest results are reported for each group in order to answer the second research question.

With the intent of analyzing the effect of RBF, in section 4.3 the performances of control (n=10) and experimental (n=10) groups are compared through a variety of perspectives (scores, room for improvement, percentage of errors, frequency statistics. In

section 4.4 the correlation analysis results are displayed. Section 4.5 shows the results of tests by focusing on each target consonant separately and the most relevant implications regarding that aspect.

After presenting the outcomes regarding the research questions, the following sections (4.6 and 4.7) include extra information obtained from the participants' responses in the questionnaire, as well as the experimental group's evaluation of RBF intervention.

4.1. Pretest Results

The first research question was posed to assess the participants' ability to produce, discriminate and identify words with /ɹ/ and /h/ in onset position. The target consonants were present in 12 words (hail/rail, hay/ray, heap/reap, hook/rook, hope/rope and hug/rug) presented twice in each of the three tests. The maximum score possible in each test was: 24 for the production test, 24 for the identification test, and 24 for the discrimination test. Tables 3a and 3b were assembled to better display the results of each group.

Table 3a - Pretest results of correct responses for the Experimental Group

Participants	Production	Discrimination	Identification
Experimental	R & H	R & H	R & H
P1	12	21	16
P2	15	24	13
P3	13	24	7
P4	12	19	20
P5	16	24	21
P6	13	24	15
P7	9	24	15
P8	12	23	17
P9	17	24	18
P10	16	24	19
N	10	10	10
Mean	13.50	23.10	16.10
Median	13.00	24	16.50
SD	2.46	1.72	4.04
Maximum	17	24	21
Minimum	9	19	7

Source: Elaborated by the author (2019)

Table 3b - Pretest results of correct responses for the Control Group

Participants	Production	Discrimination	Identification
Control Group	R & H	R & H	R & H
P11	17	14	19
P12	13	24	3
P13	10	24	11
P14	12	24	11
P15	14	24	17
P16	18	24	22
P17	16	24	24
P18	18	22	18
P19	18	24	24
P20	24	18	18
N	10	10	10
Mean	16.00	22.20	16.70
Median	16.50	24.00	18.00
SD	3.97	3.45	6.63
Maximum	24	24	24
Minimum	10	14	3

Source: Elaborated by the author (2019)

Regarding the production pretest, only one participant (P20) performed at ceiling level. Therefore, 95% (19 out of 20) of the participants produced /ɹ/ and /h/ incorrectly. Note that, apart from 3 participants (P16, P18 and P19) who scored between 18 and 23 (75% up), the other 16 participants scored below that percentage. In other words, 80% of the participants scored 17 or below that. The production accuracy values for the experimental group are mean: 13.50; SD: 2.46, while the control group obtained mean: 16.00; SD: 3.97.

The discrimination pretest, used to verify if participants would have difficulties distinguishing /ɹ/ and /h/ as two different sounds, revealed that out of 20 participants, 16 (80% of them) scored above 90%. Within those, 14 participants (70 % of them) scored at ceiling levels. The discrimination accuracy values for the experimental group are mean: 23.10; SD: 1.72, while the control group obtained mean: 22.20; SD: 3.45. It is important to highlight that, since the results of the discrimination test showed limited variance among participants, inferential statistical analysis became unnecessary (LARSON-HALL, 2010). Moreover, another reason for not running inferential statistics was the fact that only one participant (P11) scored below 75% (18 tokens), meaning that there was no significant room for improvement in the overall results of the discrimination test.

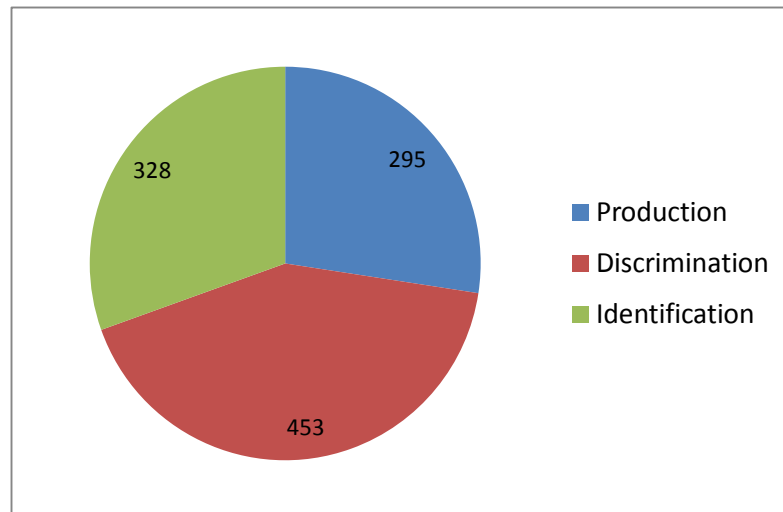
The results of the identification pretest revealed that 2 participants (P17 and P19) performed at ceiling level. Therefore, 90% (18 out of 20) of the participants identified /ɹ/ and

/h/ incorrectly. Of those, 4 participants (P3, P12, P13 and P14) scored below 50 % (12 tokens), while 6 participants (P1, P2, P6, P7, P8 and P15) scored between 51 and 74 % (12 to 17 tokens). The remaining 8 participants scored between 75 % and 91.67% (18 to 22 tokens). The identification accuracy values for the experimental group are mean: 16.10; SD: 4.04, while the control group obtained mean: 16.70; SD: 6.63.

The results above show that the test with most frequent accurate responses was the discrimination test, followed by the identification test, and then the production test. It is important to highlight that this pattern was followed by the control and experimental groups.

In order to better visualize the results according to the total score of the 1440 responses (20 participants x 24 tokens x 3 tests), the graph below was assembled.

Figure 12 - Control and Experimental Groups Total Score on Pretests (n=20).



Source: Elaborated by the author (2019)

Regarding the total score based on a 480-point score per test, we can observe that the twenty participants scored 295 in the production test, 328 in the identification test and 453 in the discrimination test. In other words, of 480 occurrences of /ɹ/ and /h/, 185 (40%) were incorrectly produced; 152 (30%) were misidentified and 27 (10%) were incorrectly discriminated. According to the results displayed in this section, it is possible to affirm that, the English /ɹ/ and /h/contrast poses no relevant difficulties to BP learners concerning their acoustic property differences (discrimination), however BP learners have difficulties producing and identifying /ɹ/ and /h/ accurately.

The result of the production pretests reinforces the findings of previous studies regarding Brazilians difficulties pronouncing English words having /ɹ/ in onset position (DEUS, 2009; MORGAN, 2016; OSBORNE, 2010; SCHADECH, 2013). Moreover, the fact that /ɹ/ was produced as /h/ 90.64% of the total misproductions for /ɹ/ and /h/ consonant was produced as /ɹ/ 68.59% of the misproductions for /h/(see section for 4.5), indicates that language transfer is taking place. These findings goes in line with Odlin's (1989) definition of language transfer, since the influence resulting from the similarities and differences between /ɹ/ and /h/ in English and in Brazilian Portuguese is interfering in the language being acquired. Furthermore, the fact that learners are beginners reinforces the confusion since the new information regarding the new language. In other words, learners were not able to separate their L1 and L2 phonetic subsystems.

The results of both perception pretests corroborate with Osborne's (2015) study, on which she administered identification and discrimination tests, and BP learners of English from low proficiency level performed well on auditory discrimination of the English /ɹ/ and /h/ as two distinct segments, but poorly in the identification test. Regarding the low mean scores in production and identification tests, a plausible explanation is the fact that in the present study those tests included orthographic input. In other words, participants may have retrieved knowledge from their L1 spelling-sound relation and applied it to L2 outcomes (SILVEIRA, 2008, ZIMMER, 2004). Differently, the discrimination test was the only test on which written input was not inserted, thus participants displayed a high percentage of accurate responses when compared to production and identification tests.

It is important to highlight that the use of reading tasks (including orthography) may not be the only explanation for language transfer to occur, since on Osborne's (2010) participants spoke freely about any subject and still the data obtained revealed that 3 out of 4 occurrences of /ɹ/ were produced as a fricative.

4.2. Posttest Results

The second research question examined how learners' from the experimental and control groups performed in their production and perception of the English consonants /ɹ/ and /h/ in the posttests. The posttests were essential to determine whether there were changes in the scores from pre to post tests, given that the same test instruments and procedures used in the pretest were repeated in the posttest. The analysis was based on 1440 responses (20

participants x 24 tokens x 3 tests). The maximum score possible in each test was 24. Tables 4a and 4b were assembled to better display these results.

Regarding the production posttest, two participants (P1 and P18) scored 24, performing at ceiling level. Moreover, 11 participants scored between 18 and 23 on the test. Apart from P7, P12, P13 and P14, who scored 12 or below, the remaining 3 participants (P3, P9 and P17) scored between 15 and 17. The production accuracy values for the experimental group are mean: 19.80; SD: 4.05, while the control group obtained mean: 17.50; SD: 6.25.

The discrimination posttest revealed that, 17 out of 20 participants scored at ceiling level. The remaining participants (P11, P13 and P18) scored 14, 22 and 22, respectively. In the experimental group all participants scored at ceiling level. The production accuracy values for the experimental group are mean: 24.00; SD: 0, while the control group obtained mean: 22.60; SD: 3.13.

The results of the identification posttest revealed that, 6 participants (P1, P3, P4, P6, P16 and P19) performed at ceiling level (24 tokens), while 7 participants (P5, P8, P11, P15, P17, P18 and P20) scored between 75% and 91.67% (18 to 22 tokens). Moreover, 4 participants (P2, P9, P10 and P12) scored between 51 and 74% (12 to 17 tokens). The remaining 3 participants (P7, P13 and P14) scored 50% or below that (12 tokens or less). The identification accuracy values for the experimental group are mean: 19.40; SD: 5.92, while the control group obtained mean: 18.70; SD: 5.65.

Table 4a -. Posttest results of correct responses for the Experimental Group

Participants	Production	Discrimination	Identification
Exper.Group	R & H	R & H	R & H
P1	24	24	24
P2	20	24	13
P3	15	24	24
P4	23	24	24
P5	21	24	23
P6	22	24	24
P7	12	24	7
P8	22	24	22
P9	16	24	16
P10	23	24	17
N	10	10	10
Mean	19.80	24.00	19.40
Median	21.50	24.00	22.50
SD	4.05	0	5.92
Maximum	24	24	24
Minimum	12	24	7

Source: Elaborated by the author (2019)

Table 4b - Posttest results of correct responses for the Control Group

Participants	Production	Discrimination	Identification
Control Group	R & H	R & H	R & H
P11	18	14	20
P12	12	24	16
P13	11	22	10
P14	5	24	8
P15	22	24	20
P16	22	24	24
P17	17	24	23
P18	24	22	22
P19	22	24	24
P20	22	24	20
N	10	10	10
Mean	17.50	22.60	18.70
Median	20.00	24.00	20.00
SD	6.25	3.13	5.65
Maximum	24	24	24
Minimum	5	14	8

Source: Elaborated by the author (2019)

According to the posttest mean scores from each group, we can observe that the test with more accurate responses for control and experimental groups is the discrimination test. The control group displayed the same pattern of the pretest, scoring higher on discrimination, then on the identification test and lower on the production test (tables 3b and 4b). However, the experimental group displayed a different pattern since there were more accurate responses in the production test than on the identification in comparison to the pretests (tables 3a and 4a).

In sum, according to the posttest mean scores from each group, there was improvement in the three tests for control and experimental groups. The fact that both groups improved their mean scores from pre to posttests can lead to some assumptions. Firstly, neither posttests nor RBF and posttests had negative effects on the production, perception and identification of /ɹ/ and /h/ as two different segments. In other words, it could be that instead of helping learners differentiate those consonants, posttests and RBF could reinforce learners' confounds regarding /ɹ/ and /h/. Therefore, it affected positively both groups of participants.

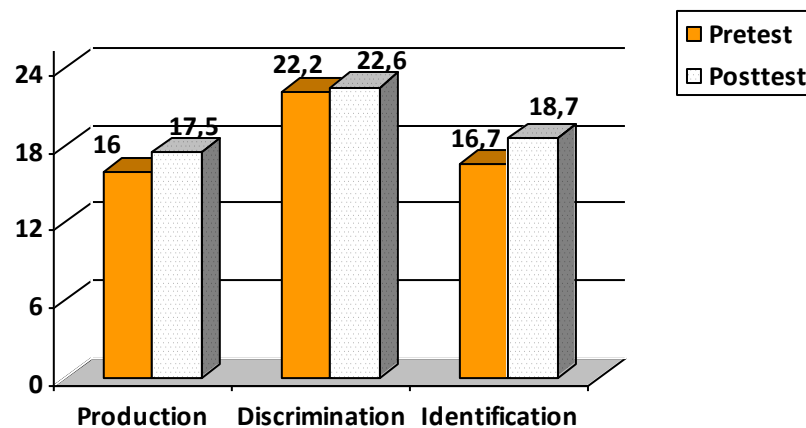
The fact that not only the experimental group, but also the control group (that was not provided with RBF) improved their mean score may be explained by a combination of factors: a) the fact that repeated tests may have had a positive effect in making learners perceive /ɹ/ and /h/ contrasts; b) The use of minimal pairs in many trials may have directed learners' attention to the target consonants differences, c) some learners might have searched for answers on their own or even asked their English teacher about the differences between

those segments, since some learners reported being confused about the differences between <sh> and <ch> and /ɹ/ and /h/ after taking the pretests. However, due to research limitations these were not verified in this study.

4.3 Comparing Control and Experimental Groups Pre and Posttests

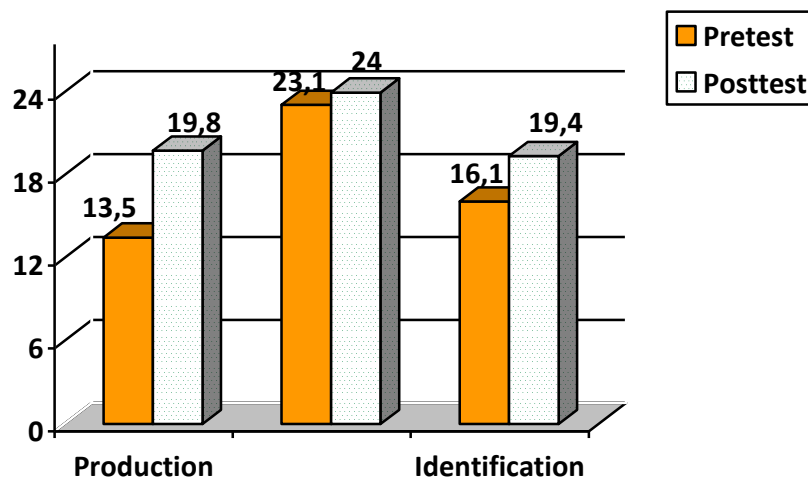
The third research question examined how experimental and control groups differ in performance from pre to posttests. Figures 13a and 13b display the results of the production, discrimination and identification tests based on the means of accuracy per group.

Figure 13a - Control Group pre and posttests mean scores of accuracy for Production, Discrimination and Identification Tests (Maximum = 24)



Source: Elaborated by the author (2019)

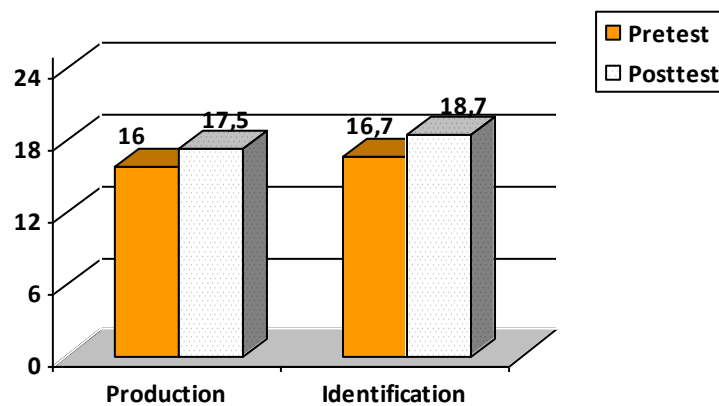
Figure 13b - Experimental Group pre and posttests mean scores of accuracy for Production, Discrimination and Identification Tests (Maximum = 24)



Source: Elaborated by the author (2019)

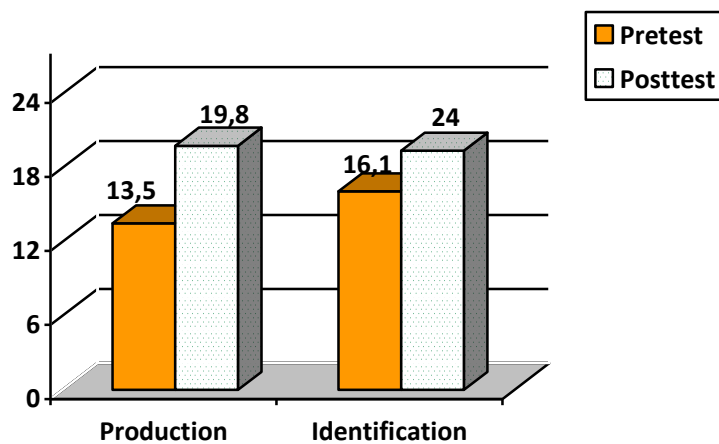
By comparing the mean scores from pre to posttests, note that there was improvement in the three tests for control and experimental groups. In other words, overall segmental accuracy improved in the production and in both perception tests, including the discrimination test, on which the pretests results had disclosed very little room for improvement. Given the fact that the discrimination test results displayed limited variance (too many participants performing at ceiling or nearly ceiling levels), a decision was made to exclude these results from the analysis that required the use of statistical test. Therefore, the following comparisons in this section do not include the discrimination test results. In order to better visualize the results from production and identification pre and posttest only, Figure 14a and 14b were elaborated.

Figure 14a - Control Group pre and posttests mean scores of accuracy for Production and Identification Tests (Maximum = 24)



Source: Elaborated by the author (2019)

Figure 14b - Experimental Group pre and posttests mean scores of accuracy for Production and Identification Tests (Maximum = 24)



Source: Elaborated by the author (2019)

By looking at the pretests results from both groups (solid columns in Fig.14a and 14b), we can note that the control group performed better than the experimental group in both pretests (maximum score for each test = 24). While the control group obtained a mean score of 16 in the production test, (SD: 3.97) and 16.7 in the identification test (SD: 6.63); the experimental group obtained 13.5 in the production test (SD: 2.46) and 16.1 in the identification test (SD: 4.04). These pretest results showed that the experimental group had more difficulties than the control group in producing and identifying the target consonants accurately.

A comparison of pre and posttest results from both groups (Fig.14a and 14b), reveal that the experimental group outperformed the control group in production as well as in the identification mean scores. Whereas the experimental group obtained a mean of 19.8 in the production test (SD: 4.05) and 19.4 in the identification test (SD: 5.92), the control group obtained a mean of 17.5 in the production test (SD: 6.25) and 18.7 in the identification test (SD: 5.65.). Therefore, there was a gain of 6.3 mean points in the production performance from pre to post-test for the experimental group, while in the control group the gain was of 1.5 mean points. Moreover, there was a gain of 9.9 mean points in the identification performance from pre to post-test for the experimental group, while in the control group the gain was of 2 mean points.

Independent Mann-Whitney tests were used to compare the means of the two groups in the pre and posttests. In the pretest, the result was not significant neither for production ($Z=-1.67$, $p=.093$) nor for identification ($Z=-.607$, $p=.544$). In other words, the two groups were not significantly different before treatment was administered to the experimental group.

Regarding the posttests, the results showed no significant difference between the groups neither for production ($Z=-.767$ $p=.443$) nor for identification ($Z=-.576$, $p=.565$).

Table 5 - Independent Mann-Whitney comparing the means of the two groups in the pre and posttests.

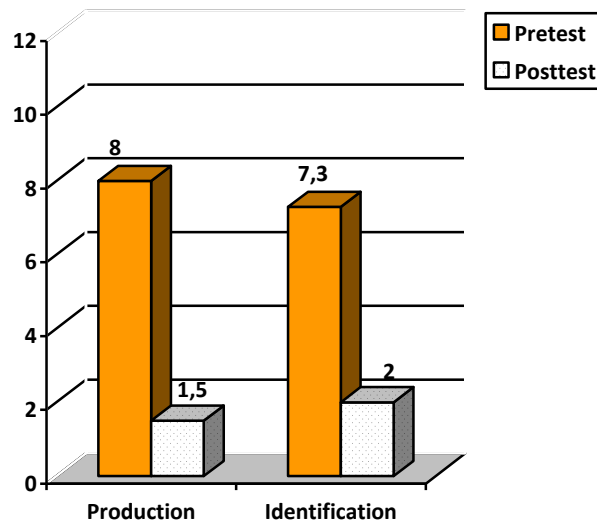
	pre_pro_rh	pre_id_rh	post_pro_rh	post_id_rh
Mann-Whitney U	28.000	42.000	40.000	42.500
Wilcoxon W	83.000	97.000	95.000	97.500
Z	-1.678	-.607	-.767	-.576
Asymp. Sig. (2-tailed)	.093	.544	.443	.565
Exact Sig. [2*(1-tailed Sig.)]	.105 ^a	.579 ^a	.481 ^a	.579 ^a

Source: Elaborated by the author (2019)

When comparing group performances, it is relevant to inspect how much room for improvement was available for the pretest results displayed for each group. In other words, it

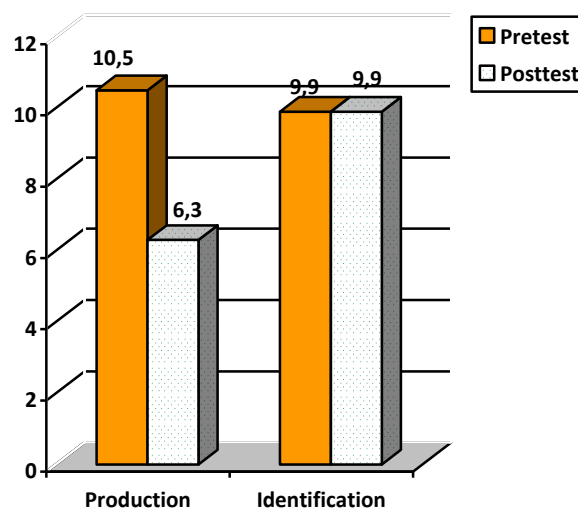
could be argued that the experimental group outperformed the control group because the later performed better in the pretests and therefore did not have enough room for performing as well as the former. Therefore, Fig.15a and 15b display in mean score the available room for improvement (solid columns) and the posttest score gained in the posttest by each group (dotted column). The values were obtained by subtracting the pretest mean scores obtained from 24, which was the maximum possible score.

Figure 15a - Control Group mean score available room for improvement in posttests



Source: Elaborated by the author (2019)

Figure 15b -Experimental group mean score available room for improvement in posttests



Source: Elaborated by the author (2019)

In the production pretest, the control group could have gained 8 mean points and it gained 1.5 mean points, indicating an improvement of 18.75 %. The experimental group displayed 10.5 mean points of room for improvement and had gained 6.3 mean points, corresponding to 60% of improvement. These results indicate that the control group could have scored at least as much as the experimental group in the production test.

The identification pretest revealed that the control group could have improved its mean score in 7.3 points and it gained 2 mean points in the posttest. In other words, the mean points gained corresponded to 27.40 % of improvement. These results indicate that the control group had much more room for improvement than it had actually improved in posttests. The experimental group displayed 9.9 mean points of room for improvement in pre tests and it has gained the total mean score (9.9), corresponding to 100% of improvement.

Two-paired sample Wilcoxon signed ranks were used to compare the gain scores within each group in the pre and posttests. For the control group, the results (Table 6) show no significant differences from pretest to posttest neither for production ($Z=-1.12$, $p=.259$) and nor for identification ($Z=-1.42$, $p=.153$).

Table 6 - Paired Sample Wilcoxon Test Statistics Control Group

	post_pro_rh - pre_pro_rh	post_id_rh - pre_id_rh
Z	-1.129 ^a	-1.429 ^a
Asymp. Sig. (2-tailed)	.259	.153

Source: Elaborated by the author (2019)

Regarding the experimental group, the results (Table 7) show no significance for identification tests ($Z=-1.42$, $p=.153$). However, from pre to posttests a high significant difference was found for production ($Z=-2.70$, $p=.007$). From this result it is possible to affirm that the feedback received affected significantly the production of the target consonants by the experimental group.

Table 7 - Paired Sample Wilcoxon Test Statistics Experimental Group

	post_pro_rh - pre_pro_rh	post_id_rh - pre_id_rh
Z	-2.703 ^a	.007
Asymp. Sig. (2-tailed)	.007	.153

Source: Elaborated by the author (2019)

In sum, the comparison of the mean scores from pre to posttests revealed that the experimental group outperformed the control group considerably in production as well as in the identification tests. This fact can be interpreted as supporting the assumption that RBF better assisted learners in diminishing their confusion regarding the contrasts of /ɹ/ and /h/.

Moreover, statistical tests within group from pre to posttests also showed a high significance for production in the experimental group. These results go in line with Hattie and Timperley (2007) meta analysis of 7,000 studies, on which feedback about a task performance including instruction providing cues in the form of video, audio, or computer-assisted instructional demonstrated to be effective.

Regarding the use of learning pronunciation via internet, it also corroborates to Sadeghi and Heidar (2016) study, on which the students from experimental group had a much better pronunciation performance with the use of websites in posttests in comparison with the control group who did not receive any training.

4.4. Correlations between the Production and Identification Pre and Posttests

The fourth research question examined whether there was an interaction between perception and production in the pretests, as well as the in the posttests. In order to answer the question, scores in the production and identification pretest and posttests for the control and experimental groups were examined with the use of Bivariate Spearman correlations. The correlation analysis was performed with the scores separate for the experimental and the control group in the pretest and the posttest and the analysis shows two results. The first round of analysis was performed with the scores from /ɪ/ and /h/ combined (24 tokens x 10 participants = 240 tokens per test) displayed in Table 8 and Table 9. The second one was performed with the scores of each consonant apart (12 /ɪ/ tokens x 10 participants = 120) and (12 /h// tokens x 10 participants = 120) displayed from Table 10 to table 13.

Table 8 - Correlation analysis for perception and production for the control group

	Production pretest	Production posttest
Identification pretest	r=.650 p=.042	--
Identification posttest	--	r=.711 p=.021

Source: Elaborated by the author (2019)

Table 9 - Correlation analysis for perception and production for experimental group

	Production pretest	Production posttest
Identification pretest	r=.282 p=.430	--
Identification posttest	--	r=.522 p=.122

Source: Elaborated by the author (2019)

Correlation results of /ɹ/ and /h/ in the production test revealed the following. For the control group, the production scores in the pretest were significant and strongly correlated with the identification pretest scores ($r=.650$; $p=.042$). The posttests scores were also significant with a strong correlation ($r=.711$; $p=.021$). For the experimental group, the production scores were non-significant with a weak correlation with the identification pre test scores ($r=.282$; $p=.430$); and the posttests scores were not significant with a moderate correlation ($r=.522$; $p=.122$). Note that all correlations are positive, thus indicating that the better a participant performed in the perception tests (identification), the better s/he performed in the production tests.

In order to have a clearer understanding of the data set, correlation analyses were also conducted by separating the data per type of target consonant. Tables 10 and 11 display the results of perception and production of /ɹ/ for the control and experimental groups, respectively.

Table 10 - Correlation analysis for perception and production of /ɹ/ for the control group

	/ɹ/ Production pretest	/ɹ/ Production posttest
/ɹ/ Identification pretest	$r=.124$ $p=.733$	--
/ɹ/ Identification posttest	--	$r=.549$ $p=.100$

Source: Elaborated by the author (2019)

Table 11 - Correlation analysis for perception and production of /ɹ/ for the experimental group

	/ɹ/ Production pretest	/ɹ/ Production posttest
/ɹ/ Identification pretest	$r=-.717$ $p=.020$	--
/ɹ/ Identification posttest	--	$r=.382$ $p=.276$

Source: Elaborated by the author (2019)

The correlation results of /ɹ/ revealed the following for the control group. The production scores were not significant showing a very weak positive correlation with the identification pretest scores ($r=.124$; $p=.733$); and the posttests scores were not significant either, showing a moderate positive correlation ($r=.549$; $p=.100$). For the experimental group, the production pretest scores were significant, showing a strong negative correlation with the identification pretest scores ($r=-.717$; $p=.020$); and not significantly correlated for the posttests scores, showing a weak positive correlation ($r=.382$; $p=.276$).

Tables 12 and 13 below, display the correlation results for the perception and production of /h/ for the control and experimental groups, respectively.

Table 12 - Correlation analysis for perception and production of /h/ for the control group

	/h/ Production pretest	/h/ Production posttest
/h/ Identification pretest	r=.516 p=.127	--
/h/ Identification posttest	--	r=.731 p=.016

Source: Elaborated by the author (2019)

Table 13. Correlation analysis for perception and production of /h/ for the experimental group

	/h/ Production pretest	/h/ Production posttest
/h/ Identification pretest	r=-.750 p=.012	--
/h/ Identification posttest	--	r=.047 p=.898

Source: Elaborated by the author (2019)

The correlation results of /h/ revealed the following. For the control group, the production scores showed a positive non-significant moderate correlation with the identification pre test scores ($r=.516$; $p=.127$) and a significant strong positive correlation for the posttests scores ($r=.731$; $p=.016$). For the experimental group, the production scores were significant, strong and negatively correlated with the identification pre test scores ($r=-.750$; $p=.012$) and not significant, showing a weak positive correlation for the posttests scores ($r=.047$; $p=.898$).

Thus, the correlation analyses for each target sound show different patterns for the experimental and the control groups. In the pretests of the experimental group, we can observe a strong and significant negative correlation between the perception and production of each target sound (Tables 11 and 13), which indicates that the higher the scores of participants in the identification pretests, the lower their scores in the production pretests. These results go in the opposite direction of what is predicted by theories of L2 speech learning, which predict that the better a learner perceives an L2 contrast, the better s/he produces it (FLEGE, 1995). However, it is important to highlight that Flege (1999) also argued that "...production and perception may not be brought into perfect alignment, as in L1 speech acquisition (p.1273)."

Indeed, the control group data corroborates the prediction that a better perception leads to a better production (Tables 10 and 12). Note that in the posttest results, the performance of the experimental group follows the pattern predicted by the theoretical models. Perhaps this alignment between perception and production for the experimental group in the posttest could have been triggered by the electronic feedback provided to the experimental group, which

obtained lower scores in all pretests, when compared to the control group (see sections 4.1 and 4.3).

4.5. Non-target Outcomes of /ɹ/ and /h/ onset

Regarding the production test results, raters transcriptions revealed that from a total of 960 words containing /ɹ/ and /h/ onset (including pre and posttests), 292 were incorrectly produced by participants. Within these 292 non-target productions, 171 correspond to words having /ɹ/ onset (rail, ray, reap, rook, rope, rug), while 121 corresponds to words having /h/ onset (hail, hay, heap, hook, hope, hug). More specifically, /ɹ/ was produced as /h/ 155 times (90.64% of the total misproductions for /ɹ/), while the /h/ consonant was produced as /ɹ/ 83 times (68.59% of the misproductions for /h/). Although the results confirm that BP learners of English tend to replace the opposite is also true: very often /h/ is replaced with /ɹ/.

Moreover, /ɹ/ was misproduced as other sounds (apart from /h/) 38 times (31.40%) and /h/ was misproduced as other sounds (apart from /ɹ/) 16 times (9.35%). Table 14 displays the participants' outcomes.

Table 14 - Frequency of other types of non-target productions of /ɹ/ and /h/ onset

Segment Transcription of Words	<w>	/i:/	<sh>	<v>	/ð/	Ø
Hail	5					1
Hay	11	2				
Heap	2					1
Hook	5		1			
Hope	1					
Hug						9
Rail	4			1		
Ray	4				1	
Reap	2					
Rook	1					
Rope	2					
Rug	1					
TOTAL →	38	2	1	1	1	11

Source: Elaborated by the author (2019)

In order to better display judges' transcriptions of participants' productions, outcomes are sometimes represented by graphemes and other times by phonemes. Moreover, segment deletion is represented by the symbol \emptyset .

We can note that /h/ words were transcribed by the judges as <w> (25 times), as <sh> (one time), as /i:/ (2 times), and as being deleted (11 times); whereas /ɹ/ words were transcribed by the judges as <v> (one time) and <w> (15 times). In total there were 54 non-target productions represented by other sounds (38 regarding /h/ and 16 regarding /ɹ/).

Furthermore, two recurrent types of consonant substitution are replacing both target consonants with /w/, an approximant sound that is a sound that occasionally replaces rhotics in initial stages of L1 acquisition in BP (MIRANDA, 2002), and deleting /h/. Thus, almost all of the non-target productions observed in the data set provide support to the idea that BP learners may be transferring their L1 knowledge to the L2 being learned. Only a few non-target productions can be attributed to misreading (the 5 cases displayed in columns 2 to 5 in Table 14).

4.6 Additional Variables

Although no research question was established regarding the information collected via questionnaire, this instrument was used to gain a further understanding of the participants' background and attempt to understand how individual difference factors might be related to their performance on the perception and production tests. Table 15 displays a summary of the participants' answers in the background questionnaire.

As seen in Table 15, out of 20 participants, 15 were females and five were males. Their ages ranged from 18 to 62 years old (mean: 27.6 years). Regarding their education level status, they had already pursued or were pursuing the following degrees: high school (three participants), graduate (eight participants) and undergraduate (nine participants).

Regarding participants' language background, three of them had knowledge of foreign languages (Italian (P4), French (P8), Spanish, Japanese and Korean (P18)). One reported having never studied English in regular schools, six studied from 6 to 10 years and four participants from 1 to 4 years (mean: 6.25 years); 13 of them had never studied in private language schools, two studied for 6 months, other two for 12 months, one for 18 months and the remaining two for 24 months (mean: 5.20 months).

Table 15 - Participants' answers in the background questionnaire

Background Questionnaire														
Participants	Personal Information			Language Studies				Additional Exposure to English				Motivation		
	Gender	Age	Education	Language	Regular School in Years	Private Course in Months	Abroad in Years	Interactions	Activities	Types of Activities	Week Hours	Likes	Reasons	Use of EFL Resources online
P1	F	34	UG	0	2	0	0	0	0	0	0	Y	N	Linguee, Duolingo
P2	F	62	UG	0	4	0	0	0	0	0	0	Y	O	Duolingo
P3	F	43	HS	0	1	0	1	2	2	1, 2	6	Y	O	Duolingo
P4	F	50	GR	Italian	7	24	0	1	4	1,2,5,6	5	Y	O	Duolingo
P5	F	21	UG	0	8	0	0	2	3	2,3,5	1,5	Y	N	Google Translator
P6	F	24	UG	0	10	0	0	2	5	1,2,3,6,7	8	Y	N	Duolingo, lyrics Translation
P7	F	25	UG	0	6	24	0	1	4	1,2,5,6	11	Y	O	Linguee & Mario Vergara Dictionaries & lyrics translation
P8	F	27	GR	French	10	6	0	1	5	1,2,5,6,7	10	Y	N	lyrics translation
P9	M	22	HS	0	8	6	0	2	5	1,2,3,5,6	10	Y	N	0
P10	F	30	GR	0	8	0	0	1	3	1,2,7	3,5	Y	N	0
P11	F	19	UG	0	7	2	0	2	3	1,2,6	4,5	Y	N	0
P12	M	20	HS	0	7	0	0	0	2	2,5	3,5	Y	N	Text and lyrics Translators
P13	F	18	GR	0	7	0	0	0	1	2	3	Y	N	0
P14	M	19	GR	0	0	0	0	0	3	1,2,6	3,5	Y	O	0
P15	M	21	GR	0	7	12	0	0	2	1,2	1,5	Y	N	0
P16	F	22	GR	0	9	0	0	2	5	1,2,5,6,7	8,5	Y	N	G.Translator & Apps for EFL
P17	M	30	GR	0	7	0	0	1	4	1,2,6,7	7	Y	L	Google Translator
P18	F	23	UG	Spanish Japanese Korean	7	12	0	2	5	1,2,4,6,7	10	Y	N	0
P19	F	21	UG	0	3	0	0	2	5	1,2,4,6,7	13	Y	A	Dictionaries and G.Translator
P20	F	22	UG	0	7	18	0	1	3	1,2,7	5	Y	N	0

Source: Elaborated by the author (2019)

Notes: a) Education (High School, Undergraduate, Graduate); b) Interactions with non-Brazilians (0= never, 1= once or twice, 3= sometimes, 4= frequently); c) Quantity of different activities outside class (from 1 to 7), d) Types of activities (1=watch movies or series, 2= listen to music, 3= speak English with colleagues, 4= Play videogames in English, 5= study pronunciation via websites, 6= other activities in English and 7= read books and articles); e) reasons (N=needs for studies or work, L=likes, O= other reasons A= all reasons).

The additional exposure to English questions revealed the following: only one of the 20 participants has lived abroad; 14 of them reported having interacted in English with non-Brazilians, although not frequently. Two of them reported not being involved in any activities which include English (apart from their regular classes), the remaining 18 participants reported watching movies or series, listening to music, speaking English with colleagues, playing videogames in English, studying pronunciation via websites, reading books and articles or doing other activities in English (mean: 5.72 weekly hours).

All of the participants said they liked the language and most of them reported studying English because they need it for study or work. Duolingo, Google translator, online dictionaries which provide translation, Linguee and Mario Vergara videos were mentioned as EFL resources used for self-study.

In sum, individual differences variables might have played a role their performance on the perception and production tests, however due to the limited dataset, it was difficult to verify whether these variables really interfered in the results.

4.7 Evaluation of Feedback

On the day the participants from the experimental group had come for the posttests, the researcher handed in a short questionnaire (see Appendix L) including seven questions to inquire about the feedback processes they had undergone. These questions intended to verify their opinion, as well as to reveal which of the resources provided were considered more relevant to them. Table 16 was elaborated in order to better display their answers.

Table 16 - Experimental group evaluation of the feedback received

	Opinion on Feedback Received	Most helpful resource
P1	Very important for learning pronunciation.	Youtube + IOWA
P2	Great for improving pronunciation.	Youtube + IOWA
P3	Very important for making me aware of my personal needs.	IOWA + Audio files
P4	Valuable for making me aware of my learning.	Audio files
P5	Very important because it shows me where I need to focus efforts.	Youtube
P6	Very good! I could notice my difficulties in distinguishing between <r> and <h> and <ch> and <sh>.	IOWA + Audio files
P7	I liked it because when I know my mistakes I can make improvements.	Youtube
P8	Very important for deepening my understanding and making me aware of what I do not notice.	Youtube
P9	Very good because now I know on what to focus.	IOWA
P10	I loved receiving feedback of my pronunciation. It should be obligatory at the end of each level.	IOWA

Source: Elaborated by the author (2019)

As Table 16 shows, RBF intervention received 100% of approval from participants. Feedback with resources delivered via e-mail was described as very important for learning, improving pronunciation and also as a way to increase awareness concerning their needs. One participant (P10) has even mentioned 'it should be obligatory at the end of each level'. Regarding the three types of resources provided, the Youtube videos and the Iowa sounds of speech were considered the most helpful. However, the audio files were also reported as relevant by some participants.

In sum, this report indicated that students had positive reactions towards the type of feedback and resources provided, which corroborates with Kung and Chuo (2002) who reported that students found that learning English through ESL/EFL websites was interesting and that the teaching strategies used by the teachers were effective and necessary.

CHAPTER V

5. CONCLUSIONS

The objective of this last chapter is to summarize the main findings of this research. It also includes considerations regarding the pedagogical implications of providing pronunciation feedback outside the classroom. Finally, it provides discussions regarding its limitations and suggestions that may contribute to future studies in the area.

5.1 Summary of Overall Results

The present study began with the assumption that Brazilian speakers often confuse the English consonants /ɹ/ and /h/. Therefore, 20 Brazilian EFL learners from level 1 were assessed with the use of a word-reading production test, a same/different discrimination test and an identification test in a laboratory setting. The results of those tests revealed participants' needs regarding those consonants and also whether production and perception tests displayed any correlation. On this matter, the discussions address the extent to which learners' outcomes corroborate previous studies and how it relates to the concept of language transfer. Another objective of the research was to test whether participants who were provided with RBF intervention sent by e-mail would have their production and perception of /ɹ/ and /h/ English consonants changed, and how much it differed from the control group.

The first research question inquired about the ability of the Brazilian EFL learners to produce, discriminate and identify /ɹ/ and /h/ English consonants. According to the results, it is possible to affirm that: a) the English /ɹ/ and /h/ contrast poses no relevant difficulties to BP learners concerning their acoustic property differences in discrimination tests (Osborne's, 2015); b) BP learners have difficulties producing (DEUS, 2009; MORGAN, 2016; OSBORNE, 2010; SCHADECH, 2013) and identifying /ɹ/ and /h/ accurately (Osborne's, 2015), frequently replacing /ɹ/ with /h/ and also /h/ with /ɹ/ (MANFÉ et al. (2018). These results reinforce the previous findings of studies regarding language transfer, since Brazilians seem to be influenced and confused by the similarities and differences between the language being learned and their native language.

The second research question examined how the experimental and control groups performed in the posttests. The fact that both groups improved their mean scores from pre to

posttests revealed that posttests solely (control group), and posttest with RBF (experimental) did not affect groups negatively. In other words, it did not reinforce their difficulties regarding /ɹ/ and /h/ consonants. Moreover, although not investigated in this study, factors such as testing effect, noticing and motivation, might as well have played a role in the results.

Shifting discussion to the second aim of this study, the third research question verified whether the groups would have their mean scores changed and how they differed. The results showed that the experimental group outperformed the control group considerably in production as well as in the identification mean scores in the posttests. This fact can be interpreted as supporting the assumption that RBF contributed to the experimental group improvement. Moreover, statistical tests within group from pre to posttests also showed a high significance for production in the experimental group. Therefore, the feedback helped the participants to learn how to produce the target consonants.

Lastly, the fourth research question analyzed whether there was a relationship between production and perception. The correlation analyses results displayed two different results. When the scores of /ɹ/ and /h/ were combined, all correlations from experimental and control groups were positive. On the other hand, when each target consonant was analyzed separately, correlations were positive for both groups in posttests, but in the pretest the experimental group showed a strong negative correlation between the perception and production of each target sound.

5.2. Pedagogical Implications

Studies considering the difficulties BP learners have in learning English can contribute to the improvement of pronunciation teaching and the development of new materials and techniques in order to better assist EFL learners. The pedagogical implications here outlined will be discussed according to the research findings.

In the pretests, BP learners displayed difficulties producing and identifying /ɹ/ and /h/ accurately. Since English has many lexical items which contrast by replacing /ɹ/ by /h/, and problems distinguishing between these sounds could interfere in a successful communication, when teachers notice that learners display difficulties with this contrast, it is a priority planning ways of assisting learners. In other words, teachers must be attentive to their learners' pronunciation needs and the factors that might be impeding their understanding of certain features (e.g., language transfer processes, auditory or articulatory constraints).

The fact that both groups improved their mean scores from pre to posttests can lead to some assumptions. For the control group, which had not been provided with feedback or additional resources to illustrate the differences between /ɹ/ and /h/, it could be inferred that repeated tasks may have had a positive effect on making learners perceive the target contrast. Thus, a useful suggestion is that teachers propose audio-based activities with and without orthographic input including minimal pairs as an attempt to direct learners' attention to those consonant differences. Moreover, the experimental group posttest revealed a substantial increase in mean scores, suggesting that corrective feedback including audio, video, orthography and facial articulation input as instruction were effective ways of diminishing learners' difficulties regarding the target contrast. Therefore, a valuable recommendation is that feedback must be accompanied with a variety of input types (e.g., textual, auditory, visual-articulatory).

The effectiveness of RBF in the perception and production of /ɹ/ and /h/ consonants by BP learners of English demonstrated that the intervention plan adopted in this study provided an effective way of using freely available internet resources for enabling pronunciation improvement without using class time. Thus, giving individualized attention regarding pronunciation in a classroom with many learners is possible. Moreover, an e-mail with the same resources can be sent to each new student who displays the same difficulties regarding pronunciation. Indeed, it is very likely that learners who share the same L1 will display the same priorities regarding the L2 being learned.

In sum, the present study has demonstrated that, first, it is important to identify learners' priorities regarding their EFL pronunciation. Secondly, the use of computers allied with the access to internet can facilitate EFL pronunciation teaching and learning (e.g., e-mail, YouTube, websites). Furthermore, it is important to highlight that the videos and audios provided as resources should be short (ideally, they should last less than five minutes altogether if viewed once), in order to keep the pronunciation activities feasible to learners. Corrective feedback with audio-video-orthographic resources is not only practical and effective but was also considered useful and appreciated by learners.

5.3 Limitations and Suggestions for Further Research

The present study has several limitations and they can be used as suggestions for future research. For instance, the tests included other consonants (apart from /ɹ/ and /h/) that

posed difficulty to BP speakers (e.g., /tʃ/ and /ʃ/); however, no analyses were carried out in order to verify whether the outcomes of the untargeted consonants had also been influenced from pre to posttests. Another relevant issue that was not addressed in the study and might have affected the results was the role played by the phonological context surrounding the target consonants. Moreover, there was no attempt to analyze how word frequency may have impacted participants' outcomes in the tests.

The fact that participants were beginners also raises another limitation. This made it difficult to include a task which included extemporaneous speech that could better reflect natural communication. Furthermore, assessment did not include a delayed posttest to determine whether the intervention had a lasting effect on participants' outcomes. Investigating these two variables is strongly suggested by Thomson and Derwing (2014) as it can contribute to the studies in the pronunciation field. In addition, the interval between pre and posttests for experimental and control groups differed in two weeks, which may have influenced the results.

The impossibility of controlling how many times each participant accessed videos and how much time they spent practicing the target contrast was another drawback in this study. As previously mentioned in the pilot section, feedback with resources was made available on a virtual platform in order to control these variables; however, due to constant failures in the system this plan became no longer effective. Therefore, it is of crucial importance that further research attempts to control for this variable.

Despite its limitations, it is important to highlight that the results reported in this study contribute to the area of pronunciation teaching outside the classroom. More specifically, it offered a practical way of assisting learners in producing and identifying /ɹ/ and /h/ more accurately with the use of feedback including resources which are freely available online. As a final point, I hope this study has instigated future researchers in filling some of the gaps this study has left.

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APPENDIX A - Consent Form (Control Group)

Universidade Federal de Santa Catarina

Centro de Comunicação e Expressão

Programa de Pós-Graduação em Inglês e Literatura Correspondente

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

1. Introdução: Você está sendo convidado a participar de um projeto de pesquisa que busca estudar características específicas da pronúncia da língua inglesa e suas relações com o português. Este formulário contém dados relacionados ao consentimento para utilização de informações coletadas durante a realização da pesquisa. Os pesquisadores são a mestrandia Karine Pinto Manfé, CPF 028.332.286-19 e a professora doutora Rosane Silveira, CPF 715.936.839-87.

2. Objetivos: Este estudo visa contribuir ao ensino de Língua Inglesa, uma vez que os dados coletados podem servir para a elaboração e melhoria de materiais didáticos, adequando-os às necessidades dos alunos brasileiros aprendizes do idioma e, também, contribuindo para o ensino nas áreas de Fonética e Fonologia de modo geral.

3. Seleção dos participantes: O participante desta pesquisa precisa ter mais de 18 anos; não ter problemas auditivos; e ter o português brasileiro como língua materna.

4. Procedimentos: Se aceitar participar da pesquisa, você (i) responderá a um questionário que busca compreender melhor seu perfil como aprendiz da língua inglesa, (ii) deverá ler (em inglês) palavras que aparecerão na tela do PowerPoint e o áudio será gravado, (iii) ouvirá alguns arquivos de áudio (em inglês), assinalará as respostas correspondentes às perguntas, e (iv) responderá a um questionário sobre sua participação na pesquisa. Esses procedimentos serão realizados em 2 encontros com duração de 30 minutos cada.

5. Riscos ou desconfortos: Os riscos ou desconfortos associados à sua participação na pesquisa são mínimos, limitando-se a possível cansaço mental, nervosismo e/ou ansiedade ao realizar os testes e responder ao questionário. Além do mais, asseguramos que esta pesquisa está submetida aos critérios da Resolução 510/16 e suas complementares provenientes do Comitê de Ética em Pesquisa com Seres Humanos (CEPSH), que dispõe sobre as normas aplicáveis a pesquisas cujos procedimentos metodológicos envolvam a

utilização de dados diretamente obtidos com os participantes ou de informações identificáveis ou que possam acarretar riscos maiores do que os existentes na vida cotidiana. Se porventura existirem, por mínimas que sejam, qualquer tipo de despesas tidas pelos participantes da pesquisa e dela decorrentes, haverá garantia de ressarcimento dos gastos pelo pesquisador responsável, bem como indenização diante de eventuais danos oriundos também da pesquisa de acordo com a legislação vigente e amplamente consubstanciada.

6. Voluntariedade na participação: O participante pode, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os dados do desistente.

7. Confidencialidade: Não haverá identificação nominal dos participantes, nem divulgação de quaisquer informações que podem revelar sua identidade.

8. Divulgação dos resultados: Todos esses dados integrarão o corpus da pesquisa. Esta pesquisa será concluída em Fevereiro de 2019 e o estudo tornar-se-á público.

9. Quem contatar: Se você tiver qualquer dúvida sobre a pesquisa, podemos conversar sobre ela agora ou você pode entrar em contato conosco:

Rosane Silveira - Celular: (48) 99615-9978 Email: rosane@cce.ufsc.br

Campus UFSC Trindade: CCE Bloco B sala 108, Florianópolis.

Karine P.Manfê - Celular: (48) 99908-8098 Email: karinefogiel@gmail.com

Caso ainda haja dúvidas referentes aos seus direitos ou a sua participação, você também pode recorrer ao Comitê de Ética em Pesquisa com Seres Humanos (CEPSH) da UFSC através do telefone (48) 3721-6094 ou nas instalações localizadas no Prédio Reitoria II, 4º andar, sala 401, localizado na Rua Desembargador Vitor Lima no. 222, Trindade, Florianópolis. Se você estiver de acordo em participar desta pesquisa, assine por extenso no espaço abaixo.

Eu, _____, CPF número _____
concordo em participar deste estudo e autorizo o pesquisador a utilizar os dados por mim fornecidos.

Assinatura do Participante

Assinatura do Pesquisador

Florianópolis, ____ / ____ / ____



APPENDIX B - Consent Form (Experimental Group)

Universidade Federal de Santa Catarina

Centro de Comunicação e Expressão

Programa de Pós-Graduação em Inglês e Literatura Correspondente

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

1. Introdução: Você está sendo convidado a participar de um projeto de pesquisa que busca estudar características específicas da pronúncia da língua inglesa e suas relações com o português. Este formulário contém dados relacionados ao consentimento para utilização de informações coletadas durante a realização da pesquisa. Os pesquisadores são a mestrandia Karine Pinto Manfé, CPF 028.332.286-19 e a professora doutora Rosane Silveira, CPF 715.936.839-87.

2. Objetivos: Este estudo visa contribuir ao ensino de Língua Inglesa, uma vez que os dados coletados podem servir para a elaboração e melhoria de materiais didáticos, adequando-os às necessidades dos alunos brasileiros aprendizes do idioma e, também, contribuindo para o ensino nas áreas de Fonética e Fonologia de modo geral.

3. Seleção dos participantes: O participante desta pesquisa precisa ter mais de 18 anos; não ter problemas auditivos; e ter o português brasileiro como língua materna.

4. Procedimentos: Se aceitar participar da pesquisa, você (i) responderá a um questionário que busca compreender melhor seu perfil como aprendiz da língua inglesa, (ii) deverá ler (em inglês) palavras que aparecerão na tela do PowerPoint e o áudio será gravado, (iii) ouvirá alguns arquivos de áudio (em inglês) e assinalará as respostas correspondentes às perguntas, (iv) receberá feedback dos seus testes contendo recursos para autoestudo via e-mail, e (v) responderá a um questionário sobre sua participação na pesquisa. Esses procedimentos serão realizados em 2 encontros com duração de 30 minutos cada.

5. Riscos ou desconfortos: Os riscos ou desconfortos associados à sua participação na pesquisa são mínimos, limitando-se a possível cansaço mental, nervosismo e/ou ansiedade ao realizar os testes e responder ao questionário. Além do mais, asseguramos que esta pesquisa está submetida aos critérios da Resolução 510/16 e suas complementares provenientes do Comitê de Ética em Pesquisa com Seres Humanos (CEPSH), que dispõe sobre as normas aplicáveis a pesquisas cujos procedimentos metodológicos envolvam a

utilização de dados diretamente obtidos com os participantes ou de informações identificáveis ou que possam acarretar riscos maiores do que os existentes na vida cotidiana. Se porventura existirem, por mínimas que sejam, qualquer tipo de despesas tidas pelos participantes da pesquisa e dela decorrentes, haverá garantia de ressarcimento dos gastos pelo pesquisador responsável, bem como indenização diante de eventuais danos oriundos também da pesquisa de acordo com a legislação vigente e amplamente consubstanciada.

6. Voluntariedade na participação: O participante pode, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os dados do desistente.

7. Confidencialidade: Não haverá identificação nominal dos participantes, nem divulgação de quaisquer informações que podem revelar sua identidade.

8. Divulgação dos resultados: Todos esses dados integrarão o corpus da pesquisa. Esta pesquisa será concluída em Fevereiro de 2019 e o estudo tornar-se-á público.

9. Quem contatar: Se você tiver qualquer dúvida sobre a pesquisa, podemos conversar sobre ela agora ou você pode entrar em contato conosco:

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Caso ainda haja dúvidas referentes aos seus direitos ou a sua participação, você também pode recorrer ao Comitê de Ética em Pesquisa com Seres Humanos (CEPSH) da UFSC através do telefone (48) 3721-6094 ou nas instalações localizadas no Prédio Reitoria II, 4º andar, sala 401, localizado na Rua Desembargador Vitor Lima no. 222, Trindade, Florianópolis. Se você estiver de acordo em participar desta pesquisa, assine por extenso no espaço abaixo.

Eu, _____, CPF número _____
concordo em participar deste estudo e autorizo o pesquisador a utilizar os dados por mim fornecidos.

Assinatura do Participante

Assinatura do Pesquisador

Florianópolis, ____ / ____ / ____

APPENDIX C – Participants’ Questionnaire

Questionário do Participante da Pesquisa

1. Nome: _____ 2. Idade: _____

3. E-mail: _____ 4. WhatsApp: _____

5. Nível de Escolaridade:

 Ensino Fundamental Ensino Médio Graduação Pós-Graduação6. Você fala outro(s) idioma(s) **além do português**? sim não

Caso afirmativo, quais idiomas? Qual seu nível de proficiência? Com qual frequência você o/os pratica? _____

7. Você já estudou inglês antes? Sim Não8. Caso a questão anterior seja afirmativa, **assinale** o que corresponde a sua experiência com o estudo da língua inglesa:a. Você estudou inglês antes dos 7 anos de idade? Sim Não

Se sim, por quantos anos? _____

b. Estudou inglês em Escola de Idiomas e/ou fez aulas particulares? Sim Não

Se sim, por quanto tempo? _____

c. Você estudou inglês em escola regular no Brasil? Sim Não

Se sim, preencha a tabela abaixo:

Escola de Ensino Regular		Por quantos anos?			
		1	2	3	4
No Ensino Fundamental I (06 a 09 anos)	<input type="checkbox"/> Sim <input type="checkbox"/> Não				
No Ensino Fundamental II (10 a 14 anos)	<input type="checkbox"/> Sim <input type="checkbox"/> Não				
No Ensino Médio (15 a 17 anos)	<input type="checkbox"/> Sim <input type="checkbox"/> Não				

9. Você **tem** o costume de utilizar o inglês em contextos fora da sala de aula? Sim Não Se sim, assinale a tabela a seguir:

Atividades		Por quantas horas semanais?			
		-1	1	2	3+
Assisto a filmes e/ou seriados em inglês.	() Sim () Não				
Ouçoo música em inglês.	() Sim () Não				
Pratico conversando inglês com colegas.	() Sim () Não				
Jogos de computador ou games em inglês.	() Sim () Não				
Estudo a pronúncia através de sites.	() Sim () Não				
Outras atividades em inglês.	() Sim () Não				
Leitura de artigos/literatura em inglês.	() Sim () Não				

10. Já utilizou a língua inglesa para se **comunicar em outro país**? () Sim () Não

Se sim, preencha a tabela abaixo:

País	Motivo (turismo, trabalho, estudo, outro)	Tempo de permanência

11. Você já utilizou a língua inglesa para se **comunicar com estrangeiros (mesmo que no Brasil ou via mídia)**? () nunca () 1 a 2 vezes () às vezes () frequente

12. Você **gosta** do idioma inglês? () Sim () Não

13. Por qual **motivo** você estuda inglês?

() Por gostar () Por necessidade (trabalho/estudos) () Outros

14. Você costuma **estudar inglês por conta própria** fazendo pesquisas na internet?

() sim () não

Caso afirmativo, exemplifique algum site ou como procura informações?

Muito obrigada pela sua participação! ☺

APPENDIX E – Production’s Test Stimuli Quantity and Types

Target Words (12) X 2 = 24

HAIL	HAY	HEAP	HOOK	HOPE	HUG
RAIL	RAY	REAP	ROOK	ROPE	RUG

FAMILIARIZATION (4) X 1 = 04	COOK	SOLD	LAMP
KICK			

DISTRACTERS (14) x 2 = 28

CHAIR	CHIN	CHUCK
SHARE	SHIN	SHUCK
VILE	VINE	
FILE	FINE	

GATE	GUESS
------	-------

MATE MESS

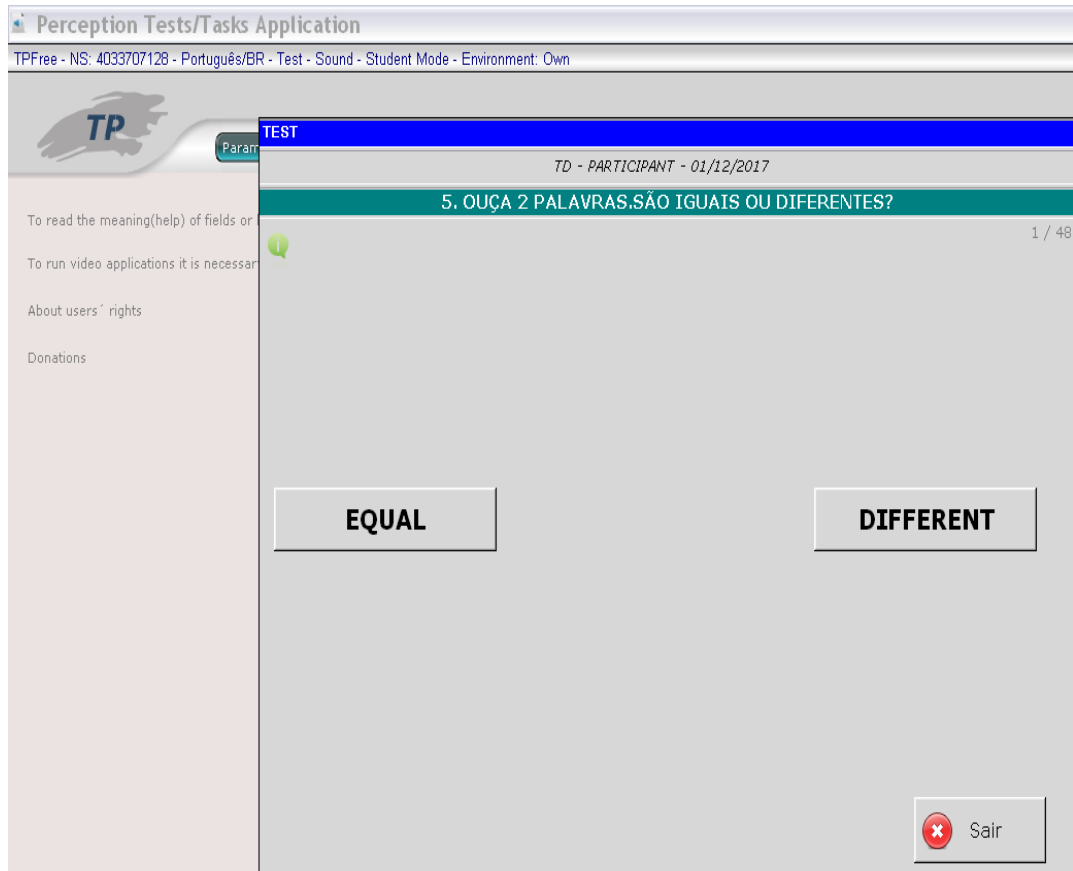
56 Production Stimuli

Familiarization = 04

Target Words = 24

Distractors = 28

APPENDIX F –Discrimination Test on TP Software



APPENDIX G – Discrimination Test Stimuli Quantities and Types

Stimuli Quantities and Types in the Discrimination Test on TP

<u>COOK COOK</u>	KEY KEY	SHUCK <u>SHUCK</u>	REAP REAP
<u>LOOK LOOK</u>	KEY SEA	CHUCK <u>CHUCK</u>	HEAP HEAP
<u>COOK LOOK</u>		SHUCK CHUCK	REAP HEAP
<u>LOOK COOK</u>	VINE VINE	CHUCK SHUCK	HEAP REAP
	VINE FINE		
<u>SICK SICK</u>		ROPE ROPE	RUG RUG
<u>KICK KICK</u>	GUESS <u>GUESS</u>	HOPE HOPE	HUG HUG
<u>SICK KICK</u>	MESS GUESS	ROPE HOPE	RUG HUG
<u>KICK SICK</u>		HOPE ROPE	HUG RUG
	CHAIR <u>CHAIR</u>		
<u>COLD COLD</u>	SHARE <u>SHARE</u>	ROOK <u>ROOK</u>	HAIL HAIL
<u>SOLD COLD</u>	CHAIR SHARE	HOOK <u>HOOK</u>	RAIL RAIL
	SHARE CHAIR	ROOK HOOK	HAIL RAIL
VILE VILE		HOOK ROOK	RAIL HAIL
VILE FILE	SHIN SHIN		
	CHIN CHIN	HAY HAY	
GATE GATE	SHIN CHIN	RAY RAY	
GATE MATE	CHIN SHIN	HAY RAY	
		RAY HAY	

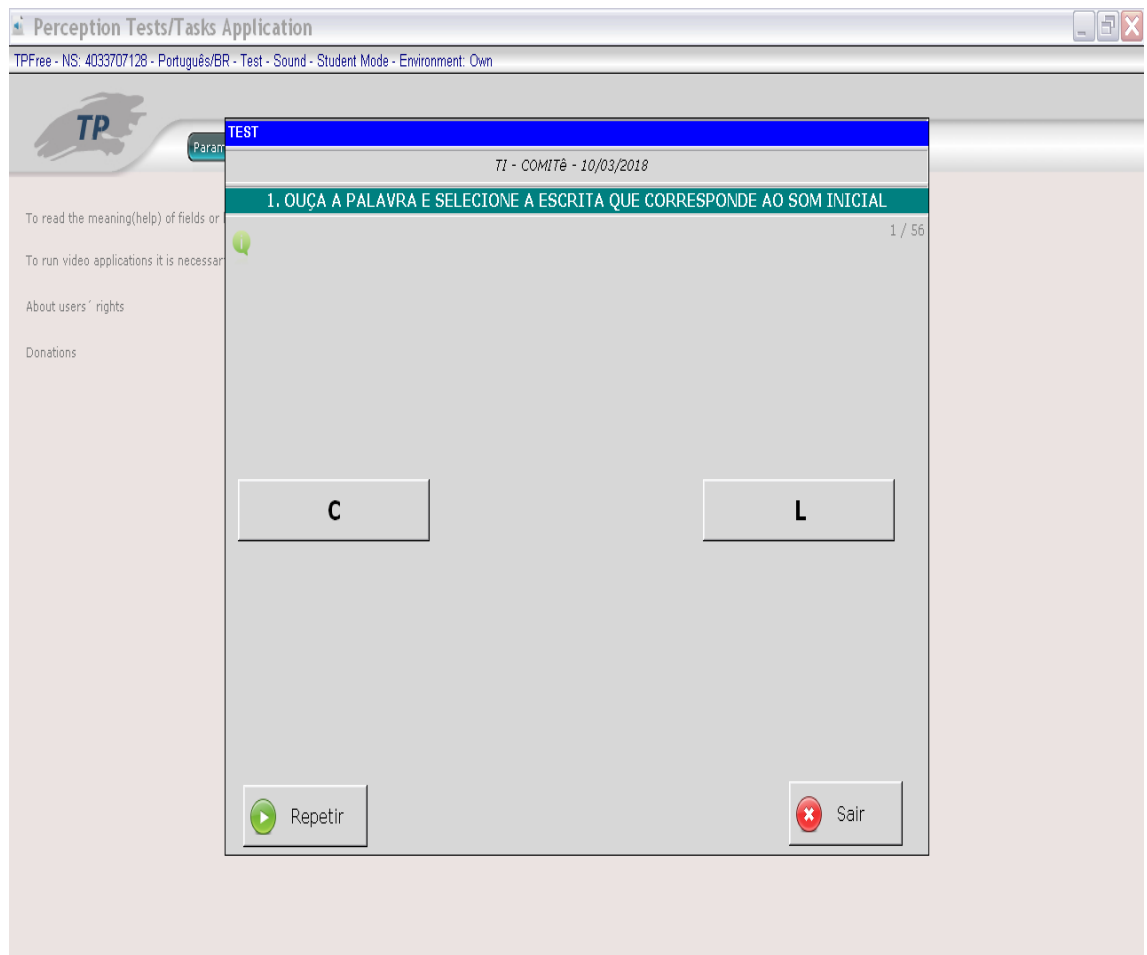
56 Discrimination Stimuli

Familiarization = 08

Target Words = 24

Distractors = 24

APPENDIX H – Identification Test on TP Software



Consonants:

C and L

F and V

H and R

Ch and SH

APPENDIX I – Perception Identification Test Stimuli Quantities and Types

Stimuli Quantities and Types in the Identification Test on TP

TARGET WORDS (12) X 2 = 24

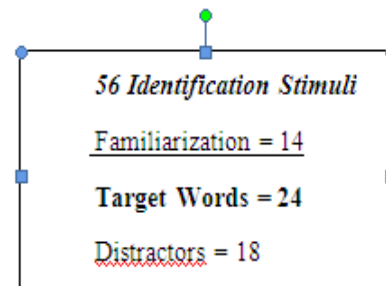
H	HAIL	HAY	HEAP	HOOK	HOPE	HUG
R	RAIL	RAY	REAP	ROOK	ROPE	RUG

FAMILIARIZATION (7) X 2 = 14

<u>C or L</u>	COOK	LAMP	LOOK	
F or V	FILE	FINE	VILE	VINE

DISTRACTERS (06) x 3 = 18

CH	CHAIR	CHIN	CHUCK
SH	SHARE	SHIN	SHUCK



APPENDIX J – RBF Email 1

Olá Participante!

Mais uma vez obrigada por estar participando desta pesquisa. Através do feedback esperamos contribuir um com o outro para que tenhamos mais conhecimento sobre o estudo da pronúncia. Este processo de estudo envolve 2 encontros presenciais e 2 e-mails contendo atividades.

Este primeiro e-mail inclui o seu feedback dos testes e também traz as primeiras atividades para que você possa aprimorar sua pronúncia da língua inglesa. **De acordo com os seus testes, você precisa aprimorar a pronúncia de 2 letras: R e H em início de palavra.**

Palavras que iniciam com a letra R são pronunciadas da seguinte forma:

<http://soundsofspeech.uiowa.edu/resources/english/movies/r-sound.htm>

<https://www.youtube.com/watch?v=KVcc7NGIfCg>

Palavras que iniciam com a letra H são pronunciadas da seguinte forma:

<http://soundsofspeech.uiowa.edu/resources/english/movies/h-sound.htm>

<https://www.youtube.com/watch?v=LyMd92bpe3g>

Assim que assistir os vídeos dos 4 links me envie (no corpo desse e-mail) as 8 palavras com R e as 7 com H.

Após eu receber seu e-mail com as palavras solicitadas, você receberá o segundo e último e-mail contendo mais atividades.

Bons estudos!

APPENDIX K – RBF Email 2

Olá Participante!

Obrigada pelo envio das palavras. Dando continuidade às atividades...

Estou enviando 2 arquivos contendo 2 blocos de áudio em anexo. Escute as palavras e digite as letras iniciais correspondentes às palavras no espaço abaixo.

Escute cada áudio anexado e digite se a palavra começa com a letra **H** ou **R**:

Bloco de Áudio 1

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____
- f) _____
- g) _____
- h) _____
- i) _____
- j) _____

Bloco de Áudio 2

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____
- f) _____
- g) _____
- h) _____
- i) _____
- j) _____



Fico no aguardo das suas repostas dos blocos de áudio 1 e 2 .

Abraço!

APPENDIX L – RBF Questionnaire (Experimental Group)

Questionário sobre o feedback recebido

1. Nome: _____ Data _____

2. O que você achou de receber Feedback da sua pronúncia? Explique o porquê de sua opinião. _____

3. Em relação aos recursos de vídeo e áudio disponibilizados para auxiliar na pronúncia, assinale 1, 2 ou 3.

1- **Muito** relevante

2- Relevante

3- **Pouco** relevante

() Vídeos do Youtube

() Imagem da boca mostrando a pronúncia da letra e algumas palavras com áudio

() Blocos de Áudio de palavras com espaço para digitar consoante inicial

4. Qual desses recursos acima mais lhe ajudou a perceber as diferenças entre o R e o H?

5. Além dos recursos disponibilizados nessa pesquisa, você fez alguma outra busca (por conta própria) para estudar mais sobre a pronúncia do inglês? () sim () não

Se sim, você acredita que esta pesquisa tenha motivado sua busca? () sim () não

6. Utilize este espaço caso queira deixar algum comentário sobre a sua participação nesta pesquisa. _____

Muito obrigada pela sua participação! ☺

APPENDIX M – Judges Explanation and Transcription for Productions

Transcription of Participants' Productions

Information:

- There are 55 audio files to be listened to.
- Each audio file contains 24 words (max.2 minutes).
- You will need approximately 110 minutes to conclude the whole listening process.

Instructions:

- 1) Have a pencil and the blank sheets provided in hands.
- 2) Put on your headphones and play the audio files.
- 3) Write the 24 words produced as you listen to them.
- 4) **In this study only the initial sound/letter is essential in the transcription.**
- 5) In case you cannot identify what initial letter was produced, insert a question mark (?)
- 6) Make sure the audio file number (1-55) you are listening to, corresponds to the number in the sheet provided (1-55).

Initial Sound (FILE 01)	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	

Initial Sound (FILE 02)	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	

Initial Sound (FILE 03)	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	

Initial Sound (FILE 04)	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	

APPENDIX N – Production and Identification Results with /ɹ/ and /h/ apart
(based on a 12-point scale per participant per consonant)

Group	PARTICIPANTS	PRODUCTION				IDENTIFICATION			
		pre /ɹ/	post /ɹ/	pre /h/	post /h/	pre /ɹ/	post /ɹ/	pre /h/	post /h/
EXPERIMENTAL	P1	4	12	8	12	8	12	8	12
	P2	12	11	3	9	7	8	6	5
	P3	12	12	1	3	4	12	3	12
	P4	0	12	12	11	12	12	8	12
	P5	4	9	12	12	10	12	11	11
	P6	10	12	3	10	8	12	7	12
	P7	0	5	9	7	9	5	6	2
	P8	1	10	11	12	8	12	9	10
	P9	7	4	10	12	9	8	9	8
	P10	6	12	10	11	7	5	12	12
	Subtotal		56	99	79	99	82	98	79
CONTROL	P11	8	9	9	9	10	10	9	10
	P12	10	8	3	4	1	7	2	9
	P13	0	0	10	11	7	5	4	5
	P14	2	1	10	4	5	4	6	4
	P15	9	11	5	11	9	11	8	9
	P16	12	10	6	12	12	12	10	12
	P17	6	5	10	12	12	12	12	11
	P18	11	12	7	12	9	12	9	10
	P19	6	10	12	12	12	12	12	12
	P20	12	12	12	10	8	10	10	10
Subtotal		76	78	84	97	85	95	82	92

APPENDIX O – Interval between Pre and Posttests

EXPERIMENTAL GROUP (Mean= 17.00)							
Participants	Pretest	Email 1	Reply 1	Email 2	Reply 2	Posttest	Interval
P1	24/05	27/05	30/05	31/05	14/06	15/06	20 days
P2	04/06	04/06	04/06	11/06	20/06	25/06	21 days
P3	04/06	14/06	14/06	15/06	19/06	21/06	17 days
P4	06/06	07/06	14/06	14/06	14/06	20/06	14 days
P5	07/06	07/06	27/06	27/06	27/06	28/06	21 days
P6	18/06	18/06	19/06	21/06	25/06	26/06	8 days
P7	20/06	20/06	02/07	02/07	09/07	18/07	28 days
P8	29/06	29/06	04/07	04/07	04/07	19/07	20 days
P9	03/07	03/07	16/07	17/07	19/07	25/07	22 days
P10	12/07	12/07	18/07	18/07	18/07	19/07	7 days

CONTROL GROUP (Mean= 9.60)			
Participants	Pretest	Posttest	Interval
P11	30/08	06/09	7 days
P12	31/08	14/09	14 days
P13	03/09	14/09	8 days
P14	04/09	12/09	8 days
P15	05/09	19/09	14 days
P16	14/09	26/09	8 days
P17	17/09	26/09	9 days
P18	21/09	28/09	7 days
P19	27/09	05/10	8 days
P20	27/09	05/10	8 days

APPENDIX P – Scores and Corresponding Percentages for Correct Answers

Production & Identification

12	100,00%
11	91,67%
10	83,33%
9	75,00%
8	66,67%
7	58,33%
6	50,00%
5	41,67%
4	33,33%
3	25,00%
2	16,67%
1	8,33%

Perception (R & H together)

24	100,00%
23	95,83%
22	91,67%
21	87,50%
20	83,33%
19	79,17%
18	75,00%
17	70,83%
16	66,67%
15	62,50%
14	58,33%
13	54,17%
12	50,00%
11	45,83%
10	41,67%
9	37,50%
8	33,33%
7	29,17%
6	25,00%
5	20,83%
4	16,67%
3	12,50%
2	8,33%
1	4,17%