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María del Rosario Garita Sánchez[1]
María Isabel González Lutz[2]
Nathalia Solís Pérez[3]

Abstract: *This article presents the results of the research project named Longitudinal Study of the Pronunciation of Vowel Sounds in English of Students from the Bachelor Degree in English Teaching at the Paraíso Campus of the University of Costa Rica. The project was conducted from 2015 to 2018, and it responded to the researchers' concern to find out which are the most troublesome pronunciation areas for learners. The main objective of this investigation was to determine the most difficult English vowel sounds to pronounce for the learners in their first, second and third year of their major. The study also examined the students' and professors' perception in relation to the difficulty of these vowels sounds. As for the methodology, the study followed a correlational design within a mixed method approach that encompassed a total of 57 students divided into two groups. To gather the data, the students' pronunciation was recorded and surveys were administered to learners and instructors. The data obtained from the recordings was processed using logistic regression; the vowels were organized from the most difficult to the easiest, and then the findings were compared to the data obtained from the surveys. The results revealed that the three most difficult vowels for students were /ɪ/, /æ/ and /ʊ/. The findings also showed discrepancies in the vowel sounds that learners and teachers perceived as difficult in comparison to the pronunciation difficulty found in the recordings. These significant differences have an impact not only on the decisions that instructors make, but also on the students' awareness of their pronunciation problems.*

Key words: *vowel sounds, pronunciation, instruction, perception.*

Resumen: *Este artículo presenta los resultados del proyecto de investigación denominado Estudio longitudinal de la pronunciación de los sonidos vocálicos en inglés en estudiantes del Bachillerato en la Enseñanza del Inglés del Recinto de Paraíso de la Universidad de Costa Rica. El proyecto respondió a la preocupación de las investigadoras por descubrir cuáles son los problemas de pronunciación más significativos para el alumnado de la carrera. El objetivo principal fue determinar cuáles son los sonidos vocálicos en inglés más difíciles de pronunciar para un grupo de estudiantes en su primer, segundo y tercer año de carrera. El estudio también examinó la percepción del estudiantado y de las personas instructoras en relación con la dificultad de estos sonidos vocálicos. En cuanto a la metodología, el estudio siguió un diseño correlacional dentro de un enfoque mixto, que abarcó un total de 57 estudiantes divididos en dos grupos. Los resultados de las grabaciones se procesaron por medio de regresión logística; las vocales fueron organizadas de la más difícil a la más fácil, posteriormente, los resultados fueron comparados con la información obtenida de las encuestas. Los resultados revelaron que las tres vocales más difíciles para los estudiantes fueron /ɪ/, /æ/ y /ʊ/. Los hallazgos también mostraron discrepancias entre los sonidos vocálicos que estudiantes y personas instructoras consideraron difíciles en comparación con los resultados del análisis de las grabaciones. Estas diferencias tienen un impacto no solo en las decisiones que toma el equipo docente, sino también en la concienciación del alumnado sobre sus problemas de pronunciación.*

Palabras clave: *sonidos vocálicos, pronunciación, instrucción, percepción.*

[1] *Docente de la Universidad de Costa Rica, Recinto de Paraíso, Carrera de Bachillerato y Licenciatura en la Enseñanza del Inglés, Costa Rica. Dirección electrónica: mariadelrosario.garita@ucr.ac.cr*

[2] *Investigadora y profesora de la Universidad de Costa Rica, Catedrática de la Escuela de Estadística, Costa Rica. Dirección electrónica: mariaisabel.gonzalezlutz@ucr.ac.cr*

[3] *Docente de la Universidad de Costa Rica, Recinto de Paraíso, Carrera de Bachillerato y Licenciatura en la Enseñanza del Inglés, Costa Rica. Dirección electrónica: nathalia.solisperez@ucr.ac.cr*

1. Introduction

Having accurate pronunciation when communicating in a foreign language is fundamental in order to transmit the intended message with clarity and avoid misunderstandings. Some language instructors tend to ignore this micro skill because they prefer to focus on other areas of the language such as grammar or vocabulary. In the case of the English language, since it is not an official language in our country, both teachers and students are not in contact with native speakers of English on a daily basis when they interact with others. Hence, EFL (English as a Foreign Language) students should be trained adequately to improve their pronunciation in English because they are not immersed in a context where they could easily pick the correct pronunciation. Indeed, it is imperative that university students who intend to become English teachers work on improving their pronunciation because they will be models for their future students.

In Costa Rica, the Ministry of Education (MEP) has its teachers take the Test of English for International Communication (TOEIC), which evaluates their English level. On February 29th, 2016 MEP published on its official website that based on the results obtained from TOEIC (2015), 20,7% of English teachers scored in the lowest levels of the Common European Framework of Reference for Languages (83 had an A1 or beginner level of English and 898 had an A2 or elementary level) (Díaz, 2016). Even though most teachers improved their level of English in comparison to the test administered in 2008, this meant that unfortunately, there were English teaching students who were graduating from the university without mastering the language properly, which is an issue that will have a negative impact on high school students who attend public or private institutions. These figures motivated the researchers to examine one area of the language where college students may be failing and little evidence is available: pronunciation of vowel sounds. Moreover, as former supervisors of the professional practicum that learners carry out in their fourth year of the major, the researchers noticed that some students made pronunciation mistakes while teaching. Indeed, in some cases, the wrong pronunciation of vowel sounds was salient and repetitive.

Therefore, this study arises from the researchers' concern about identifying specific deficiencies that the students from the English Teaching major at the Paraíso Campus of the University of Costa Rica have in regards to the pronunciation of vowel sounds in English. Having an accurate pronunciation will help these students have a better performance in their speaking courses and communicate efficiently in English, and also, it is a must that their

pronunciation is near native since they will become teachers and therefore, role models for their own high school pupils who will be imitating the way they speak and pronounce words.

The current study presents the main findings obtained from a research project that was registered in the Research Institute of Education from the University of Costa Rica. The project was named *Longitudinal Study of the Pronunciation of Vowel Sounds in English of Students from the Bachelor Degree in English Teaching at the Paraíso Campus*. The aim of the study was to determine the most difficult vowel sounds to pronounce for a group of students from the English Teaching major. In 2015, the pronunciation of the students who were in the first, second and third year of the major was analyzed to compare the performance among generations. Additionally, researchers kept a record of the first-year students' pronunciation in order to analyze their evolution throughout the years 2015, 2016 and 2017. Furthermore, the study intended to gather the students' and professors' perception regarding the difficulty of the sounds to compare these results with the recordings.

2. Review of Literature

The phonological acquisition of a second language is a complex process that requires learners not only to integrate the new linguistic features of the second language to their own system, but also to be able to materialize that knowledge through the correct perception and articulation of the sounds (Iruela, 2004, pp. 50-51). Without question, this can be very challenging for the students and especially if their first language differs considerably from the second one. This also explains why for some learners it is extremely difficult to achieve proficiency in phonological perception and to attain an intelligible production.

Besides the evident complexity behind attaining a near-native pronunciation, other relevant factors influence the acquisition process. Saville-Troike (2006, pp.82-87) and Celce-Murcia, Brinton and Goodwin (2010, pp. 15-22) point out aspects such as the age, the exposure, the amount of prior knowledge and instruction, the aptitude, attitude and motivation, and the role of the first language. However, it is the latter the one that influences pronunciation the most, much more than in any other areas of the language. In fact, some models and acquisition theories identify the native language as responsible for phenomena such as interference and transfer. Both concepts refer to the use of phonological elements of the first language in the second language; nevertheless, interference is seen more as an obstacle to pronounce properly while transference is perceived more as a strategy to deal with a phonological gap between languages (Iruela, 2004, p.55). For this reason, it is

imperative to understand the differences between both language systems to anticipate possible troublesome areas for students and to try to address those issues in the language classroom.

2.1 Differences between the English and Spanish Vowel System

According to Celce-Murcia et al (2010, pp. 114-125), the American English language has fourteen vowel sounds. The phonetic symbols used in the study and in this article are the ones found in Celce-Murcia et al. (2010, p. 115). Eleven of these sounds are either simple phonemes which means that are not accompanied by a glide movement (/ɪ/, /ɛ/, /æ/, /ɑ/, /ɔ/, /ʊ/ and /ʌ/), or vowels with an adjacent glide, that is, accompanied by /y/ or /w/ (/iy/, /ey/, /ow/, /uw/). The remaining three phonemes are diphthongs formed by a vowel sound followed by a nonadjacent glide within the syllable (/ay/, /aw/ and /ɔy/). Vowel sounds are classified as voiced, in other words, they are characterized by a continual vibration of the vocal cords and as continuants because the airstream escapes the mouth without any obstruction or interruption.

The main articulators involved in the utterance of vowel sounds are the tongue, the lips and the jaw; thus, Celce-Murcia et al (2010, pp. 114-125) explain that depending on the movement or position of those parts of the mouth, the vowel sounds can be analyzed in terms of four different dimensions. First of all, the authors state that vowels can be categorized into high, mid and low based on the position of the tongue in the mouth. Also, they can be classified as front, central or back depending on how forward or backward the tongue is in the oral cavity. The third dimension that the authors mention is related to the position of the lips which establishes the degree of spreading or rounding of the lips. Finally, they say that the length of the vowel determines if the phoneme is tense or lax, that is, if the muscles involved in the production are tense or relaxed when the sound is pronounced. Table 1 summarizes the main characteristics of the simple vowel sounds. It is relevant to clarify that these are the vowel sounds included in this study; diphthongs were not taken into consideration.

Table 1
Characteristics of the English vowel sounds

Sound	Tongue Position	Lip Position	Tense or Lax
/iy/	High – Front	Unrounded	Tense
/ɪ/	High – Front	Unrounded	Lax
/ey/	Mid – Front	Unrounded	Tense
/ɛ/	Mid – Front	Unrounded	Lax
/æ/	Low – Front	Unrounded	Lax
/ɑ/	Low – Central	Unrounded	Tense
/ɔ/	Low – Back	Rounded	Tense
/ow/	Mid – Back	Rounded	Tense
/ʊ/	High – Back	Rounded	Lax
/uw/	High – Back	Rounded	Tense
/ʌ/	Mid - Central	Unrounded	Lax

Source: Adapted from Celce-Murcia et al (2010)

Different from the English vowel system, in Spanish there are five pure vowels, fourteen diphthongs and five triphthongs. The pure vowels sounds are /a/, /e/, /i/, /o/, and /u/. They can also be classified based on the position and movement of the articulators; for instance, for the vowel /i/, the tongue moves high to the front of the mouth and the lips are unrounded (see Table 2). These vowel sounds can occur in both stressed and unstressed syllables, and they can be categorized into strong or weak vowels. Diphthongs are the result of the union of two vowel sounds; one considered as strong (/a/, /e/ or /o/) and the other one seen as weak (/i/ or /u/). The fourteen diphthongs in Spanish are: /ai, au, ei, eu, oi, ou, ia, ie, io, iu, ua, ue, uo, ui/. On the other hand, triphthongs occur when three vowel sounds are together, and it is usually the union of two weak sounds and a strong one, for example /ioi, uai, iau, uei, and iei/ (Sedláčková, 2009, pp. 18-22). Table 2 presents the main features of the pure Spanish vowels.

Table 2
Characteristics of the Spanish vowel sounds

Sound	Tongue Position	Lip Position
/a/	Low – Front	Unrounded
/e/	Mid – Front	Unrounded
/i/	High – Front	Unrounded
/o/	Mid – Back	Rounded
/u/	High – Back	Rounded

Source: Adapted from García (2003)

Helman (2004) explains that the Spanish vowel system is much simpler than the English one, and this makes it difficult for language students to perceive or pronounce new phonemes. According to the author, although there are some sounds that are present in both systems, when there is no correspondence between the spelling and pronunciation of the vowels, confusion can arise. In addition, Helman (2004) mentions that in Spanish, the length of the vowels is not a significant feature and sounds tend to be closer and more to the front of the mouth than in English (pp. 454-455). All these differences lead Spanish speakers to try to substitute the sound that they do not know for one that approaches to that phoneme in their native language.

A positive aspect is that despite the differences between both languages' vowel system, "even adult L2 learners are likely to discern the phonetic differences between certain L1 and L2 vowels, especially if the L1 has fewer vowels than the L2 (e.g., the 5-vowel system of Spanish in comparison to the 15-vowel English system)". This statement is presented by Flege and his colleagues as support for their model named the Speech Learning Model, which is a theory that predicts learning of L2 pronunciation focusing on both production and perception (Flege, cited in Strange, 1995, pp. 237 and 238). The authors support the fact that Spanish speaking students have an advantage when learning English pronunciation since their L1's vowel sounds are less than the ones found in the L2. Furthermore, the model hypothesizes that "the greater the perceived distance of an L2 vowel from the closest L1 vowel, the greater is the likelihood that a new category will be established for the L2 vowel" (p. 243). Even though the present study did not deal with perception of vowel sounds, it is relevant to state that this is an aspect that may have some influence in students' pronunciation accuracy: L2 vowel sounds that are perceived as very different from the L1 will be salient by language learners.

2.2 Pronunciation Difficulties for Spanish Speakers

Understanding the differences between the English and Spanish phonological system can help students and instructors foresee possible areas of difficulty that have to be addressed in the language classroom. In terms of perception, Boomershine (2013, pp. 103-105) explains that the students' first language can work as a filter through which the input received is adapted to their native language system. When this input differs greatly from their first language, students have to make an additional effort to incorporate the new pronunciation features. For instance, Spanish speakers must learn to identify the duration differences in the English vowels, an aspect that is not relevant for the perception of the Spanish vowels. This may cause complications in the way students perceive a sound inducing learners to associate the unknown sound to a single vowel in their native language.

A second aspect that the author emphasizes is the linguistic experience. As Boomershine describes, when Spanish speakers become relatively proficient in English, their level of perception is more English-like in comparison to a non-proficient speaker. The author also makes reference to the studies conducted by Fledge and Morrison, whose findings identified that monolingual Spanish speakers perceived the English /iy/ and /ɪ/ as the Spanish /i/, the vowel /æ/ as the Spanish /a/, and the vowel /ɛ/ as the Spanish /e/. This is a significant result because it suggests that as the exposure to the language increases, the perception of the sounds should also improve.

In terms of pronunciation, García (2003, pp. 17-20) illustrates the most common mistakes Spanish speakers make when pronouncing the English vowel sounds:

- The English sound /iy/ is usually pronounced as the Spanish sound /i/, but the /iy/ sound is slightly higher and longer than the Spanish phoneme.
- The English vowel /ɪ/ is also pronounced as the Spanish /i/; however, this sound is more relaxed in comparison to its Spanish counterpart. Spanish speakers would consider this sound as an "intermediate vowel", that is, placed in the vowel chart lower than the sound /i/ but higher than the sound /e/. This intermediate quality is particularly difficult for Spanish speakers to identify and to produce.
- The vowel /uw/ is in most aspects similar to the Spanish /u/, but the main difference is that the English sound is less tense.
- The sound /ʊ/ is one of the most troublesome because it is more relaxed than the Spanish /u/. Again, it is in an intermediate position. It is between the Spanish sound /u/ and /o/, so students are likely to pronounce it as a high-tense /u/.

- The sounds /ɑ/ and /ʌ/ are new phonemes for the Spanish speakers; therefore, learners tend to substitute it for other sounds. For instance, the vowel /ɑ/ is commonly produced as the Spanish /o/ or as the diphthongs /ou/ or /au/ because of the way words are spelled in English.

According to Sedláčková (2009) the English sounds /ɛ/, and /ɔ/ should not represent a problem from Spanish learners since they are very similar to the Spanish vowels /e/ and /o/. The only sound that may cause problems is /æ/ because it is usually replaced by /ʌ/ or /ɑ/. In relation to the sound /ey/, it can be pronounced as the Spanish diphthong /ei/. The sound /ow/ is not present in Spanish, but it can be replaced by the vowels /o/ and /u/ together which might help to acquire the sound. In addition, the author shares Boomershine's perceptive in terms of the vowel length. Both agree that requesting Spanish learners to distinguish between tense or lax English vowels will constitute a struggle because this dimension is not a significant characteristic for the Spanish vowels (pp. 21-22).

All these differences between the English and Spanish vowels sounds reveal the need to adapt the pronunciation instruction to the learners' specific areas of difficulty order to promote the successful acquisition of the sounds. Understanding how sounds should be taught and what sounds should be included or emphasized in the curriculum will lead to a more effective teaching experience.

2.3 Effectiveness of pronunciation instruction

It is evident that explicit teaching is not a mandatory requirement for a person who wants to become a proficient and accurate speaker of a foreign language. Being immersed and having to communicate in the culture where the language is spoken as a native language would help the learner pick up the phonetics and phonology of the target language. Even though each person learns at a different speed, having to interact with native speakers and perform tasks in the foreign language on a daily basis seems to be enough to develop ones' speaking skills. The learning process works differently in a formal teaching setting where students are not immersed in the foreign language's culture.

Language teachers may experience the feeling at some point of their careers that explicit instruction of certain aspects of language seems worthless. That is, it gives the impression that for some topics or for a specific group of students, explaining the language rules is worthless because they make many mistakes when doing speaking or writing

exercises to practice the aspects taught. On the contrary, there are other occasions when students prove to have clearly understood the subject matter, and most of them perform very well in the tasks assigned. Few scholars have addressed and done research on this area, which makes it even more valuable to inquire about whether teaching a foreign language explicitly is the best approach to develop its skills and micro-skills: listening, speaking, writing, reading, vocabulary and pronunciation. Referring specifically to the areas of speaking and pronunciation, there are some authors that contribute to this topic from contexts different from English learning as a foreign language. Indeed, there were no scholars found who refer to the effectiveness of explicit instruction in the case of Spanish speakers learning English as a foreign language.

Kissling (2013) carried out a study where she compared implicit and explicit instruction of certain Spanish consonants that have proven to be challenging for English native speakers. The author found that both teaching types equally helped students enhance their pronunciation. This finding demonstrates, as exposed by the author, that there might have been other aspects such as the type of tasks or feedback given to students that facilitated the improvement in their pronunciation (p.1).

Brown (1991) supports the idea that there are certain pronunciation aspects that do not require explicit teaching because they can easily be transferred from the native language to the foreign language or can be effortlessly learned (cited in Munro, Derwing & Thomson, 2015). Indeed, Munro et al (2015) state that teachers can rely on contrastive analysis in order to anticipate the difficulties that some language learners may experience; in addition, they explain that there are two issues that may arise. First, some students may come from different backgrounds and hence they may have different native languages. The second drawback is that contrastive analysis is less useful to predict mistakes than traditionally assumed (p.42). The authors support this statement by providing the example of Cantonese (Chan, 2006 cited in Munro et al, 2015) and Mandarin and Slavic (Munro and Derwing, 2008 cited in Munro et al, 2015) where aspects of the foreign language being learned are totally absent in the native language, and they are easily acquired by learners, which means that the differences established between both languages will not always determine difficulty areas (p.42).

Two other authors who refer to Japanese speakers learning English contribute to this discussion as well. In a study by Saito (2011), which focused on eight target sounds that included vowels and consonants, it was found that explicit instruction had an effect on

comprehensibility, mostly in a section where the participants had to read some sentences. However, there was not a significant reduction of the learners' Japanese accent while speaking in English (p.45). The second author, Koike (2014, p.365) suggests that explicit instruction improves the linguistic ability of adult learners of a foreign language. In the case of Japanese speakers, the author emphasizes the importance of teaching them aspects such as intonation, stress and tone of the English language because these elements represent big differences between the two languages and therefore greatly affect students' pronunciation in English (p.366). This statement by Koike relates to Munro's et al (2015), since these authors stress the relevance of contrastive analysis as a way to establish the similarities and differences between the native and foreign language. This input serves as a guide to select the elements of a language that should be prioritized in instruction.

There is no certainty that explicit instruction of pronunciation elements would guarantee that language learners would improve their pronunciation. However, it is an area in which students need training, but what aspects of pronunciation should be taught? Contrastive analysis provides insight to answer this question. A comparison between the target and foreign language should be considered in order to establish what features the languages share and what differences exist in order to foresee pronunciation gaps that learners may encounter. English instructors should be aware of the discrepancies between Spanish and English phonetics and focus on these aspects in the language class. Even though there is not much research on the explicit instruction of English vowel sounds to Spanish speakers, some authors mentioned above, such as Boomershine (2013), García (2003) and Sedláčková (2009), have stated the areas of difficulty that Spanish learners may also encounter.

3. Methodology

Since the current study analyzed not only students' pronunciation, but also the perception of both students and instructors, a mixed-method approach was followed. Hernández, Fernández and Baptista (2014, p. 534) state that this type of research design encompasses quantitative and qualitative data, as well as their joint discussion in order to make inferences obtained from all the information gathered and reach better understanding of the topic being studied. The recordings were treated with a quantitative analysis by employing logistic regression, and for the questionnaire, average difficulty for each sound was obtained and compared between students and teachers; the level of significance was 5%. Moreover, this was a panel/longitudinal study because it tracked students' pronunciation during their first

three years of the major, and it belongs to the type of correlational research because it relates different variables such as pronunciation difficulty, time and perception. Delgado (2014, p.57) explains that the aim of this approach is not only exploring the different variables; its focus is to find the connection among the variables throughout the study. In fact, the results obtained explain how difficult pronunciation was for students, how this difficulty relates to their level in the major and what their and their instructors' perception about this difficulty is.

3.1 Participants

The current study evaluated the pronunciation of the eleven vowel sounds of students from the Bachelor in English Teaching from the Paraíso Campus at the University of Costa Rica during the period 2015 to 2017. Each year of the major is composed by only one group of students. The population to conduct the study was intentionally chosen, and the requirement to participate is described below. Participants can be divided in two groups:

Group A: students that during the second semester in 2015 were taking the following courses:

IO-5002 Laboratory of Oral Communication II: 24 students

IO-5004 Laboratory of Oral Communication IV: 15 students

IO-5450 Laboratory of Oral Communication VI: 18 students

These students were in their first, second and third year of their major respectively. It is evident that in this year, 2015, the data gathered allowed to compare the performance of the three generations.

Group B: students who entered the major in 2015, and from 2015 to 2017 they took the following courses in the II Semester of each year:

2015 IO-5002 Laboratory of Oral Communication II: 23 students

2016 IO-5004 Laboratory of Oral Communication IV: 19 students

2017 IO-5450 Laboratory of Oral Communication VI: 11 students

The purpose with this second group was to follow the students up during their first three years of the major in order to determine whether instruction had an effect on students' performance when pronouncing the vowel sounds. That is, the study wanted to prove if the vowel sounds became easier year after year. The number of students in this group was

reduced throughout the years because of the following reasons: falling behind in the curriculum, dropping-out of the university, shifting majors, shifting campus or being absent the day that the recording was made.

3.2 Instruments and Procedure

3.2.1 Recordings

In order to evaluate the pronunciation of vowel sounds, a list of words was created; it included three words for each vowel sound, so in total there were thirty-three words in the list. The words were taken from a reader that belonged to a course that the participants had taken one semester before they were recorded. It was sought to select words where the target sounds were stressed and located in a middle position (in the case of multi-syllable words). These are the lists of words used in the study.

Table 3
Lists of words per sound used with the BA in English Teaching major students from the Paraíso Campus of the University of Costa Rica in 2015 - 2016 - 2017

2015			2016-2017		
1. /iy/	2. /ɪ/	3. /ɛ/	1. /iy/	2. /ɪ/	3. /ɛ/
ch**ee**se	s**i**t	r**e**st	h**ee**l	s**y**ndrome	p**e**rspective
eat	l**i**ve	**a**ny	l**e**thal	w**i**nk	r**e**medy
s**ee**	s**i**ck	w**e**lcome	sl**ee**p	w**i**nd	coll**e**ct
4. /ey/	5. /æ /	6. /ʌ /	4. /ey/	5. /æ /	6. /ʌ /
r**ai**n	m**a**n	l**u**nch	ev**a**ding	l**a**ck	cons**u**mption
l**a**te	h**a**t	r**u**n	aw**a**ke	n**a**p	v**u**lnerable
p**a**per	s**a**d	**u**ncle	int**a**ke	l**a**ndscape	h**u**nter
7. /ɑ/	8. /ɔ/	9. /ow /	7. /ɑ/	8. /ɔ/	9. /ow /
h**o**t	st**o**re	b**oa**t	sc**a**r	sn**o**re	h**o**me
w**a**tch	d**o**g	wind**ow**	chr**o**nic	st**o**rm	c**oa**st
b**o**x	c**a**ll	**o**pen	st**o**ck	f**o**recast	r**oa**d
10. /uw/	11. /ʊ/		10. /uw/	11. /ʊ/	
f**oo**d	f**u**ll		m**oo**d	t**oo**k	
m**o**vie	p**u**t		poll**u**te	l**oo**k	
st**u**dent	g**oo**d		l**o**se	b**oo**k	

Source: Information taken from Garita, González and Solís (2019, pp. 56, 57)

As Table 3 shows for all students who belonged to group A, the same list of words was used. In the case of students from group B, the researchers first planned to use a different list of words in each year of the study, but after doing the recording of the second year, it was decided to keep the same list of words for years 2016 and 2017 in order to avoid that the students' performance be affected by the words themselves; this was a suggestion made by the statistician who is also author of this article. The list of words for year 2016 and year 2017 was the same, but it was different from the one in year 2015.

3.2.2 Questionnaires

In the third year of the study, students from group B filled out a questionnaire (see Appendix 1). This instrument was also completed by instructors who were teaching courses in the BA in Teaching English in the second semester of 2017 in order to gather their opinions about their students' pronunciation. The purpose of administering the questionnaire to both groups was to compare their perceptions later on. In the first part of the questionnaire, students and instructors were asked to choose the level of difficulty from the easiest to the most difficult that each vowel sound represented for the students of the major. The second part consisted in selecting characteristics of vowel sounds such as the absence of the sound in the native language, the spelling, first language interference, the tense or lax feature or other that could be the cause why students pronounced them wrongly.

3.2.3 Procedure

During the first year of the study, researchers informed students about the purpose of the study and the process they would go though if they decided to participate. No formal consent form was given to students since at that time the research institute where the project was registered ("Instituto de Investigación en Educación") did not request it.

After that, participants from group A were contacted through an e-mail message, and an appointment with each one of them was scheduled in order to make the recording.
A cellphone was used to make the first recordings, but since the quality of the audio was not the best, a journalistic recorder was borrowed from the campus' library to continue with the recordings. Students were provided a printed list of the words and read them aloud one by one. It is relevant to mention that despite the background noise in the first recordings still it was possible to listen to the students' pronunciation of the vowel sounds which did not interfere with the results obtained.

For years 2 and 3 the recordings were made at the language lab, where the equipment allowed to obtain a better audio quality. However, the audio quality of the recordings from year 1 was good and did not alter the results. The subjects read the words, which were projected on the screen, one by one; it was decided not to use the printed list of words because the researchers wanted to control the speed at which the students would speak.

The recordings made during the 3 years of the study were analyzed following the same procedure. First, the researchers reviewed each recording individually by grading the pronunciation of each word as right or wrong. Next, the grades of both instructors were compared and differences were highlighted. The researchers gathered in order to analyze the words that were graded differently and agreed whether the pronunciation was right or wrong.

After the recordings of the students in third year were made, a validation of the grading instrument was carried out using expert criteria. Two students from each year of the study (from group B) were chosen randomly, and an experienced university professor who is also a native speaker of English graded the pronunciation of these students. The grades given to students by this professor were compared to the researchers' grades.

The questionnaire described above was applied in the third year of the research. One of the researchers distributed the instrument in class to the participants of the study who were taking the course IO-5450 Laboratory of Oral Communication VI. An appointment was set with each instructor of the major the same semester in order to have them complete the questionnaire as well.

3.3 Data Analysis

The data of the study are a dichotomous variable that take only two values: correct pronunciation or incorrect pronunciation. For the purpose of the analysis, these two categories were codified with number 1 when the pronunciation was correct and with zero when the pronunciation was incorrect. The analysis that corresponds to this type of data is logistic regression. The logistic model looks like below:

$$P(Y=1) = \frac{e^{f(X)}}{1+e^{f(X)}}$$

Where:

Y= 1 (correct pronunciation) and 0 (incorrect pronunciation)

P(Y=1) = probability for a vowel sound to be pronounced correctly

$f(X)$ = logit or linear part of the model

ε = base of natural logarithms

The logit for the model (1) that was applied to the cross-sectional analysis of the three generations in 2015 is defined as:

$$f(X) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_{12} X_1 X_2 + \varepsilon$$

Where:

X1 = qualitative variable that takes the following values: 1 for the first year generation, 2 for the second year generation, and 3 for the third year generation.

X_2 = qualitative variable that takes values from 1 to 11 that correspond to the different vowel sounds.

ε = random error

The logit for the model (2) that was applied to the longitudinal comparison of a students' cohort when moving from one year of the major to the other is defined as:

$$f(X) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_{12} X_1 X_2 + \varepsilon$$

Where:

X_1 = qualitative variable that takes as value 2 if the year that the cohort attended was second and 3 if the year was third.

X_2 = qualitative variable that takes values from 1 to 11 that correspond to the different vowel sounds.

The models were evaluated with maximum likelihood using JMP (SAS Inst. Inc., Cary, NC, USA). This type of analysis produces data that shows the odds for a certain sound to be pronounced correctly. With these odds we built odds ratios to compare one sound with another one.

Regarding the questionnaires, for the first part that dealt with the perception of students and professors, the students' average difficulty for each sound was compared with the difficulty given by the teachers using "t" of Student with a significance level of 5%.

4.   Results and Discussion

The results of the present study will be divided into four sections. The first and second sections explain the results obtained from the recordings of groups A and B respectively. The third section describes the information obtained after the validation of the grading instrument used for the recordings. Finally, the last section includes the perception of students and teachers in regards to the level of difficulty of the vowel sounds.

4.1   Recordings 2015

In 2015, participants from group A were recorded in order to analyze their pronunciation of the vowel sounds. Based on the results obtained (see Appendix 2), it was possible to organize the sounds from the most difficult to the least difficult for each of the three generations. The level of difficulty of the vowel sounds is shown in Table 4.

Table 4
Difficulty of vowel sounds from most difficult to least difficult for the BA in English Teaching major students from the Paraíso Campus of the University of Costa Rica in 2015
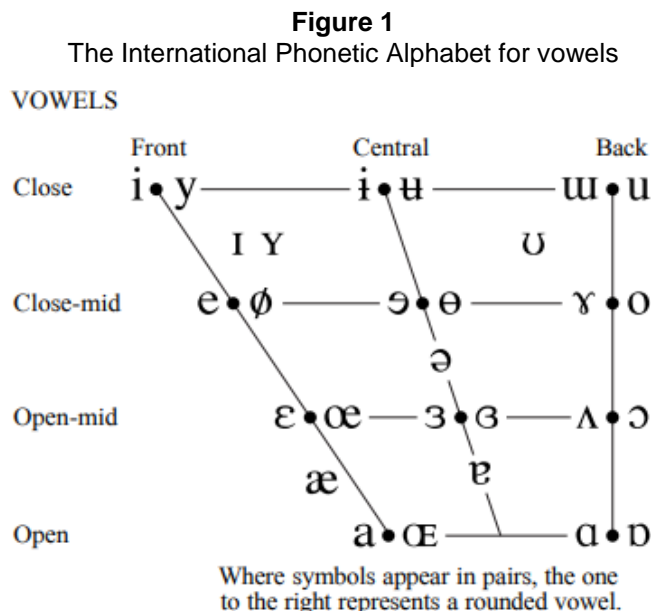
Range of difficulty	1st year students	2nd year students	3rd year students
1[a]	/ɪ/	/ɪ/	/æ/
2	/æ/	/æ/	/ʊ/
3	/ʊ/	/ʊ/	/ɪ/
4	/ɑ/	/ɑ/	/ɑ/
5	/ɔ/	/ɔ/	/ɔ/
6	/ʌ/	/ʌ/	/ow /
7	/ow /	/ow /	/uw/
8	/uw/	/uw/	/ʌ/
9	/iy/	/iy/	/ɛ/
10	/ɛ/	/ɛ/	/iy/
11[b]	/ey/	/ey/	/ey/

[a] Most difficult sound
[b] Easiest sound
Source: Information taken from Garita, González and Solís (2019, pp. 30-31)

As it can be seen, the three most difficult sounds for the three generations were the same: /ɪ/, /æ/ and /ʊ/. The range of difficulty changed for third year students though. These results reveal that despite the students' level of English, there were some factors that could have influenced all participants equally. One of those aspects is the characteristics of the vowels sounds. For instance, the three vowel sounds that proved to be more difficult for students to pronounce are lax vowels, which mean that for their articulation, the muscles involved have to be relaxed. This is relevant because as García (2003, p.19) explains the tense and lax dimension is not a distinctive feature in the Spanish vowel system; therefore, it is difficult for Spanish speakers to perceive or make that difference. Another aspect that could have been related to the difficulty of the sounds is their position in the vowel chart. Figure 1 illustrates the position of the English and Spanish vowel sounds.

Figure 1
The International Phonetic Alphabet for vowels

Where symbols appear in pairs, the one
to the right represents a rounded vowel.

Source: Reproduction of The International Phonetic Alphabet (Revised to 2005). Reprinted from International Phonetic Association (2015). Retrieved May 2nd, 2019 from https://www.internationalphoneticassociation.org/content/ipa-vowels

As figure 1 shows, the three vowel sounds: /ɪ/, /æ/ and /ʊ/ are located in what García (2003, p.20) calls "intermediate" position or they are "intermediate vowels." In the case of the vowel /ɪ/, it is located between the Spanish vowels /i/ and /e/, which according to the author makes its perception and production troublesome. Similarly, the sounds /æ/ and /ʊ/ are located in the vowel chart between the Spanish vowels /e/-/a/ and /u/-/o/ respectively; this leads students to try to pronounce the English vowels as one of the previous Spanish sounds. Thus, the fact that lax vowels located in an intermediate position represented a difficulty for three groups of students with different levels of exposure and instruction is a clue that other adult Spanish speakers may encounter a similar level of difficulty when pronouncing these English vowel sounds.

The difficulty that these three vowel sounds represent for students can be explained also by Flege's Speech Learning Model. The author "argued that equivalent or similar sounds in the L2 are difficult to learn because the learners can perceive those similar sounds as equivalent to the sounds in L1" (Flege cited in Alzahrani, 2014, p.9). This theory explains why these English sounds that share similarity with Spanish sounds are located at the top of the rank; it is highly possible that it was difficult for learners to pronounce them accurately because they produced the equivalent Spanish sound instead. The researchers noticed that

students made this type of substitutions in some occasions, which were marked as wrong pronunciation; however, these cases were not registered.

Table 4 also presents the difficulty of the other eight vowels, which is almost the same for the three generations of students. In the case of the vowels /ɑ/ and /ɔ/, although they seem similar to the Spanish /a/ and /o/, their production requires the muscles to be tense, a dimension that was identified by García (2003, p.19) as problematic. The English vowel /ɑ/ also differs from its Spanish counterpart /a/ because in the former the position of the mouth is wide open and the lips are neither rounded nor spread (Celce-Murcia et al, 2010, pp.119-120). In addition, the vowel sound /ʌ/, which does not exist in Spanish, occupies a difficulty level of six and eight in Table 4; this is significant because it reinforces the theory of Munro and Derwing, (2008) which proposes that aspects of the second language that are completely absent in the native language do not necessarily become a difficulty for language learners (p.42). Flege's Speech Learning Model also supports this statement because his contribution states that "new (dissimilar) sounds are easier to acquire since they are not equivalent to any sound in the L2" (Flege cited in Alzahrani, 2014, p. 9).

Another aspect that could have influenced students' pronunciation is the type and amount of instruction received. In regards to the type of instruction, it is crucial for teachers to identify the problematic areas in the pronunciation of the vowel sounds; in this way, the instruction and practice will be oriented to improve those aspects that are challenging for learners. Munro et al (2015) suggest using the contrastive analysis to anticipate problems that language speakers can encounter (p.42). As the results in Table 4 revealed, the participants needed more instruction or practice in order to internalize problematic features such as the tense/lax dimension. In relation to the amount of input, in the English Teaching major the vowel sounds are taught explicitly only during the first year; consequently, the fact that the three generations encountered similar pronunciation difficulties reveals the need to reinforce the correct pronunciation of problematic vowel sounds throughout the different levels and not only at the beginning of the major. Celce-Murcia et al (2010) explain that in EFL environments where students have little opportunities to listen to samples of authentic language, it is vital for instructors to maximize the exposure students receive to improve their competence in the language (p.18).

Table 5 exemplifies how vowel sounds can have different levels of difficulty for each generation. In this table, we can see which generation obtained the highest or lowest levels of difficulty being 1 the first generation, 2 the second and 3 the third one.

Table 5
Difficulty for each generation to pronounce each vowel sound in 2015

Vowel sounds	Difficulty		
	Highest difficulty	Medium difficulty	Lowest difficulty
/iy/	1[a]	2[b]	3[c]
/ɪ/	1	2	3
/ɛ/	**1**	**3**	**2**
/ey/	1	2	3
/æ/	1	2	3
/ʌ/	1	2	3
/ɑ/	**1**	**3**	**2**
/ɔ/	1	2	3
/ow/	1	2	3
/uw/	**1**	**3**	**2**
/ʊ/	**2**	**3**	**1**

[a] First generation
[b] Second generation
[c] Third generation
Source: Researchers' own design based on the data collected, November 2015

It is evident that first year students are the ones that experienced more difficulty with the sounds; this was expected because at this point in the major, they are starting to learn the sounds. This relates to Flege's idea that non experienced Spanish speakers have difficulties perceiving L2 vowels that are less distant to their L1 vowels (cited in Strange, 1995, p. 246). In addition, it is relevant to notice that the table highlights that in the case of the sounds /ɛ/, /ɑ/, /uw/ and /ʊ/, third year students proved to struggle more than second year students when pronouncing them. This means that even if students are in advanced stages of the learning process, they still need training on those vowels sounds they have not mastered yet. In this way, the type and amount of instruction should depend on the learners' specific language needs.

4.2 Recordings 2016-2017

In the years 2016 and 2017, the recordings of the participants from group B took place. Students read the same lists of words in both years to determine if the pronunciation of the vowels improved after the instruction and exposure received in the language classroom. In addition, the analysis of the recordings revealed the level of difficulty of the vowel sounds for this group of students in both years.

Table 6 shows the comparison of the level of difficulty of each vowel sound in relation to each other sound. The sounds in the columns are individually compared to each sound in the

rows in order to determine which of the two is more difficult. Where an "x" is found, it means that the sound in the column is easier than the sound in the row, and when a value is found, the sound in the column is more difficult than the sound in the row. In this way, we can say that sound 1 in the columns (/iy/) is easier than sound 2 in row 2 (/ɪ/) or that sound /iy/ is more difficult than the sounds in rows 3 and 4 (/ɛ/ and /ey/ respectively).

Table 6
Odds ratios of incorrect pronunciation for the comparison of each vowel sound in relation to the others[1] using the same words and the same cohort in the second and third year[2]

Sound	1 /iy/	2 /ɪ/	3 /ɛ/	4 /ey/	5 /æ/	6 /ʌ/	7 /ɑ/	8 /ɔ/	9 /ow/	10 /uw/	11 /ʊ/
1 /iy/		1.25	X	X	3.40*	X	2.08	X	X	X	2.44*
2 /ɪ/	X		X	X	2.73*	X	1.67	X	X	X	1.96
3 /ɛ/	4.38	5.45*		X	14.86*	2.69	9.12*	X	3.26*	4.16*	10.70*
4 /ey/	8.97	11.17*	2.05		30.48*	5.52*	18.70*	X	6.69*	8.52*	21.93*
5 /æ/	X	X	X	X		X	X	X	X	X	X
6 /ʌ/	1.62	2.02	X	X	5.51*		3.39*	X	2.21	1.54	3.97*
7 /ɑ/	X	X	X	X	1.63	X		X	X	X	1.17
8 /ɔ/	6044.89	7530.11*	1381.64*	673.84	20537.98*	3721.55	12600.29*		4510.21*	5744.32*	14777.75*
9 /ow/	1.34	1.67	X	X	4.55*	X	2.79*	X		1.27	3.28*
10 /uw/	1.05	1.31	X	X	3.58*	X	2.19	X	X		2.57*
11 /ʊ/	X	X	X	X	1.40	X	X	X	X	X	

[1] The odds ratios in each case compares the sound that appears in the column with the one that appears in the row of the matrix. Only the reasons of advantage greater than 1 are recorded. The X corresponds to the odd ratios less than 1.
[2] The two years were not recorded separately because the sound * year interaction was not significant, so it was concluded that the difficulty of the sounds was maintained from one level to the other.
*Significant at 5% level
Source: Researchers' own design based on the data collected, November 2016 and November 2017

In relation to the sound difficulty, the three most difficult vowels according to the students' pronunciation were /æ/, /ʊ/ and /ɑ/. As it was explained before, the vowels /æ/ and /ʊ/ are lax vowels located in an intermediate position in the vowel chart; characteristics that proved to be problematic for Spanish speakers. In the case of the vowel /ɑ/, if it is compared to the Spanish /a/, the English vowel requires a bigger opening of the mouth which implies that the muscles have to be tenser. Again, it can be inferred that it was the tense dimension of the vowel what caused the errors. For the rest of the vowel sounds, they appeared in the following order: /ɪ/, /iy/, /uw/, /ow/, /ʌ/, /ɛ/, /ey/ and /ɔ/. As García (2003) also suggests, the vowels /ɪ/ and /iy/ can be difficult to pronounce because students replace them for the

Spanish /i/ making no distinction between a tense or lax vowel; this explains why they obtained a higher level of difficulty than the rest of the sounds (p. 20). Another interesting phenomenon is the case of the stressed schwa (/ʌ/), which many instructors would perceive as the most difficult for its characteristics and its absence in the Spanish language. However, the fact that it was not the most problematic one suggests that if instructors are aware of the difficulty of a sound, they are more likely to tackle the sound in class and to give students the necessary training, which can help to reduce the number of errors.

The results obtained from group B also allowed researchers to determine if the instruction and exposure had an effect on the students' pronunciation during the years 2016 and 2017. A limitation researchers faced was that even though it was intended to determine the effect throughout the three years, this was not possible because the list of words used in 2015 was different from the list used in 2016 and 2017. Table 7 shows the levels of difficulty obtained in 2015, 2016 and 2017.

Table 7
Level of difficulty of the vowel sounds in 2015, 2016 y 2017

Level of difficulty	2015	2016-2017
1[a]	/ɪ/	/æ/
2	/æ/	/ʊ/
3	/ʊ/	/ɑ/
4	/ɑ/	/ɪ/
5	/ɔ/	/iy/
6	/ʌ/	/uw/
7	/ow/	/ow/
8	/uw/	/ʌ/
9	/iy/	/ɛ/
10	/ɛ/	/ey/
11[b]	/ey/	/ɔ/

[a] Most difficult sound
[b] Easiest sound
Source*: Information taken from Garita, González and Solís (2019, p. 33)

The data from Table 7 contradict Boomershine's idea (2013) that as the learners' performance improves, their perception of sounds would also improve (pp. 103-105). As it can be seen, the sounds /æ/, /ʊ/ and /ɑ/ ranked as the three most difficult sounds in the table; this can be explained by the amount of exposure or instruction received. Taking into account that in the English Teaching major at the Paraíso Branch the vowel sounds are explicitly taught only during the first year, it is possible that the students' instruction during the rest of the major focused more on suprasegmentals (word stress, rhythm and intonation) than on

segmentals (vowels and consonants), and even though this approach is not incorrect, it is also beneficial to keep a balance between both features. Furthermore, as Table 5 displayed, even students in advanced levels of the major can have specific pronunciation problems regarding vowel sounds that have to be addressed in the language classroom.

Besides the problems with the perception of sounds due to the lack of input, another possible reason why students did not improve their production of these sounds can be the instructors' tendency to focus more on the sounds that they perceive as the most difficult to acquire, overlooking other sounds which can produce even greater problems due to their difference with the learners' native language. For example, teachers might consider the sound /ʌ/ as more difficult that the sound /ɪ/ because the vowel /ʌ/ does not exist in Spanish; however, as Munro et al (2015) explained before, the absence of a sound does not necessarily represent a difficulty. For this reason, it is imperative for instructors to determine the vowel sounds that are particularly difficult for Spanish speakers and pay careful attention to those sounds; in this way, they can guarantee that students receive enough training on the problematic areas.

Finally, another probable explanation can be the type and the amount of correction students receive. Sometimes more explicit error correction techniques are needed for a student to be aware of his or her pronunciation problems. It is necessary for instructors to make sure that learners not only understand the correction, but also that they produce a correct version of the error. In the same way, promoting self-correction is also vital for the students to be aware of the areas in which they have to improve; allowing students to monitor their own pronunciation will promote independence and help students to be more accurate.

4.3 Validation of the Instrument

As part of the last year of the study, a validation of the grading instrument was carried out. From 198 words examined, there was agreement in 155 of them between the researchers and the expert, which means that the researchers graded the recordings appropriately. The results are displayed in Table 8.

Table 8
Number and percentage of grades according to agreement between the researchers and an expert

Sound	No agreement incorrect-correct[1]		No agreement correct-incorrect[2]		Agreement		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
/iy/	2	11	0	0	16	89	18	100
/ɪ/	5	28	1	5	12	67	18	100
/ɛ/	0	0	0	0	18	100	18	100
/ey/	1	6	0	0	17	94	18	100
/æ/	8	44	0	0	10	56	18	100
/ʌ/	5	28	0	0	13	72	18	100
/ɑ/	5	28	3	17	10	56	18	100
/ɔ/	4	22	0	0	14	78	18	100
/ow/	0	0	0	0	18	100	18	100
/uw/	3	17	0	0	15	83	18	100
/ʊ/	4	22	2	11	12	67	18	100
All sounds	37	19	6	3	155	78	198	100

[1]Graded as incorrect by the researchers and correct by the expert
[2]Graded as correct by the researchers and incorrect by the expert
Source: Information taken from Garita, González and Solís (2019, p. 74)

As the table shows, more disagreement was found in the incorrect-correct relation than in the correct-incorrect relation. That is, there is more disagreement in the words that were graded as incorrect by the researchers and correct by the expert. This is positive because it reveals that there were just few instances in which the researchers perceived a sound as correct when it actually was incorrect. Moreover, the sound that had the highest number of non-concordances was /æ/, which means that this sound might have been presented as more difficult in the results than it actually is. However, the disagreement between the researchers and the expert did not affect the fact that /æ/ ranged as the most difficult sound because the values obtained in the odds ratios have a value of twice, triple, five and even 30 times. Thus, this information evidences that the results obtained from the recordings are accurate.

4.4 Perception of Vowel Sound Difficulty

To compare the students' and teachers' perception in regards to which vowel sounds were the most difficult for them, they rated the sounds using a Likert scale from the easiest to the most difficult, being 1 the easiest and 5 the most difficult. Table 9 presents the results obtained from their perception.

Table 9

Mean perception[1] of students and teachers from the BA in English Teaching from the Paraíso Campus of the University of Costa Rica about the difficulty of each sound in 2017

Sound	Professors	Students	$P(t>t_0)$[2]
1 /iy/	2,42	3,00	0,3844
2 /ɪ/	3,71	2,18	0,0007
3 /ɛ/	2,00	1,27	0,0278
4 /ey/	2,29	1,36	0,0157
5 /æ/	3,86	2,82	0,0629
6 /ʌ/	2,43	1,64	0,0796
7 /ɑ/	4,29	3,73	0,2285
8 /ɔ/	3,57	1,55	<0.0001
9 /ow/	2,43	1,45	0,0059
10 /uw/	3,71	2,55	0,0136
11 /ʊ/	2,71	2,27	0,2996

[1]On a scale of 1 to 5
[2] Probability associated with the mean comparison test
Source: Information taken from Garita, González and Solís (2019, p. 70)

Students rated /ɑ/, /iy/ and /æ/ as the most difficult sounds while instructors perceived the sounds /ɑ/, /æ/, /uw/ and /ɪ/ as the most problematic. The fact that both acknowledged the difficulty of the English vowel /ɑ/ indicates that they recognize a pronunciation difference with the Spanish counterpart /a/; this is positive because as it was mentioned before, learners tend to confuse these sounds. The other sound in which they agreed on was /æ/, a vowel that involves some parameters students can struggle with: muscles are relaxed; it is located between the Spanish /e/ and /a/ in the vowel chart; and it requires spreading of the lips. The case of /iy/ and /uw/ was not expected by the researchers due to their similarity to the Spanish vowels. Possibly, they were considered difficult because they are tense vowels, a characteristic that does not exist in Spanish. The sounds /ʊ/ and /ʌ/ were not rated as troublesome as the previous ones, which indicate that those sounds that are not present in the Spanish vowel system are not necessarily perceived as difficult by non-native pupils and teachers.

Table 9 also reveals that the levels of difficulty given by the professors where higher than the students' ratings; that is, professors were stricter when selecting the difficulty of a vowel. Vowels /ɪ/, /æ/, /ɔ/, and /uw/ received approximately a rating of 3, which means that

they have a medium difficulty, and the sound /ɑ/ received a 4, which means difficult. On the other hand, the maximum rate used by students was 3, and it was assigned only to two sounds; the rest of the vowels obtained ratings of 1 and 2 (very easy and easy). These results show that instructors are more aware of the difficulty vowels can represent for learners; nevertheless, pupils do not seem to recognize that vowels can be troublesome and that they might be having problems pronouncing some of them.

When participants were asked for the reasons why they considered it was difficult to pronounce the vowel sounds, both teachers and students agreed on the absence of a sound in the native language as the main reason. Interestingly, the recordings revealed that students did not have major problems with the sound /ʌ/, which does not exist in Spanish. They only had troubles with the tense sound /ɑ/, which tend to be confused with the Spanish vowel /a/. Professors also provided other reasons such as lack of spelling-sound correspondence, the influence of the first language, and the last reason was the tense-lax feature. This evidences that even though the tense-lax characteristic was proven to be problematic for Spanish speakers, instructors are not aware of this relevant finding. The same occurred with students; they perceived the tense-lax dimension as the least possible reason only followed by the lack of spelling-sound correspondence. The fact that participants did not choose the length of a vowel or the Spanish interference as the main causes for pronunciation problems prove once more that their perception do not necessarily match the students' performance.

After comparing the results gathered from the recordings and the questionnaires, it can be seen that the students' and teachers' perception partially match the learners' pronunciation problems.

Table 10
Level of difficulty of sounds according to the recordings' analysis and the students' and teachers' perception

Recordings 2015	Recordings 2016-2017	Professors' perception	Students' perception
/ɪ/	/æ/	/ɑ/	/ɑ/
/æ/	/ʊ/	/æ /	/iy/
/ʊ/	/ɑ/	/uw/	/æ /
/ɑ/	/ɪ/	/ɪ/	/uw/
/ɔ/	/iy/	/ɔ/	/ʊ/
/ʌ/	/uw/	/ʊ/	/ɪ/
/ow/	/ow/	/ʌ/	/ʌ/
/uw/	/ʌ/	/ow/	/ɔ/
/iy/	/ɛ/	/iy/	/ow/
/ɛ/	/ey/	/ey/	/ey/
/ey/	/ɔ/	/ɛ/	/ɛ/

Source: Researchers' own design based on the data collected, November 2015, 2016 and 2017, and September 2017.

As it is shown in Table 10, the results of both instruments indicate that the vowels /æ/ and /ɑ/ pose a high level of difficulty for Spanish speakers. However, the sound /ʊ/, which was one of the three most difficult sounds in the recordings, was not perceived as problematic as the students' pronunciation revealed. This is a significant finding because the discrepancy between perception and pronunciation affects directly the teaching decisions instructors make in relation to which sounds should or should not be emphasized or practiced in the classroom. Being pronunciation a relevant factor in competence and comprehensibility, it is crucial for the teaching process to be oriented to the learners' specific weaknesses. Moreover, it is imperative for learners to be aware of their pronunciation problems so that they can focus on those areas that need to be improved; however, as Table 10 revealed, participants perceived some sounds as difficult when they were, in fact, easy for them. This can be related to the type of correction students receive; for instance, if the correction only comes from the instructor, students are not developing the ability of self-monitoring and self-correcting. Thus, promoting activities in which pupils analyze their own pronunciation can be highly beneficial to enhance their performance in the language. Also, it is crucial to vary the type of feedback provided and to offer correction in a more meaningful way, so that learners can actually benefit from it.

5.   Conclusions and Recommendations

The analysis of the three generations in the year 2015 (group A) showed that the level of difficulty for each vowel sound was almost the same for each of the three groups of students. In the cases where the level of difficulty varied among the generations, the difference was only one level, which demonstrates that there was very little discrepancy. Moreover, this data aligned with the results obtained from group B. This input leads to the conclusion that it would be useful for instructors of the major to pay close attention to the most difficult vowel sounds found in this study when planning their lessons and during instruction.

Also, as it was expected, first year students were the ones that made more mistakes pronouncing the vowels. It is evident that beginner learners experience more pronunciation difficulty. It is relevant to mention though that in the case of the second year group, they proved to pronounce three sounds better than third year students did. This fact may be justified by specific characteristics of the students that led to this performance, which demonstrates that specific groups of students may have specific weaknesses that need to be known and addressed by professors.

The analysis of group B indicated that the level of difficulty of the vowel sounds stayed the same during the two years; in other words, instruction might not have had any impact on students' performance. As it was mentioned previously in the analysis section (4.2 Recordings 2016-2017) vowel sounds are included in the course program of a first year course only. This may be the reason why from second year to third year there was no major impact on students' pronunciation; it is possible that the mistakes learners made in their first year were not addressed in class or corrected, which led students to make the same errors year after year. For this reason, professors should dedicate more class time to the vowel sounds and to monitor and provide feedback related to this aspect.

Furthermore, in the study, the sounds that proved to be the most difficult were mentioned in the literature as the ones that may represent more trouble for Spanish speakers, so in this case the theory and the results found match. It is evident that it is mostly the difference in lengthening of the English vowel sounds what represents a challenge for Spanish speakers. The differences in length should be highlighted when teaching the different vowel sounds in English.

The validation of the recordings' results showed that the vowel sounds where the researchers had more disagreement with the native-speaker professor where sounds that

ranked as the most difficult according to the pronunciation of learners who belonged to group B. Moreover, it was confirmed that the researchers graded the recordings correctly and the few errors made did not affect the results of the study. This fact should motivate non-native English teachers to do more research on this topic and be confident about the knowledge they have. Indeed, the previous research consulted did not acknowledge any data about Spanish speakers learning English. This means that there is lack of information on the topic but also a big opportunity to explore more. More studies are needed in order to support or disapprove what has been stated in the theory.

In relation to the analysis of students' and instructors' perception, there were differences between both. Similarly, the results obtained from the analysis of the recordings showed that the real difficulty of sounds did not match entirely what instructors and learners perceived. Together with the fact that the professors were stricter when grading the difficulty that the sounds represented for the students, it is shown that both should be aware of the real difficulty that vowel sounds represent for learners. In order to obtain this information, it is suggested that instructors who teach speaking courses and laboratory courses measure throughout the semester their students' performance regarding pronunciation; this data will help them and their students recognize their weaknesses and areas for improvement. Teaching decisions should be done based on evidence that demonstrates what the students' needs are, and this evidence would provide valuable input to learners who would definitely be more aware of what pronunciation aspects they must improve. Another crucial aspect is to promote more autonomy in the error correction area to empower students to improve their own pronunciation problems.

As for the limitations faced in the study, one difficulty researchers had when analyzing the recordings made in 2015 was that students read the list of words continuously; this implied a greater effort for the researchers when checking the students' pronunciation. Another situation that was not expected was the reduction of the group of participants who were followed up during years 2015, 2016 and 2017. It would have been ideal to have the same amount of students; however, this group was reduced from 23 to 11 students for various reasons. Finally, researchers encountered a limitation in relation to the list of words used for group B; it was intended to use a different list of words each year; nevertheless, due to a suggestion by one researcher, the same list of words was used during years 2016 and 2017 to avoid that the words themselves could have affected the students' pronunciation. This allowed researchers to compare only the results obtained in 2016 and 2017.

6.   Acknowledgement

7.   References

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Appendix 1: Questionnaire

El siguiente cuestionario pretende recolectar información sobre la percepción de los (as) estudiantes de la carrera de Enseñanza del Inglés del Recinto de Paraíso en relación con la pronunciación de los sonidos vocálicos. Esta información será utilizada en la investigación denominada *"Estudio longitudinal de la pronunciación de los sonidos vocálicos en inglés del estudiantado del Bachillerato en Enseñanza del Inglés del Recinto de Paraíso".* Los datos recopilados serán tratados con confidencialidad.

Parte I. Indique el nivel de dificultad de los siguientes sonidos vocálicos según su percepción.

Sonidos	Muy fácil	Fácil	Dificultad media	Difícil	Muy difícil
/ iy /	O	O	O	O	O
/ ɪ /	O	O	O	O	O
/ ey /	O	O	O	O	O
/ ɛ /	O	O	O	O	O
/ æ /	O	O	O	O	O
/ a /	O	O	O	O	O
/ ʌ /	O	O	O	O	O
/ ɔ /	O	O	O	O	O
/ ow /	O	O	O	O	O
/ ʊ /	O	O	O	O	O
/ uw /	O	O	O	O	O

Parte II. Indique cuáles de las siguientes opciones representan dificultades que usted enfrenta a la hora de pronunciar un sonido vocálico en inglés.

Se me dificulta…

	Sí	No
1. Pronunciar sonidos vocálicos que no existen en español.	O	O
2. Pronunciar vocales en donde la ortografía no corresponde a la pronunciación.	O	O
3. Pronunciar ciertos sonidos vocálicos por interferencia de la lengua materna.	O	O
4. Hacer la diferencia entre "tense" y "lax vowels".	O	O
6. Otra(s)	O	O

Appendix 2: Odds ratios per generation

Sound	1	2	3	4	5	6	7	8	9	10	11
1		357.50 174.25 148160075.0	0.66 0.00 1517542.5	X	102.67 49.63 5118271.0	5.11 1.00 1517542.5	11.00 12.81 25502117.0	9.63 14.55 22979930.0	3.3 3.15 4731162.1	2.89 0 3093452.1	62.33 150.33 229799300.0
2	X		X	X	X	X	X	X	X	X	0 0 1.55
3	1.52 1961701.3 0	544.38 341826459.0 97.63		X	156.33 97362335.00 33.73	7.78 1961701.3 1.00	16.75 25134298.0 16.80	14.66 28539590.0 15.14	5.03 6186904.2 3.12	4.39 1 2.04	94.92 294909102.0 151.43
4	3655898.0 1961701.3 1.0	1307000000 341826459.0 148160075.0	2400888.2 1.0 1517542.5		375338857.0 97362335.0 51182571.0	18671193.0 1961701.3 1517542.0	40214877.0 25134298.0 25502117.0	35188018.0 28539590.0 22979930.0	12064463.0 6186904.2 4731162.1	10588165 1 3093542	227884306.0 294909102.0 229799300.0
5	X	3.48 3.51 2.89	X	X		X	X	X	X	X	X
6	X	70.0 174.25 97.63	X	X	20.1 49.63 33.73		2.15 12.81 16.80	1.88 14.55 15.14	X	X	12.21 150.33 151.43
7	X	32.5 13.6 5.81	X	X	9.33 3.87 2.01	X		X	X	X	5.67 11.73 9.01
8	X	37.14 11.98 6.45	X	X	10.67 3.41 2.23	X	1.14 0 1.11		X	X	6.48 10.33 10.0
9	X	108.33 55.25 31.32	X	X	31.11 15.74 10.82	1.55 0 0	3.33 4.06 5.39	2.92 4.61 4.86		X	18.89 47.67 48.57
10	X	123.91 341826459.0 47.89	X	X	35.58 97362335.0 16.55	1.77 1961701.3 0	3.81 25134298.0 8.24	3.34 28539590.0 7.43	1.14 6186904.2 1.53		21.6 294909102.0 74.29
11	X	5.74 1.16 0	X	X	1.65 0 0	X	X	X	X	X	

Source: Researchers' own design based on the data collected, November 2015

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