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A DUAL DIMENSIONAL PHONETIC ANALYSIS TO RECOGNIZE SOME COMMON ERRORS IN THE USE OF THE SOUND SCHWA IN TRAINED TEACHERS AND NON TRAINED TEACHERS IN PRONUNCIATION

Verónica Proaño-Ocampo

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VERÓNICA CLAUDIA PROAÑO OCAMPO

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FACULTAD DE CIENCIAS DE LA EDUCACIÓN

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APPROVAL

The thesis entitled, “**A dual dimensional phonetic analysis to recognize some common errors in the use of the sound schwa in trained teachers and non trained teachers in pronunciation**”, presented by **Verónica Claudia Proaño Ocampo**, in accordance with the requirements of being awarded the Degree of Master in Education with Mention in Teaching English as a Foreign Language, was approved by the thesis director: **Mg. Maria Esther Linares**, and defended on.....before a Jury with the following members:

.....
President

.....
Secretary

.....
Informant

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INTRODUCTION

The entitled investigation: “A Dual Dimensional Analysis to Recognize Some Common Errors in the Use of the Schwa Sound in Trained Teachers and Non Trained Teachers in Pronunciation ” has as its main purpose to dedicate a substantial review in regards to the most common English vowel: The schwa sound.

This interest begins on the controversy that the production of this relevant feature schwa sound in phonological terms might influence, in a very special way, the English sounding pronunciation second language speakers have. To be more specific, this research has the intention to explain the level of pronunciation in L2 teachers in the use of the schwa sound based on the assumption that schwa sound is a non existent sound in the Spanish vowel inventory in contrast to the English vowel inventory in which the schwa sound is the most common English vowel. For this reason, the use of the schwa sound determines how much the English sounding pronunciation a speaker has.

The level of performance will be measured under the findings in regards of the common errors teachers have when they have to pronounce words that contain this vowel sound.

This investigation is based on a dual analysis that is supported by the Educational area and Phonetics area. This Integration of both areas has two dimensions on this analysis: The educational area is developed by a classroom action research through a perceptual evaluation by a hearing validation process and segmental research. A storytelling activity

is applied by evaluating teachers in the production of the use of the sound schwa through a perceptual analysis by recording videos of a reading activity during the interaction between teachers and students. The second dimension of analysis supports the first one by a phonetic analysis based on the Praat program in order to evaluate the production of the sound schwa also in segmental form. This Phonetic analysis based on Praat is one of the most sophisticated programs in Phonetics created by the applied linguistics Boersma, P & Weenink, and D. from the University of Amsterdam in 2006.

This dual analysis has the intention to provide information in regards of the most common errors teachers make in the use of this vowel sound in all of its vowel positions under the process of English as a second language based on an integral perspective. As it was mentioned, this dual analysis is supported by two areas of study: phonetics and education that are unusually interrelated in two different environments and contexts for evaluation.

The aim is to identify vowel sounds that are not accurately pronounced by the teacher during the phonetic evaluation. Specifically, in words that contain the neutral vowel (the schwa sound) in all of its positions. These written representations English words are the same as the Spanish vowels: a, e, i, o, u. However, in terms of phonemically structure there is a large difference between English vowel inventory and Spanish vowel inventory.

This phenomenon sometimes explains the difficulty in mastering certain structures in a second language (L2) depending on the difference between the learners' mother language (L1) and the language they were trying to learn. Recognize the more common errors in the use of the schwa sound through a Contrastive Analysis between native and non native teachers, trained and non trained teachers is the intention for explaining why some features of the target language are more difficult to acquire than others.

The evaluation of the production of sounds in the dual phonetic analysis in segmental form helps greatly to evaluate whether the pronunciation is accurate or not. Phonetic programs has been designed in order to calculate this process in segmental form and can be very objective. However, there are several necessary conditions for this puporse, that are not found in regular classroom settings.

The integration of an educational perspective on this phonetic analysis was considered in the present investigation since educational grounds in the interaction between teachers and students and other external factors play important roles in evaluation. Educational settings can provide the opportunity to observe different ways of speech, under different conditions and social interactions, such as intonation, gestures, expressions of feelings that are interrelated within the production of words and sounds.

The sample of the present investigation represents English teachers as a Second Language with L1 Peruvian accent which is, in a general way, very homogeneous. Besides native speakers participated in this evaluation as referent informants. However there are two groups, trained teachers in phonetics and phonology and non trained teachers in phonetics and phonology. The results of these two groups will be compared in order to get some ideas in regards of the effectiveness of their previous trainings in the pronunciation of the schwa sound.

From the theoretical framework towards the findings of the investigation, the discussion and then conclusions of the results are included on this investigation. Additionally some recommendations in regards of some ideas to integrate the schwa sound in pronunciation courses are suggested based on the findings of this investigation.

The thesis has been organized in five chapters.

The first chapter is the investigation outline. Here we present some of the important differences between the English vowel system and the Spanish vowel system that might explain the role of the L1 interference based on these differences. This includes the consideration of educational studies for teachers to train L2 learners in the pronunciation of new L2 English sounds. We then present the formulation of the problem in which we explain why we decided to carry out this investigation. We also describe the hypotheses and the objectives, the justification and the limitation of the investigation. Furthermore, we present the antecedents of similar investigations and their importance related to our investigation.

In the second chapter, the Theoretical Framework is based on theoretical foundations and the conceptual framework in regards of Phonetic studies on L2 vowels, and then specifically on the schwa sound. Phonetic training and its implications in instructional settings is explained as well as the definitions of the basic phonetic and educational terms used by applied linguistics and phoneticians in order to learn and understand the integration of phonetic analysis in classroom contexts.

In the third chapter entitled Methodology of the Investigation, we focus on the research methodology, the type and design of the investigation in order to organize the integrated analysis based on phonetics and education, the population and the sample studied with their characteristics, the variables and their dimensions, the techniques and instruments for gathering data, the description of the instruments and process of collecting that explains the process carried out the dual dimensional analysis.

In the fourth chapter we describe the results of the investigation from the processing of the research data in its dual dimension; based on the phonetic segmental analysis, we present and describe tables and analysis spectrograms (graphics) based on numerical measurements of the formants of the schwa sound of every individual teacher from the sample. Besides we also present the results in regards of the performance in the production of the vowel by English teachers based on perceptual analysis by some American English speakers who acted as assessors.

In the fifth chapter, we make reference to the discussion of results, as well as their analysis. We review the theoretical issues in relation to the acceptance or rejection of the hypothesis by trying to give possible explanations for the findings that might help us to understand the possible errors that might interfere in the production of the schwa sound and supported by the theoretical background.

Then, we present the conclusions along with some specific recommendations for future pronunciation courses generated from the findings of this investigation.

The bibliography contains the list of all the sources used for the present investigation and specifies the kind of sources such as books,

journals, articles, magazines, some of them published by applied linguistics, phoneticians and educators.

Finally, the list of appendixes has been enclosed and contains all the valid information used to this investigation in the application of the instruments. The instruments were used for different purposes, for collecting data, tracking information and for organizing results, including tables and graphics such as reading scripts, tables of formant values (for contrastive analysis of two groups and for individual results) and plotting maps for vowels including tables of formant measurements for each individual of the sample.

This investigation has been developed to investigate some common errors made in the use of the schwa sound by L2 speakers. The information found may contribute to some ideas for pronunciation courses in order to improve students' pronunciation.

CHAPTER 1

INVESTIGATION OUTLINE

1.1 Formulation of the problem

Why is there a significant difference in the English pronunciation of native English speakers as compare to Spanish speakers? Is it so difficult to have an accurate English pronunciation or near native English sounding in Spanish speakers as L2 English learners?

In order to attempt this situation, to have an accurate English pronunciation, Spanish teachers, who become English teachers, usually attend training courses based on phonetics and phonology that provide insights about English sounds, articulator movements and practice in recognition of sounds in terms of vowels and consonants as a part of training courses in pronunciation. However, the English sounding achievement is still a goal for many non-native teachers of English.

One of the important differences between these two languages is based on the sounds and characteristics of their vowel inventory. The vowel structure between these two languages is different, Spanish vowels are only five a, e, i, o and u in terms of pronunciation and written form. On the other hand, English vowels even though they have the five letters in written form a, e, i, o and u, might contain more than one sound for each letter when English speakers pronounce words that contain vowel sounds.

The English vowel inventory is larger, more complex and demands certain articulator processes for the production of their vowels. Furthermore, most of the English vowels are weak sounds and the strong sounds are usually consonants.

One of the main differences between these two languages in terms of vowels is the use of the most common vowel sound in English is the schwa sound that is a nonexistent vowel sound in Spanish. In this sense the characteristics of the L1 determine the approach of an L2.

Consequently, the difference between these two vowel inventories is remarkable and it is widely recognized that second language (L2) learners are often unable to distinguish sound contrasts that are not presented in their native language (L1). L1 interference plays an interesting role in the learning process of a second language and the way Spanish speakers tend to pronounce English words that contain the schwa vowel.

As a consequence, the lack of real recognition of some English vowel sounds in L2 speakers, aspects such as omissions, substitutions and alliterations which are sometimes produced by the interference of the first language.

The use of the schwa sound, the most common sound in the English language, may determine the English sounding pronunciation speakers have.

In order to understand in what way Peruvian teachers can enhance their English pronunciation, it is important to analyze and understand some of the weaknesses in the intention to pronounce English vowels in English words that contain the schwa sound. Furthermore, it is important to understand that training courses in phonetics and phonology should be more focused on most of the key important factors in regards to the pronunciation of the schwa sound that English teachers need to know in order to improve their pronunciation.

The analysis of the vowel structures of these two languages (including necessarily the effects of the L1 interference in Spanish language and the use of schwa sound in L2) might help to enrich training courses in pronunciation by giving more information regarding what English teachers should learn, understand and practice for a more effective teaching.

The formulation of the problem is based on the following assumptions:

- A Phonetic analysis in Spanish speakers with Peruvian accent can provide some information about their weaknesses and strengths in the use of the schwa sound that help them to understand and deal with the L1 interference.
- Training in phonetics as a meaningful support in the pronunciation of English teachers, might be enriched by more research in regards of pronunciation and phonetics.
- Some Peruvian teachers of English may improve their pronunciation and their learners' pronunciation when they have more theoretical information. To understand the effects of the L1 interference to achieve an accurate pronunciation can be important information for the teaching and learning process in the educational area.
- There are two important aspects to be considered in this investigation that may affect the English pronunciation: the L1 interference that all Spanish speakers have and the effectiveness of some training courses Spanish speakers attend.

From what has previously been mentioned, the problem is stated as follows:

Will a Dual Phonetic Analysis identify some common errors in the use of the schwa sound by L2 speakers in order to enrich pedagogical interventions for teaching pronunciation courses aimed at helping learners to deal with the L1 interference and to be more successful in the use of the English schwa sound?

1.2 Hypothesis

1.2.1 General hypothesis

A Dual phonetic analysis can provide insights in regards to some common errors in the use of the schwa sound by Spanish speakers with Peruvian accent.

1.2.2 Specific hypotheses

High levels of accuracy in the use of the schwa sound, by Spanish speakers as English teachers, might depend on teachers' performance in the use of the schwa sound found them in a Dual phonetic analysis (classroom action research and phonetic segmental analysis).

Lower levels of accuracy in the use of the schwa sound, by Spanish speakers as English teachers, might depend on certain conditions found them by a Dual phonetic analysis (classroom action research and phonetic segmental analysis) pertaining to the L1 phonological system

1.3 Objectives of the investigation

1.3.1 General objective of the investigation

To analyze some common errors in the pronunciation of the schwa sound in trained teachers and non-trained teachers under two perspectives: a segmental phonetic analysis (phonetics by computer program) and a classroom action research (educational research) to develop a Dual Phonetic analysis.

1.3.2 Specific objectives of the investigation

To analyze the English vowel inventory and the Spanish vowel inventory in order to recognize which critical aspects

between L1 vowel sounds and L2 vowel sounds determine some common errors in the production of the schwa sound in L2 English speakers.

To recognize in segmental form certain articulator movements presented in L2 English speakers (trained teachers and non-trained teachers in pronunciation) when they produce words that contain the schwa sound through a phonetic analysis by computer.

To recognize some common errors in the use of the schwa sound in trained teachers and non-trained teachers in pronunciation through a classroom action research in interaction between teachers and students.

1.4 Justification of the investigation

The present investigation is justified from the following aspects: methodological, academic and affective.

1.4.1 From the academic aspect

In our social context, few teacher-training courses offer a substantial review of the English phonetic system, especially to provide ways, techniques and some insights to enhance their pronunciation in the use of the schwa sound, which is reflected as a weakness on the classroom context in the interaction between teachers and students.

It is necessary to start a phonetic analysis to overcome the weaknesses of these L2 English speakers and to deepen the knowledge with reference to this area.

Phonetics and phonology are more known, understood and applied in linguistic areas rather than educational areas. For this reason, the intention of this phonetic research is to extend this academic knowledge into the educational grounds. This transitional and critical process to transfer the knowledge and practice of this

area into a friendly and familiar information for educators has been developed as an effort to open a new door for educators to enhance their teachers performance from the linguistic area and technological perspective.

In this sense, for the present investigation, this new perspective has been named a Dual dimension phonetic analysis which is the integration of two areas of analysis: Phonetics and Education.

The academic aspect of the present investigation connected with the area of linguistics and applied linguistics has also the intention to promote future investigations in educational areas in order to improve the teaching learning process.

1.4.2 From the methodological aspect

The information in relation to the most common errors in the use of the schwa sound in Spanish speakers can support the content of teacher training courses in pronunciation in order to incorporate more effective practices and techniques to produce the schwa sound.

In this sense, a new perspective that may enrich the methodologies of some training courses and specializations in pronunciation attended by English teachers can be developed in the use of the schwa sound by considering some insights and ideas this investigation provides in the matter of the schwa sound in Spanish Peruvian speakers.

The intention of the Dual dimensional Phonetic Analysis is to provide insights with reference to the way English teachers can pronounce English words that contain schwa sounds and in what ways they can practice by considering the L1 interference factor.

The information based on the analysis in the use of the schwa sound will help to understand its importance in the level of accuracy Spanish speakers might achieve when they pronounce English words that contain this neutral vowel.

This research may serve as a starting point to understand which certain articulator movements and techniques are needed to achieve English sounding pronunciation.

1.4.3 From the affective aspect

The English pronunciation is one of the strongest evidences in the matter of teachers' English performance in front of their students. A phonetic analysis can bring some ideas in what way, in the practice of specific English vowels; teachers can improve their pronunciation and become effective models of teaching pronunciation for their students.

Based on knowledge and practice, teachers will start feeling more comfortable and confident in the interaction with their students. Teachers will be more encouraged to model and to train their own students in the use of this vowel sound since they will understand the common errors that impede the production of the schwa sound in their students and which certain articulator movements are needed to perform schwa sounds in certain words.

1.5 Limitations of the investigation

In terms of background knowledge, it was very difficult to find information pertaining to the acquisition and learning of the schwa sound since there was no relevant and specific information about these processes.

This limitation is related to the fact that there were no important resources that provide specific information by researchers in the areas of phonetics and phonology specifically with reference to the schwa sound.

Few years ago, the studies of the speech process in the production and perception of English sounds and its implications in the level of pronunciation in L2 speakers was much marginalized. However, there are few but important studies under the use of the Phonetic programs, which opens a new door for future findings.

One of this examples is the introduction of more sophisticated computer programs such as Praat and others, provided by researchers as an interesting tool for analysing phonetic aspects when L2 speakers produce the English phonetic sounds that helps to evaluate the principal features and implications of their L1 interference from some different languages: Japanese, Quechua, Spanish (Catalan accent) and Spanish (Colombian accent).

Furthermore, the training and use of these computer programs are not quiet easy to access. The access to the knowledge and training on these programs are generally offer to applied linguistics and linguistic areas, so for researchers from others areas, this demands time and dedication in order to understand, handle vocabulary, learn and manage the programs accurately at least for the certain specific area they want to record and analyze.

There is a large amount of online information such as online books, phonetic dictionaries and online tutorials that researchers from others areas such as psychologists, educators and others can access for learning however it is important to recognize what available sources are pertinent.

The studies and training of these programs such as Praat and others depend on the individual effort. Knowledge in linguistics and phonetics is also important to understand this information. Not all researchers and students have the opportunity to access at this information in terms of theory and practice since not many courses in phonetics and phonology provide this information for educators.

1.6 Antecedents of the investigation

Some investigations have taken place recently with the aim of providing evidence on how English vowels, vowel reduction and specific phonemes, such as the schwa sounds in some vowels, are perceived and produced in different contexts and under several conditions.

Lacabex, García-Lecumberri and Cooke (2005) on their study in regards of training and generalization effects of English vowel reduction for Spanish listeners, they studied perception and production of vowel

reduction and English schwa sound by native Spanish speakers of L2 English. A group of 50 Spanish teenagers was selected to take part in this study.

For their investigation, they focused on the difficulty that speakers of languages such as Spanish are believed to face when dealing with vowel reduction since it is not a phenomenon they are familiarized with. Their results seem to support the idea that “simple exposure to the L2 does not guarantee acquisition neither at the perceptual level nor at the production level.”¹

Their experiment was based on the evaluation of the ability of Spanish learners of English to identify the schwa sound and “reveals the influence of L1 in speakers when they have to perceive and produce English vowels.”² This investigation was based in the analysis between Spanish speakers and English speakers in a general way and did not consider the difference between Spanish speakers since there are different accents in the same language.

The present study has also provided further evidence of the relevance of L1 interference in second language speech learning, which seems to be influenced in reading forms and speaking forms that we will explain in the analysis of L1 and L2 vowels.

Due to the variability that one single language has in terms of accents, other researchers started investigating the relationship between English sounds and other languages by considering the accent of the language sample. The latest investigations currently consider the accent from the specific language researchers study to bring more objective results in the phonetic analysis under a segmental approach.

Gómez Lacabex & Gallardo del Puerto (2014), carried out their investigation: Raising Perceptual Phonemic Awareness in the EFL Classroom at the University of the Basque Country with a group of

¹ Lacabex, E.G & García Lecumberri, M. & Cooke, M. (2005): “Phonetics Teaching and learning conference (PTLC)”, *English vowel reduction by untrained Spanish learners: Perception and Production*. London. University of the Basque Country and Spanish Ministry of Science and Technology, 27-30 July 2005.Conference.

² *Op.Cit.*

Spanish learners of English. Seventy-five Basque/Spanish 6th graders (aged 12) learning English as a Foreign language distributed in three intact groups of 25 students each took part in the experiment.

This study examined the impact of phonetic training on English lexical schwa sound in primary school learners of English as a foreign language and the students' perceptual awareness on the occurrence of the schwa sound in unstressed position in English.

This research reveals the “L1 interference in the production of schwa sound in the Basque-Spanish accent in a special way.”³ Bearing in mind the differences in accents, in our investigation the Peruvian accent that differs from other Spanish accents has also its own features.

The investigation with reference to the schwa pronunciation by Japanese EFL learners developed in 2009 using Praat at the University of Aizu by Yusuke presents the vowel space of English schwa sound pronounced by Japanese and the problems of its pronunciation.

In this experiment, the sound data was collected from 13 native Japanese (age 22-23 years) who spoke English as a second language, and 3 native speakers of American English. Japanese subjects had all studied English for 10-11 years. Since formant frequencies differ between males and females, all 16 speakers were male to make the data uniform. There is no schwa sound in Japanese, the same occurs in the Spanish language, so this research can help in the pronunciation education of Japanese learners of English.⁴

The Japanese schwa vowel space showed that “Japanese is influenced by their native vowels so their schwa sound distribution is wider than native speakers' and biased based on the spelling. The problems are that Japanese subjects cannot judge what vowels are schwa sounds, and pronounce words estimated from spelling alone or pronounced like “ROMAJI” (Roman alphabet).”⁵

³ Lacabex, E.G. & García Lecumberri, M. (2014). Raising perceptual phonemic awareness in the EFL classroom. *Concordia Working Papers in Applied Linguistics (COPAL)*, 5, 203–215.

⁴ Yusuke, S (2009): *Schwa Pronunciation by Japanese EFL Learners*, Graduation Thesis not published, Aizu: University of Aizu.

⁵ *Ibid.* 1

In the present investigation the use of Praat was also an important tool due to this is a very analytical phonetic resource to extract specific information specially to measure vowel performance that was also applied in the investigation developed in Colombia by Kelly Johanna Vera Diettes.

Vera Diettes in her investigation: Perception and production of the schwa vowel /ə/ by native Colombian Spanish Speakers of L2 English in the Phonetic laboratories at the University of Leeds also used Praat software in 2009. The aim of this investigation was to evaluate the perception and production of English schwa sound by L1 Spanish speakers; however, it did so by including the orthography as an important variable that might be influencing the perceptual and productive competence of L2 speakers.

The results obtained from the data evidence that the “L2 speakers were in fact influenced by the written form of the words (the vowel letter they see). As a consequence, they did not perceive the schwa sound as a new phone, but, on the contrary, they appear to be assimilating it as several instances of their L1 vowels.”⁶

This concern was considered in our investigation in which the evaluation of the participants were also based on reading words that contains different positions of schwa sounds, the results of this investigation obtained from the native speakers suggested that “the speakers are, as well, producing schwa sounds that are different from each other, apparently because of the different orthography types.”⁷

According to previous investigations, the fact that both the L1 interference and the written form play important roles when L2 speakers pronounce some English words has also been considered in the evaluation of the sample for the present investigation. In academic contexts, languages are usually introduced to L2 speakers in a written form, either at the same time with pronunciation or sometimes even

⁶ Vera Diettes, K.J (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds.

⁷ *Op.Cit.*

before pronunciation. Another important fact is that the results of these previous investigations differ from the different language L2 speakers have. In this sense, the aim of this investigation is to evaluate the production of the English schwa sounds by English teachers with Peruvian accent.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1. Teachers' pronunciation and teaching pronunciation

Pronunciation, once a mainstay of language teaching and language teacher education, has long been ignored or relegated to elective status in the classroom. Although Brodkey, Fayer & Krasinski cited in Murphy, say that research has established that pronunciation plays a central role in speech intelligibility.

Pronunciation is rarely incorporated into instructional objectives, and when it is taught is usually done so in an ad hoc fashion. In regard to teacher education, Murphy points that TESOL teacher preparation programs that included coursework in phonetics and phonology could greatly benefit by focusing on applied approaches to phonology, including practical training in teaching pronunciation.⁸

However, Murphy also explains that pronunciation teacher education has not changed much since that time, and there is still a great need for training in the teaching of pronunciation in language teacher.⁹

⁸ Murphy, J.M (1991): "Oral communication in TESOL: Integrating speaking, listening, and pronunciation". *TESOL Quarterly*, 25:51-75.

⁹ *Op.Cit.*

On the other side, the lack of a research study in a phonetic analysis in language teachers in terms of pronunciation as an important role in the learning context is seen as the *marginalization of pronunciation* within some applied linguistics. As Lewis & Grant point, “the problem can be resolved only if applied linguists take responsibility for interpreting technical research for pedagogical specialists and incorporating pertinent findings in teacher training materials and students’ texts.”¹⁰

Lewis & Grants also explain that although teachers increased interest in pronunciation in recent years, as evidenced by the establishment of a TESOL interest section and a proliferation of pronunciation materials for learners, however “technical research about teachers’ pronunciation and the teaching process in terms of pronunciation shows evidences in the lack of performance in L2 speakers which remains a marginalized topic in applied linguistics.”¹¹

Consequently, for those non-native teachers who did not have accurate auditory models of speech during their own English learning process and who did not have technical training in phonetics and phonology with the possibility to enhance aspects in their own way of pronunciation, might reduce the possibilities to develop a successful teaching process in pronunciation by repeating the patterns proceed by their previous teachers or other teaching models.

One of the most common claims found is that the acquisition of new sounds is possibly according to Flege (1989) “one of the most challenging skill for L2 learners to acquire/learn, as a consequence, many of them tend to retain a foreign accent after achieving proficiency in other aspects of L2 production.”¹²

The need to train teachers to help them improve their pronunciation will also help them to become effective models of teaching for their students especially in the first years of development when children are still developing listening skills.

¹⁰ Levis, J., & Grant, L. (2003): “Integrating pronunciation into ESL/EFL classroom.” *TESOL journal*, 12 (2): 13-14.

¹¹ *Op.Cit.*

¹² Flege, J.E. & Bohn, O.S. (1989): “An instrumental study of vowel reduction and stress placement in Spanish accented English.” *Studies in Second Language Acquisition*. 11: 35-62.

2.2. L2 Pronunciation Instruction

The use of combinations of teaching techniques to teach pronunciation is very often in instructional settings.

Explicit pronunciation instruction and practice has focused on the acoustic, auditory, and articulatory properties of L2 sounds and prosody via three main routes: an auditory route, by which learners can decode the acoustic properties of the signal linguistically so as to access meaning; a visual route, by which learners can interpret visual information (e.g., gestures, phonetic symbols, diagrams of oral cavity); and finally, an oral route, by which learners overtly practice pronunciation skills.¹³

The auditory–oral combination has been used as part of traditional listen-and-repeat practice offered in pronunciation methods. Despite the fact that “elicited imitation has been claimed to evince performance at a surface level– that is, with learners’ being able to imitate articulatory performance without manifesting phonological competence– imitation or mimicry has been a technique used in recent pronunciation- training studies”.¹⁴

“Some studies by Derwing and Saito have reported that pronunciation instruction has little to no effect on learners’ pronunciation accuracy. They have concluded that “instruction improves segmental production but not comprehensibility or vice versa, according to. Instruction is not equally effective for all the segmental phones taught”¹⁵ and this is also supported by Gonzales Bueno and Lord.

¹³ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 502. doi:10.3138/cmlr.2324

¹⁴ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 503. doi:10.3138/cmlr.2324

¹⁵ Kissling, E. M. (2013): Teaching pronunciation: Is explicit phonetics instruction beneficial for FL learners? *Modern Language Journal*, 97(3), 721. doi:10.1111/j.1540-4781.2013.12029.x

Venkatagiri & Levis also points that instruction might “assist learners in gaining explicit knowledge to support their performance on certain types of tasks, such as reading words from a list, but it may be less useful for spontaneous speech outside the classroom.”¹⁶

Nowadays, L2 acquisition researchers have been studying the effects of explicit intervention specifically in the form of phonetic training so as to explore the acquisition process of L2 sound perception and production skills.

Despite the fact that, as explained earlier, the ability to acquire L2 sounds and prosody seems to decline at an early age, “the ability to perceive and produce L2 sounds is not lost altogether, with some sensitivity to new acoustic cues available to adults, these claims comes from studies on L2 sound discrimination and laboratory phonetic-training studies.”¹⁷

Bradlow, Iverson and others based on laboratory phonetic and training studies, have concluded that “adult learners’ L2 perception and production skills can improve after auditory phonetic training.”¹⁸ In fact, “some of these interventions have developed into framed training procedures, such as high-variability phonetic-training programs, which provide natural stimuli in a variety of speaker voices and phonetic contexts.”¹⁹

The impact of an L2 Phonetic training programs in instructional settings, in a more specific way, pronunciation trainings in a segmental approach, has been of great relevance in the latest years.

¹⁶ *Op. Cit.*

¹⁷ Lacabex, E. G., & Gallardo del Puerto, F. (2014). Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 505. doi:10.3138/cmlr.2324.

¹⁸ *Op.Cit.*

¹⁹ Cebrian, J., & Carlet, A. (2014): Second-Language Learners' Identification of Target-Language Phonemes: A Short-Term Phonetic Training Study. *Canadian Modern Language Review*, 70(4), 474-499. doi:10.3138/cmlr.2318

2.2.1. L2 Phonetic training Programs in Instructional settings

“The central component of pronunciation instruction is usually explicit teaching of L2 phonetics, typically with an emphasis on the phonetic parameters relevant to segmentals (i.e., isolated consonants and vowels). These are illustrated, more recently, through animated diagrams of the vocal tract and spectrograms produced with acoustical analysis software.”²⁰

Phonetic training involves specialized perceptual or pronunciation training with “the objective of directing learners’ attention to specific target sounds or sound contrasts that are challenging for them. The ultimate goal is to improve learners’ ability to perceive and produce the target sounds accurately.”²¹

For this reason, “phonetic instruction in the foreign language (FL) classroom typically emphasizes the differences between learners’ L1 and L2 phonological systems with regards to phonemic inventories, articulation of analogous phones, grapheme–phoneme correspondences, and phonological processes.”²² In addition to this explicit phonetics instruction component, “pronunciation instruction usually includes perception practice in the form of phoneme discrimination and identification exercises, often with feedback.”²³

In a general way, pronunciation practice is also included, the visual and individualized feedback provided by acoustical analysis software packages in regards of an acoustic phonetic training, along with the format varying considerably from word reading to chants, and feedback varying from teacher-fronted pronunciation modeling. According to Arteaga, Elliot and Pardo, “all these

²⁰ Kissling, E. M. (2013): Teaching pronunciation: Is explicit phonetics instruction beneficial for FL learners? *Modern Language Journal*, 97(3), 721. doi:10.1111/j.1540-4781.2013.12029.x

²¹ Cebrian, J., & Carlet, A. (2014): Second-Language Learners' Identification of Target-Language Phonemes: A Short-Term Phonetic Training Study. *Canadian Modern Language Review*, 70(4), 475. doi:10.3138/cmlr.2318

²² Kissling, E. M. (2013): Teaching pronunciation: Is explicit phonetics instruction beneficial for FL learners? *Modern Language Journal*, 97(3), 721. doi:10.1111/j.1540-4781.2013.12029.x

²³ *Ibid.*, 721

exercises, in addition to the core component of explicit phonetics lessons, have been thought to facilitate acquisition of target-like L2 pronunciation.”²⁴

However, on instructional settings there are still limited exposure to the target language since this exposure only happens inside the classroom. “Linguistic experience (understood as amount of instruction learners receive in their home country) often fails to affect their performance in the L2.”²⁵

Fullana and Mora did not observe a significant impact of number of years of formal instruction on the perception and production of English final-consonant contrasts by 48 Spanish/Catalan bilinguals in English as a foreign language (EFL) context. “This difficulty in improving foreign language pronunciation in instructional settings is related to the limited amount of target language input that is available, particularly native input. In this context, a possible source of native input may be found in phonetic training.”²⁶

Pronunciation training including phonetic training may help L2 learners’ performance from accurate models of teaching. Bearing in mind the instructional contexts and the teaching models of sounding English students are exposed to, there are internal learners’ factors that also affect the acquisition and learning of L2 sounds and play an important role in the teaching and learning process.

2.3. Possible Factors in the Acquisition/Learning of L2 sounds

According to previous investigations, one of the possible factors that influence in the acquisition/learning of L2 vowels is the learners’ age.

²⁴ *Ibid.*, 721

²⁵ Cebrian, J., & Carlet, A. (2014): Second-Language Learners' Identification of Target-Language Phonemes: A Short-Term Phonetic Training Study. *Canadian Modern Language Review*, 70(4), 475. doi:10.3138/cmlr.2318

²⁶ *Op. Cit.*

In general, “what has been found is that there is a tendency for early learners (exposed to their L2 in childhood) to produce L2 vowels more accurately than late learners (exposed to their L2 in adolescence or early adulthood).”²⁷

On the other hand, in regards of late learners, the studies by Scovel have suggested that “L2 learners face neurological constraints, such as restricted perceptual targets for new phonetic categories, as well as motor skill limitations, such as first language (L1) fixed articulator habits that can hinder their performance and therefore lead to improbable native-like productions”²⁸ according to the method of the Contrastive analysis and also include the contribution of the investigation of Vera Diettes.

It has been claimed by Gallardo del Puerto that factors such as “implicit learning mechanisms or imitation skills may account for the learning advantage of younger learners found in naturalistic environments, whereas factors such as cognitive maturation or metalinguistic awareness can explain learning advantages found in older learners in formal acquisition contexts.”²⁹

Some scholars have recently questioned in regards of the critical or sensitive period proposed by Lenneberg in 1967 that predicts “difficulty acquiring a foreign language, especially in terms of its phonological aspects, beyond the age of 9 or 10. Others have proposed an even earlier sensitive period for phonology, possibly by the age of 5 if not earlier.”³⁰

In this sense, the importance of age is based in how early learners are exposed to the new sounds along their process of linguistic development.

²⁷ Fledge J.E., Munro M. J., & Mc Kay (1996): “Factors affecting strengths of perceived foreign accent in a Second language.” *Journal of the Acoustic society of America* 106: 2973-2988

²⁸ Vera Diettes, K. (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds.

²⁹ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 501. doi:10.3138/cmlr.2324.

³⁰ Moyer, A. (2011): An Investigation of Experience in L2 Phonology: Does Quality Matter More than Quantity? *Canadian Modern Language Review*, 67(2), 192.

“The ensuing age debate is still front and centre in second language phonology literature despite several decades of empirical research that largely verifies the importance of age to accent even though it has not yet sufficiently clarified the nature of its role.”³¹

On the other side, Bongaerts concluded from their study of successful learners that “the challenge adults face is based in acquiring L2 speech categories stems from a tendency to filter L2 speech through first language (L1) categories, rather than using the continuous mode of perception that infants initially use when acquiring an L1.”³² This continuous mode is sometimes referred to as language general perception, which “allows infants to perceive slight differences between sounds that are not relevant to phonemic category recognition.”³³

There are a number of issues to address in the age effects agenda, the most important of which being the fact that “age is inherently confounded with social and cognitive factors underlying the learner’s orientation to language learning. Such orientations explain why some learners seek feedback; develop strategies to improve their accent, while others do not, by including the opportunities for linguistic development.”³⁴

In contrast, “during the latter months of infancy, language specific perception develops, in which the ability to perceive within-category and cross linguistic categories weakens. Critically, Bongaerts argued that those adult L2 learners who achieve the most native like pronunciation are better able to access the continuous mode of perception than are less successful learners.”³⁵

³¹ Moyer, A. (2011): An Investigation of Experience in L2 Phonology: Does Quality Matter More than Quantity? *Canadian Modern Language Review*, 67(2), 192.

³² Thomson, R. I. (2012): Improving L2 Listeners' Perception of English Vowels: A Computer-Mediated Approach. *Language Learning*, 62(4), 1232. doi:10.1111/j.1467-9922.2012.00724.x

³³ *Op. Cit.*

³⁴ Moyer, A. (2011): An Investigation of Experience in L2 Phonology: Does Quality Matter More than Quantity? *Canadian Modern Language Review*, 67(2), 192.

³⁵ Thomson, R. I. (2012): Improving L2 Listeners' Perception of English Vowels: A Computer-Mediated Approach. *Language Learning*, 62(4), 1232. doi:10.1111/j.1467-9922.2012.00724.x

The environment and learning opportunities of some individuals are also variables of relevance. The target language typically becomes incorporated into multiple aspects of immigrant children's lives, taking on great functional significance through schooling and possibly a job or career later in life, accruing interpersonal significance as well through the formation of friendships with native speakers in the surrounding community. For those who learn a new language beyond childhood, the outcomes are far less predictable.³⁶

There are more factors that have been considered in most recent studies to understand the acquisition / learning of L2 sounds, which in the past was the age the central factor that determine the successful in L2 learning.

“Research in second-language (L2) acquisition has shown that the abilities needed for learners to acquire an L2 are not solely dependent on age, which in the past was believed to be a crucial factor determining learners' ultimate success in L2 learning.”³⁷

In most recent Phonetics and phonology investigations, researchers re define their hypotheses and assumptions in order to understand the role of the L1 phonological system to incorporate into phonetic trainings the consideration of important features learners first language contain to achieve an L2 sounds successfully.

Singleton & Ryan point that “recent researchers have since refined these claims by first re-interpreting the age factor as just another interacting variable in a complex blend of factors and then providing evidence for the enduring influence of the first language (L1) phonological system on the learning of L2 speech.”³⁸

³⁶ Moyer, A. (2011): An Investigation of Experience in L2 Phonology: Does Quality Matter More than Quantity? *Canadian Modern Language Review*, 67(2), 192.

³⁷ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 501. doi:10.3138/cmlr.2324.

³⁸ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 501. doi:10.3138/cmlr.2324.

In fact, L2 speech learning models, such as Flege's Speech Learning Model by Flege, Best's Perceptual Assimilation Model by Best, and Major's Ontogeny– Phylogeny Model by Major, all agree that learners' L1 is a fundamental component in their L2 speech-learning success.

2.4. First Language (L1) phonological system on the learning of L2 speech

Most recent researchers as Lacabex & Gallardo del Puerto acknowledge in 2014 that those “L2 sounds which are phonetically highly similar to those of the L1 should be easy to perceive and produce. Those L2 sounds that phonetically approach the L1 phonological space are likely to cause learning difficulties, as they will be assimilated to L1 sound categories.”³⁹ We now know that L1 sound patterns are acquired in early infancy and that L2 sound patterns are perceptually filtered by those L1 patterns.

To be more specific, for those “L2 sounds which fall outside the L1 phonological domain, perception and production are predicted to be successful, as these sounds should not encroach on the L1 phonological space.”⁴⁰ In addition, the distinction between naturalistic learning environments and formal learning contexts has been acknowledged to be important for understanding and assessing the effects of various factors influencing L2 speech development. However, this depends on what sounds are regarding to, due to the similarities between L1 and L1 might also determine the performance of a foreign accent in L2 learners.

“The more similar the L1 is to the L2, the younger the learner starts to learn, the longer the learner resides in the L2 environment, and the more exposure the learner has to the L2, the less likely it is that her speech will be foreign accented.”⁴¹

³⁹ Lacabex, E. G., & Gallardo del Puerto, F. (2014): Two Phonetic-Training Procedures for Young Learners: Investigating Instructional Effects on Perceptual Awareness. *Canadian Modern Language Review*, 70(4), 501. doi:10.3138/cmlr.2324.

⁴⁰ *Op. Cit.*

⁴¹ Kissling, E. M. (2014): What Predicts the Effectiveness of Foreign-Language Pronunciation Instruction? Investigating the Role of Perception and Other Individual

Consequently, “cross-linguistic interference at the phonetic level probably contributes a great deal to what is perceived as foreign accent.”⁴²

According to Flege and Hillebrands, “L2 learners move in the direction of the target language, but are still different from the native speakers. They further demonstrated that adult L2 learners may use acoustic cues to the phonetic contrast differently from the native speakers.”⁴³

The speech learning model (SLM), proposed by James Flege in 1995, states that “adults speak with foreign accents because as age increases, the likelihood that a speaker will establish new phonetic categories in the target language decreases.”⁴⁴

“This relationship between the native language sound system and target language production also explains “why speakers from various language backgrounds show different nonnative speech patterns when speaking English.”⁴⁵

“The phonetic study in regards of the phonetic structure of the speaker native language is an important consideration when selecting targets for a pronunciation program because the presence of a foreign accent is due, in part, to the phonological disparity between the speaker’s native language and the target language.”⁴⁶

Due to its important consideration, the phonetic study of English is based on the segmental phonology and the suprasegmental phonology.

Differences.*CanadianModernLanguageReview*,70(4),534.doi:10.3138/cmlr.21611177/0267658311408184

⁴² Han, J., Hwang, J., & Choi, T. (2011): The acquisition of phonetic details: Evidence from the production of English reduced vowels by Korean learners. *Second Language Research*, 27(4), 536. doi:10.1177/0267658311408184

⁴³ *Ibid.*,137

⁴⁴ Franklin, A. D., & Stoel-Gammon, C. (2014): Using Multiple Measures to Document Change in English Vowels Produced by Japanese, Korean, and Spanish Speakers: The Case for Goodness and Intelligibility. *American Journal of Speech-Language Pathology*, 23(4), 626. doi:10.1044/2014_AJSLP-13-0144

⁴⁵ *Op. Cit.*

⁴⁶ *Op. Cit.*

This investigation is focused on the segmental phonology in the following topic.

2.5. Phonetic Study on L2 Vowels

The phonetic study on L2 vowels has been considered seriously in recent research due to these investigations have been developed based on the relationship between vowel accuracy and accent.

In linguistics, Kreidler explains that the sound system of English is studied under two headings: segmental phonology and suprasegmental phonology. “Segmental aspect of the sound system includes individual vowels and consonants, and the suprasegmental aspect comprises word, phrase, and sentence stress, pitch contour or intonation, and rhythm.”⁴⁷

According to Pennington & Richards, target selection in pronunciation training has historically focused on improving the accuracy of both consonant and vowel segments. However, according to Sikorski “the majority of attention has been paid to consonants.”⁴⁸

Munro, Wang & Munro claim that “there are more studies investigating the relationship between consonant accuracy and listener perceptions of accent than studies investigating the relationship between vowel accuracy and accent.”⁴⁹

Furthermore, Celce-Murcia, Brinton, Goodwin, & Griner explain that “one important reason for a restricted attention on vowel training might be that vowels are, in some way, more difficult to train than consonants due to some vowels are produced with relatively little

⁴⁷ Sefero&gcaron;lu, G. (2005):Improving students’ pronunciation through accent reduction software. *British Journal of Educational Technology*, 36(2), 304. doi:10.1111/j.1467 8535.2005.00459.x

⁴⁸ Franklin, A. D., & Stoel-Gammon, C. (2014): Using Multiple Measures to Document Change in English Vowels Produced by Japanese, Korean, and Spanish Speakers: The Case for Goodness and Intelligibility. *American Journal of Speech-Language Pathology*, 23(4), 626. doi:10.1044/2014_AJSLP-13-0144

⁴⁹ *Op. Cit.*

constriction and less articulatory precision of the vocal tract in contrast with consonants.”⁵⁰

However, according to Sikorski, “variability in target language vowel production is a noticeable component of foreign-accented speech, and Nazzi also points that errors in vowel production contribute greatly to decreased speech intelligibility.”⁵¹

Furthermore, according to Ingram & Pittman; Munro, not too many studies have demonstrated a relationship between acoustic measures of vowel accuracy and listener perceptions of accent in vowels and in words produced by non-native speakers of English. Researchers should give greater consideration to vowels as targets in a comprehensive accent modification program.

Mehler, Dupoux, Nazzi, & Dehaene- Lambertz, indicates another important aspect that should be noted by clinicians is that “vowels are more sonorant than consonants in the speech signal and vowels have been considered the primary carriers of prosody and intonation over consonants. Therefore, it is possible that vowel training can serve as a conduit through which suprasegmental training can also be addressed.”⁵²

There are characteristics of great relevance, between the English vowel system and the Spanish vowel system, that affect the learning of English vowels for L1 Spanish speakers due to, in some way, its L1 phonological system.

One of the situations is that “the task of learning an L2 vowel system may be fundamentally different for individuals whose L1 vowel system is large and complex (e.g., Norwegian) than for individual whose L1 vowel system is small and simple (e.g., Spanish).”⁵³ In this sense, the

⁵⁰ *Op. Cit.*

⁵¹ *Op. Cit.*

⁵² Franklin, A. D., & Stoel-Gammon, C. (2014): Using Multiple Measures to Document Change in English Vowels Produced by Japanese, Korean, and Spanish Speakers: The Case for Goodness and Intelligibility. *American Journal of Speech-Language Pathology*, 23(4), 626. doi:10.1044/2014_AJSLP-13-0144

⁵³ Iverson, P., & Evans, B. G. (2007): Learning English vowels with different first-language vowel systems: Perception of formant targets, formant movement, and duration. *Journal of The Acoustical Society Of America*, 122(5), 2842. doi:10.1121/1.2783198

importance of the study on vowel systems is of great relevance. “Vowel systems can vary greatly across languages.”⁵⁴

2.6. English vowel system and Spanish vowel system

The effect of the L1 interference and the learning of new vowel sounds from a second language have been explained in some studies by Flege and Major. The L1 vowel system influences the production of L2 vowels, especially in early stages of learning.

The investigation by Major looked at the interrelationship of phonological similarity between L1 and L2. In his study of the transfer in the acquisition of English /æ/ and /ɛ/ vowels by native speakers of Brazilian Portuguese, he found that “phonetic and phonological similarities between L1 and L2 vowel systems are of great relevancy. He proposed that these similarities can lead to generalizations and interactions of the vowels within the interlanguage.”⁵⁵

It is clear that one’s first-language L1 phonetic categories affect second-language L2 vowel learning. For example, “Spanish listeners have difficulty learning to discern the difference between English /i/ and /I / presumably because they both sound like the same Spanish vowel /i/.”⁵⁶

Phonetic studies explain that “English vowel system is more complex whether is compared to the Spanish vowel system. Spanish has only five different vowels /i,e,a,o,u/. In contrast, Ladefoged explains that nine vowels are encountered in the American English Language.”⁵⁷

⁵⁴ *Ibid.*,626

⁵⁵ Major, R. (1987): Phonological similarity, nakedness, and rate of L2 acquisition. *Studies in Second Language Acquisition*, 9, 63–82.

⁵⁶ Iverson, P., & Evans, B. G. (2007): Learning English vowels with different first-language vowel systems: Perception of formant targets, formant movement, and duration. *Journal of The Acoustical Society of America*, 122(5), 2842. doi:10.1121/1.2783198

⁵⁷ Méndez, A. (1982). Production of American English and Spanish vowels. *Language & Speech*, 25(2), 191.

Another aspect of differentiation between Spanish vowel system and English vowel system is that the first one seems to be more stable in contrast to the latter in terms of variability.

“Stockwel, Peterson, Amastae and Ladefoged cited in Mendez, say that extremely wide variation is found between English dialects, while Spanish has almost none among other investigations emphasize the idea of the lack of correspondence, or a weak one between the Spanish and the English vowel systems.”⁵⁸

The high density of the English vowel system may cause some pronunciation difficulties. The American English vowel inventory contains about 15 monophthongs depending on the particular dialect / i, I, e, ε, æ, ʌ, ə, ɜ, ɝ, u, ʊ, ɔ, ɑ, ʌ/. Therefore, English has a relatively dense vowel space compared with other languages, as less than 10% of the world's languages have 15 or more monophthongs in their inventories (Maddieson, 1997). The high density of the English vowel system means that many non-native speakers of English will encounter new vowels that will pose pronunciation difficulties.⁵⁹

The duration of the vowels in every language is also an important aspect. Phonetic research categorizes vowels as short vowels and long vowels to explain the differences among language vowel systems.

Hillebrand cited in Liu, Jin & Chen, says that American English vowels can be divided into two groups based on their duration, phonemically long and short vowels. Some vowel contrasts, such as /a-ε/, /i-I/, /u-U/, and /ɔ-a/, have similar spectral features but significantly different durations.⁶⁰

Hillebrand, Crystal & van Sauten cited in Liu, Jin & Chen, says that “although vowel duration is dependent on speech materials (e.g.,

⁵⁸ Méndez, A. (1982): Production of American English and Spanish vowels. *Language & Speech*, 25(2), 191.

⁵⁹ Franklin, A. D., & Stoel-Gammon, C. (2014): Using Multiple Measures to Document Change in English Vowels Produced by Japanese, Korean, and Spanish Speakers: The Case for Goodness and Intelligibility. *American Journal of Speech-Language Pathology*, 23(4), 626. doi:10.1044/2014_AJSLP-13-0144

⁶⁰ Liu, C., Jin, S., & Chen, C. (2014). Durations of American English Vowels by Native and Non-native Speakers: Acoustic Analyses and Perceptual Effects. *Language & Speech*, 57(2), 238-253. doi:10.1177/0023830913507692

connected speech versus citation-form syllables), the duration patterns as a function of vowel were quite similar.”⁶¹ In this sense, phonemically short vowels tend to have shorter durations than long ones regarding of speech materials.

A transference process between English language and Spanish language might be also caused by Spanish vowel inventory. “The Spanish vowel system comprises the five vowels /i, e, a, o, u/, four of which are shared with English, /i, e, u, o/. The low-central vowel /a/ is unique to Spanish. Spanish speakers learning English will encounter six new vowels: /ɪ, ɛ, æ, ʌ, ɑ, ʊ/.”⁶²

Some researchers also explain that there are specific transference processes in some vowels from L1 to L2 that may not necessary cause negative effects. Stockwell and Bowen suggest that “some English vowels (e.g. **vowel i** and **vowel a**) are transferable to Spanish without noticeable ill effects. Their contention seems to be mostly based on perceptual characteristics rather than quantitative analysis of both vowel systems.”⁶³

Iverson & Evans point that “the L1 assimilation strategy could be problematic for individuals with small L1 vowel systems, because it is more likely that there will be cases of multiple L2 vowels assimilating to the same L1 category (e.g., English /i/ and /I/) assimilating to Spanish /i/, making it harder for listeners to discern differences among these L2 vowels.”⁶⁴

Despite the initial difficulty based on the L1 interference to learn English as a second language, the fact that L1 Spanish vowel inventory is

⁶¹ *Ibid.*, 240.

⁶² Franklin, A. D., & Stoel-Gammon, C. (2014): Using Multiple Measures to Document Change in English Vowels Produced by Japanese, Korean, and Spanish Speakers: The Case for Goodness and Intelligibility. *American Journal of Speech-Language Pathology*, 23(4), 626. doi:10.1044/2014_AJSLP-13-0144

⁶³ Méndez, A. (1982): Production of American English and Spanish vowels. *Language & Speech*, 25(2), 191

⁶⁴ Iverson, P., & Evans, B. G. (2007): Learning English vowels with different first-language vowel systems: Perception of formant targets, formant movement, and duration. *Journal of The Acoustical Society of America*, 122(5), 2847. doi:10.1121/1.2783198

very small, which is the case of the Spanish language, might make it easier for individuals to learn.

Flege cited in Iverson & Evans, has argued that “new categories are easier to learn when they are far away from existing categories, and one could imagine that individuals with smaller vowel systems would have more unused room in the vowel space to learn new categories, although it is not clear that individuals with smaller vowel systems actually have more unoccupied space.”⁶⁵

In this sense, the dimension of the vowel system in every language might influence in the learning of new categories of sounds in L2.

Flege & MacKay cited in Iverson & Evans, has also explained that individuals with larger L1 vowel systems may be more successful in using assimilation i.e., less chance of multiple L2 vowels assimilating to the same L1 category, but they may have more difficulty learning new categories. If individuals with large vowel systems have less unoccupied space to learn new vowels, they would need to change their existing L1 category representations to better match the L2 vowels, creating merged or compromise categories.⁶⁶

Hence the representations and associations made by the individual learners from their L1 to their L2 bring important impact in the learning processes. This includes also the modification of existing categories that cause some effects on new learning sounds.

Munro and Fledge cited in Iverson & Evans, say that “changing existing categories in this way is thought to be more difficult than learning entirely new categories. It is thus possible that individuals with larger L1 vowel systems may rely more on L1 assimilation and less on new learning than do individuals with smaller L1 vowel systems.”⁶⁷

Finally, “one of the most relevant differences between English vowel system and Spanish vowel system is the presence of neutral

⁶⁵ *Ibid*, 2843

⁶⁶ Iverson, P., & Evans, B. G. (2007): Learning English vowels with different first-language vowel systems: Perception of formant targets, formant movement, and duration. *Journal of The Acoustical Society of America*, 122(5), 2843. doi:10.1121/1.2783198

⁶⁷ *Ibid*, 2843

vowels. This is, particularly the case of a frequent vowel in English: *schwa*.⁶⁸

2.7. A very common English vowel: The schwa sound

The English vowel /ə/, called, schwa sound is a central short vowel. It is the most common vowel sound occurring in English. For that reason, “it is a key phoneme when learning the phonology of English as an L2, the level of frequency in the use of this phoneme determines the level of performance in pronunciation of the English language. The usual name for the neutral vowel [v], heard in English at the beginning of such words as *ago*, *amaze*, or in the middle of *afterwards*; sometimes is also called the indefinite vowel.”⁶⁹

Cruttenden cited in Heselwood, says that “*schwa* is the most commonly occurring vowel in English (2001: 148), being found initially, internally and finally in surface word-forms. Recognizing *schwa* as the realization of a phoneme in RP English is unnecessary in non-final contexts.”⁷⁰

According to the Dictionary of linguistics and phonetics “*schwa* is a particularly frequent vowel in English, as it is the one most commonly heard when a stressed vowel becomes unstressed, e.g. *telegraph* becoming *telegraphy* /'teləgrɑ:f/ v. /tə'legrəfi/. It is also the usual pronunciation of the vowel in such words as *the*, *a*, *an*, *and*. The term ‘*schwa*’ comes from the German name of a vowel of the central quality found in Hebrew.”⁷¹

⁶⁸ Schwa. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fschwa%2F0>

⁶⁹ Schwa. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fschwa%2F0>

⁷⁰ Heselwood, B. (2009): R vocalization, linking R and intrusive R: accounting for final schwa in RP English. *Transactions of The Philological Society*, 107(1), 66. doi:10.1111/j.1467-968X.2009.01215.x

⁷¹ *Op.Cit.*

In terms of quality, “it is a mid, halfway between close and open, and central vowel, halfway between front and back. It is also described by Roach as lax vowel; that is, not articulated with much energy.”⁷²

Lindblom & Flemming cited in Bricker & Orie, say that “cross-linguistically, the schwa sound is a vowel that lacks a well-defined phonetic target.”⁷³

The schwa sound is mostly related to weak syllables, that is; syllables in which the vowels have undertaken a *reduction process*.⁷⁴ As a result, it is important for the aim of this action research to discuss how these processes of reduction work in the English language and how they differentiate from what is seen or known in Spanish. In English, vowel reduction can occur as a consequence of several factors.

On the other hand, Spanish vowels are very stable, have quite the same variation and are very clear: a, e, i, o, u, so they are called as strong vowels by other speakers. It has been seen that all the five vowels have quite the same duration. As a consequence, unlike English, Spanish does not have reduced vowels. Hence the time duration in pronunciation the English vowels by L2 speakers might determine the quality of the production of the schwa sound.⁷⁵

Depending on dialect, it may correspond to any of the following orthographic letters:

- a. like the 'a' in *about* [ə'baʊt]
- b. like the 'e' in *taken* ['teɪkən]
- c. like the 'i' in *pencil* ['pensl]
- d. like the 'o' in *eloquent* ['eləkwənt]
- e. like the 'u' in *supply* [sə'plaɪ]

⁷² Vera Diettes, K. (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds. 18

⁷³ Bricker, V. R., & Orie, O. O. (2014). Schwa Yucatecan Maya in the modern Yucatecan languages and orthographic evidence of its presence in colonial chontal and pre-Columbian Maya hieroglyphic texts. *International Journal of American Linguistics*, 80(2), 176.

⁷⁴ Vera Diettes, K. (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds.

⁷⁵ *Op.Cit.*

It is worth mentioning that “schwa may represent the reduced form of any vowel or diphthong in an unaccented position. This phenomenon that occurs in English is known as vowel reduction. For that reason, as also stated by Roach, learners of English need to learn when it is appropriate to produce a schwa and when it is not.”⁷⁶

According to the background knowledge, L1 phonological system influences in the production of English as a second language. During this transition from the L1 to the acquisition/learning L2 as a target language, there are situations that generate processes in the way L2 learners will pronounce the second language. The situation appears more interesting when this L2 target sound (schwa) does not exist in L1. Recent investigations explain some of the possible pronunciation errors that might cause L2 speakers produce their own representations of an English schwa sound.

2.7.1. Possible pronunciation errors in the use of the schwa sound in L2 speakers

As Avery and Ehrlich point, the correction of mispronounced sounds that interfere with students’ comprehensibility can go a long way in improving students’ performance understanding and confidence in speaking English.⁷⁷ The pronunciation errors that learners make are not just random attempts to produce unfamiliar sounds. Rather they reflect the sound inventory, rules of combination and the stress and intonation patterns of their native language as Avery and Ehrlich explain.⁷⁸

In a recent investigation about perception and production of the vowel schwa by Colombian speakers by Vera Diettes, based on the variable orthography in the use of schwa, Diettes points that although the schwa sound is considered as a new phone for Spanish native speakers, since it is located in an *empty area* of the Spanish

⁷⁶ *Op. Cit.*

⁷⁷ Avery, P. & Ehrlich, S. (1992): *Teaching American pronunciation. Textbook and manual of reference on teaching the Pronunciation of North American English* U.S.A. Oxford University Press.

⁷⁸ *Op.Cit.*

vowel space, the findings suggests that this specific L2 vowel is not being perceived as a new phone. Quite the opposite, speakers appear to be assimilating this sound as more than one instance of an existing phonetic category.⁷⁹

Vera Diettes points on her investigation that, “the problem occurs specifically when speakers are not able to recognize as a new phone so they assimilate this sound by association with the stable vowels Spanish language have (a, e, i, o, u,) in order to locate this sound in somewhere of their articulation process.”⁸⁰ The fact that tendencies were observed in her investigation in the production of schwa, based on the orthographical variable, provides evidence on that “L2 learners are somehow influenced by the seen or written form, that is; the Spanish vowel letter they read, when producing the phoneme.”⁸¹

Vera Diettes also explains in her investigation with Colombian speakers based on Praat, “that two types of *schwa* were found as more difficult for speakers to produce, the ones spelt with the vowel letters < a > and < e > in terms of Colombian accent.”⁸²

Hence, the L1 interference is a very strong influence when Spanish speakers produce the target language (English) in terms of articulator process and reinforced by the written form.

One of the ways to understand and study the articulator processes in informant speakers for a phonetic study is by using phonetic software programs. To understand the use of these programs, there are some acoustic components that are important to know previously for this investigation.

⁷⁹ Vera Diettes, K. (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds.

⁸⁰ *Op.Cit.*

⁸¹ *Op.Cit.*

⁸² *Op.Cit.*

2.8. Phonetic components for a study of English vowels

There are many phonetic components for a study of vowels. We are going to explain some of them that were needed to understand for the present investigation.

2.8.1. Acoustic phonetic

According to the Dictionary of linguistics and phonetics the *acoustic phonetic* term is “the branch of which studies the physical properties of speech sound, as transmitted between mouth and ear, according to the principles of acoustics. In this way, acoustic evidence is often referred to when one wants to support an analysis being made in articulatory or auditory phonetic terms.”⁸³

2.8.2. Articulatory phonetics

Another important part of the branch of phonetics is the articulatory *phonetics* which studies the way in which speech sounds are made (‘articulated’) by the vocal organs. It derives much of its descriptive terminology from “the fields of anatomy and physiology, and is sometimes referred to as physiological phonetics. This area has traditionally held central place in the training of phoneticians, the movements involved being reasonably accessible to observation and, in principle, under the control of the investigator.”⁸⁴ The classification of sounds used in the International Phonetic Alphabet (IPA), for example, is based on articulatory variables.

⁸³ Acoustic Phonetics. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Facoustic_phonetics%2F0

⁸⁴ Articulatory Phonetics. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Farticulatory_phonetics%2F0

2.8.3. The vocal track

A general term used in phonetics to refer to “the whole of the air passage above the larynx, the shape of which is the main factor affecting the quality of speech sounds. It can be divided into the nasal tract (the air passage above the soft palate, within the nose) and the oral tract (the mouth and pharyngeal areas, oral cavities).”⁸⁵ In a more general application, the term is used in the sense of “vocal organs, including all the features of the respiratory tract involved in the production of sounds, i.e. lungs, trachea and larynx as well.”⁸⁶

“The human vocal tract is not a simple tube: it has a complex shape which can be described as series of cross-sectional area measurements, as a function of distance from the glottis.”⁸⁷ The vocal track is constituted by the oral cavities: nasal, faring and larynges. Inside these cavities are the articulators that can be divided in active and passive. The active articulator organs are: the tongue, mandible, velum palatal and lips, while the passive organs are the teeth, hard palatal and superior maxillary.

“Each vocal tract shape has a characteristic filter function that can be calculated from its size and shape. Each different configuration of the vocal track constitutes consequently a different filter in the vocal track.”⁸⁸

“A formant is a component of a sound frequency that is found in the human speech. The length of the vocal tract is correlated with body size and determines the overall dispersion of formant frequencies in speech.”⁸⁹ Through modifications and different positions that can adopt the articulators, the vocal track will have

⁸⁵ Vocal tract. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fvocal_tract%2F0

⁸⁶ *Op. Cit*

⁸⁷ Sherman, W (1994): *Vocal Track Length Perception and the Evolution of Language*, Doctorate Thesis, Aizu: Brown University.

⁸⁸ *Op. Cit.*

⁸⁹ *Ibid*, 18

different forms or configurations, different formant values. This fact allows differentiate every single vowel from the others perceptually. “The frequencies of the formants of human speech are determined by both the length and the shape of the vocal tract. This cross-sectional area function can be modified in a variety of ways in humans.”⁹⁰

2.8.4. Formant measurements

As it was mentioned before, vowels are identified by their formants. “A Formant is a term of Acoustic Phonetics of particular value in the classification of vowels and vowel-like sounds, and of transitional features between vowels and adjacent sounds.”⁹¹ A formant is the way a vowel is differentiated perceptually; it is “a concentration of acoustic energy, reflecting the way air from the lungs vibrates in the vocal track, as it changes its shape. For any vowel, the air vibrates at many different frequencies all at once, and the most dominant frequencies combine to produce the distinctive vowel qualities.”⁹²

“A frequency is a term derived from the study of the physics of sound, and used in acoustic phonetics, referring to the number of complete cycles of vocal cord vibration in a unit of time (per second). It is measured in Hertz (Hz), a term which has replaced the older ‘cycles per second’. An increase in the frequency of a sound correlates with an auditory sensation of higher pitch.”⁹³ Each dominant band of frequencies constitutes a formant, which shows up clearly in a record produced by a sound spectrograph as a thick black line. “A spectrogram is an instrument used in acoustic

⁹⁰ Sherman, W (1994): *Vocal Track Length Perception and the Evolution of Language*, Doctorate Thesis, Aizu: Brown University.

⁹¹ Formant (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fformant%2F0>

⁹² *Op. Cit.*

⁹³ Frequency. (2003): In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Ffrequency%2F0>.

phonetics which provides a visual representation of the acoustic features that constitute the sounds in an utterance.”⁹⁴

Currently, “spectrographic information can be generated electronically and displayed on a screen. Each vowel has a different formant pattern that can be presented by spectrograms.”⁹⁵

Even though, we are not conscious, we use the formants and the sound frequency that we listen to in order to identify which sound is, and in particular case, the vowels, because vowels usually have very clearly defined formant bars.

“The formant with the lowest frequency is called F1, the second F2, and the third F3 and so on. Three main formants provide the basis of vowel description: the first formant (F1) is the lowest, and the second and third formants (F2, F3) are respectively higher. The formants can be related to the articulator descriptions of vowels.”⁹⁶

“Most often the two first formants, F1 and F2, are enough to disambiguate the vowel. These two formants determine the quality of vowels in terms of the open/close (mouth position) and front/back (tongue position) dimensions.”⁹⁷

Generally, a vowel can be clearly identified by their first 2 formants: The vowels differ systematically in the frequencies of the first two formants (F1 and F2).

a) [i] has low F1 and high F2

b) [a] has high F1 and low F2

⁹⁴ Spectrograph. (2003). In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fspectrograph%2F0>

⁹⁵ *Op. Cit.*

⁹⁶ SWPHONETICS, (2015, March 25th): Praat for beginners. Tutorial: What are formants? On line. April 27th, 2015. Retrieved from: <http://swphonetics.com/praat/tutorials/what-are-formants/>

⁹⁷ Formant. (2003). In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fformant%2F0>

c) [u] has low F1 and low F2

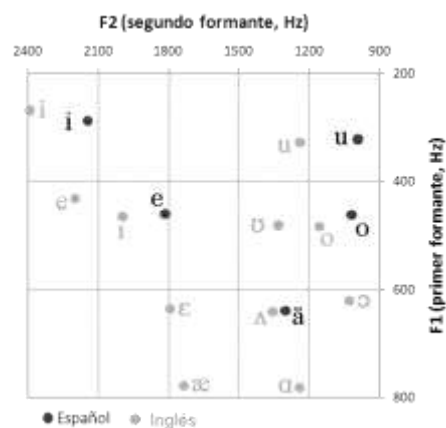
Thus the first formant F1 has a higher frequency for an open vowel (such as [a]) and a lower frequency for a close vowel (such as [i] or [u]); and the second formant F2 has a higher frequency for a front vowel (such as [i]) and a lower frequency for a back vowel (such as [u]). Vowels will almost always have four or more distinguishable formants; sometimes there are more than six.⁹⁸

The first two formants F1 and F2 are most important in determining vowel quality, and this is often displayed in terms of a plot of the first formant against the second formant.

Once we have the measurements of the F1 and F2, it is necessary to plot the formant values of vowels for a phonetic analysis and include the International Phonetic Alphabet (IPA) to organize the graphical information.

Bradlow explains in the following graph, the formant measurements for Spanish vowels and English vowels.⁹⁹ See graph 1.

Graph 1. Bradlow plotting: Spanish vowels and English vowels



⁹⁸ *Op.Cit.*

⁹⁹ Bradlow, A. (1995, March 1st):“A comparative acoustic study of English and Spanish vowels.” *Journal of the Acoustic Society of America*, (97), 1916-1924.

The "front vowels" are called when the tongue body is in the front of the mouth. All vowels show a "gap" in frequency between F1 and F2 and the height of the tongue in the mouth is inversely related to F1.¹⁰⁰ The "back vowels" are called when the tongue body is in the back of the mouth. All vowels show F1 and F2 quite close in frequency.¹⁰¹

Consequently, the higher values for F1 are when the tongue is more down and the mouth is more opened like the vowel [a] in Spanish. On the other hand, F2 has higher frequency when the tongue is in the front position, so as long as the vowel is before, the values of F2 are higher.

Formant frequency (Hz) is the center frequency of the resonance. Formants are named (numbered) in increasing order of formant frequency. Acoustically, Ladefoged (2006) explains that the expected F1 and F2 values for the English *schwa* are 500Hz and 1500Hz respectively.¹⁰² (The hertz, symbol Hz, is equivalent to cycles per second so this symbol is a unit of frequency and is defined as the number of cycles per second of a periodic phenomenon).¹⁰³

Plotting vowels in the intersection between F1 and F2 can help us to determine the position of the vowel produced in human speech. Hence the illustration below explains the mid central position of the schwa vowel in human speech recognition.

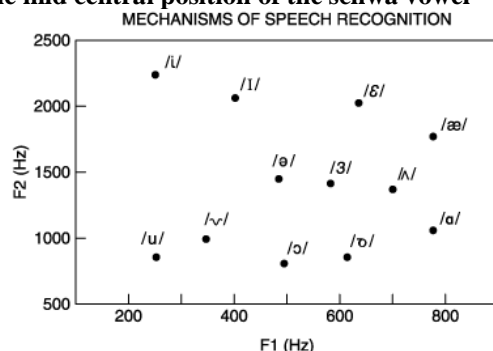
¹⁰⁰ SWPHONETICS, (2015, March 25th): Praat for beginners. Tutorial: What are formants? On line. April 27th, 2015. Retrieved from: <http://swphonetics.com/praat/tutorials/what-are-formants/>


¹⁰¹ Op. Cit.

¹⁰² Vera Diettes, K. (2009): *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds.

¹⁰³ Hertz. (2003). In *Dictionary of linguistics and phonetics*. Oxford, United Kingdom: Blackwell Publishers. Retrieved from <http://ezproxy.mcneese.edu:2048/login?url=http%3A%2F%2Fezproxy.mcneese.edu%3A2195%2Fcontent%2Fentry%2Fbkdictling%2Fhertz%2F0>

Graph 2. The mid central position of the schwa vowel



F1: Formant 1 
F2: Formant 2 *Schwa*

Each vowel has its specific own set of signature formants. Vowels in different dialects also have different formant patterns. In order to determine vowel formants in speech, there are computer programs as phonetic software that help extracting formants by providing numerical measurements for each kind of formant during a human voice recording process.

Chen, Robb, Gilbert, & Lerman cited in Liu & Chen, point that “many studies of English vowel production of non-native speakers have focused on the relationship between vowel intelligibility and acoustic features of vowels, such as formant frequencies.”¹⁰⁴

Hence in order to make the recognition formant patterns, more objective, it is very important to determine which specific English accent will be used for the participants for being evaluated (American English, Canadian English, British English, Jamaican English, etc.) since the position of the formants differ among them since the intersection by plotting vowels in F1 and F2 give us different vowel position in articulator terms.

¹⁰⁴ Liu, C., Jin, S., & Chen, C. (2014): Durations of American English Vowels by Native and Non-native Speakers: Acoustic Analyses and Perceptual Effects. *Language & Speech*, 57(2), 239. doi:10.1177/0023830913507692

Even though the study in regards of the duration of vowels is important to understand vowel production, recent studies focus the attention in formant frequencies of vowels.

Analyzing formants can be very useful since they are related to the process of articulation in the vocal tract that might provide information in regards of what had occurred during the speech process in segmental form.

CHAPTER 3

METHODOLOGY OF THE INVESTIGATION

3.1. Investigation type

The present study is an investigation of comparative-analytic orientation. Through this investigation, we intend to identify some common errors in the production of the schwa sound through a Contrastive Analysis between native and non native teachers in the level of performance in the use of the schwa sound when some English teachers have training in phonetics and phonology in an ESL context.

For the purpose of this investigation, an integration of a Classroom action research and Phonetic analysis based on Praat have been developed in order to design an integral study that we have called a Dual Phonetic analysis that has been combined in two areas of research: The educational area and the phonetic area.

3.2. A design of a dual phonetic analysis

A dual phonetic analysis for the present investigation has designed in the following manner. The construct to be evaluated is the schwa phoneme, a neutral vowel presented in many English words and in different vowel positions. To analyze phonetically this sound unit, a segmental approach has been required.

This investigation is basically in segmental form. However the classroom action research also includes a suprasegmental approach when the interaction between teachers and students takes place during the observation.

This investigation has been named a dual phonetic analysis since not only includes segmental form and a supra segmental form but also integrates two grounds of study: The Educational area and the Phonetic area.

Bearing in mind the integration of these two areas, there are two groups of teachers/informants (trained teachers and non trained teachers in phonetics and phonology).

This contrastive analysis will help us to understand, in what way, the variable of training in phonetics and phonology in some teachers may influence in the performance of the schwa sound in the following ways of evaluation:

1. In contrast to the reference results from the English native speakers, we can analyse non native teachers' results. (Phonetic analysis based on Praat).
2. From the non native teachers' results, trained teachers in pronunciation will be analysed in order to have a close examination in the level of pronunciation of the schwa sound. (Phonetic analysis based on Praat).
3. In a perceptual analysis to evaluate by hearing the use of the schwa sound (through a video class) by native speakers as evaluators. (Classroom action research).
4. By evaluating the indicators that correspond to the principal characteristics that represents a schwa vowel in different positions (through a video class) by native speakers as evaluators. (Classroom action research).

For this purpose, this Dual phonetic analysis has two areas: A Classroom action research (Educational area) and a Phonetic analysis based on Praat (Phonetic area).

3.2.1. A classroom action research design

A classroom action research is based on a classroom observation through the storytelling activity: The Very Hungry Caterpillar. This activity was recorded on a video file about teachers' performance in order to analyze the use of the schwa sound in a speech process pronunciation. A list of vocabulary words chosen was included in the story to evaluate the teachers' performance.

The intention of this research is to collect data in regard to teachers' pronunciation in the use of the schwa sound in a classroom context through the interaction between teachers and students.

The video data extracted from the classroom observation was recorded in an observational format that contains indicators that respond to the principal characteristics of the schwa sound.

Each informant received the storybook and also the script for the reading story. This script contains the list of evaluated words embedded in the story and the vowel position for the evaluation corresponding to these words.

For this purpose, the classroom observation has the intention to evaluate perceptually some vowel sounds from words that can be objectively analyzed using the segmental approach but also include aspects of the supra segmental approach.

The aspects of the supra segmental approach include the use of gestures, expressions, changes of intonation during the storytelling activity that would affect the production of speech words that contain the schwa sound when is evaluated in normal speech.

3.2.2. A phonetic analysis design

This phonetic analysis based on Praat has been designed through the evaluation of teachers' vowel production in words that contain the neutral English vowel: schwa.

Recordings of teachers' speech in the use of the English vowel schwa in different positions and its interpretations were possibly by using the phonetic program Praat that provides spectrograms (graphical representations of the sounds) for every single word. This process provides information about what occurs during the articulator process in teachers' pronunciation of the schwa sound.

Praat is a phonetic program created by the applied linguistics Paul Boersma and David Weenink from the University of Amsterdam in 2006. This Phonetic program is a scientific tool especially used by applied linguistics, phoneticians, linguistics and audiologist. Investigations for educational areas have not been found in this study.¹⁰⁵

This program can read sounds recorded by the program or audio files recorded in another way. It can also generate a graph of waves which indicate intonation, intensity, volume and other complex details. Praat is able to isolate certain sound bites or filter frequencies either manually or using scripts.

This phonetic program also demands knowledge in regard to phonetics and phonology and additional training to use this software for educators and other professionals. Once researchers are able to manage and understand this program, they can collect specific information for specific purposes of their investigations.

Praat efficiently assists the researcher in creating a digital transcription from a digital recording of human voices in the speech

¹⁰⁵ SWPHONETICS, (2015, March 25th). Praat for beginners: Introduction On line. May 12th, 2015. Retrieved from: <http://swphonetics.com/praat/introduction/#begman>

of each vowel. These results can be visualized through spectrograms and wave forms that provide information through visual representations with reference to the human process of articulation when the researchers know how to read and interpret them.

Hence the use of Praat can provide complex information in several phonetic areas and this is a very analytic tool at the same time.

The purpose to use Praat in this investigation is strictly focused on the process of articulation when informants perform English schwa vowels. In this sense Praat can be an interesting instrument to analyse information in segmental form.

This Phonetic program provides automatically formant measurements from these graphical representations. Based formant measurements, we could analyze and understand the position of some articulator movements occurred during the teachers' speech of the list of words provided for the evaluation.¹⁰⁶

The present phonetic analysis will be measured by using the Praat version 5.3.46 one of the latest advanced phonetic tool by computer for linguistic research purposes in order to recognize the level of performance in the use of the schwa sound in spoken language by teachers.

Bearing in mind the variability that identifies the schwa sound, it seems very important to have the results of native speakers in the pronunciation of the same list of words in order to discuss the results objectively. In this sense for a contrastive analysis, we have the group of bilingual teachers and the two native speakers who had taken the same evaluation for this analysis.

In addition the group of teachers tested is basically divided in two groups the trained teachers and the non trained teachers in

¹⁰⁶ SWPHONETICS, (2015, March 25th). Praat for beginners: Introduction On line. May 12th, 2015. Retrieved from: <http://swphonetics.com/praat/introduction/#begman>

pronunciation, in which their results in the matter of the level of performance in the use of the schwa sound will be evaluated.

Now, we will explain the principal characteristics of these teachers as informants/ subjects for this investigation: Native American teachers and non native teachers.

3.3. Sample of the research

The sample of subjects for this investigation was selected from an ESL context that has a methodology of a bilingual program in English. The entire sample works in the same educational institution which is a Bilingual school.

The subjects of this investigation are English teachers who work in this bilingual school where the target language is English. These subjects participated in this investigation as informants included native teachers (English teachers with New York English accent) and non native teachers (English teachers with Peruvian Spanish accent).

The evaluators were two English teachers (one English native speaker and one non English speaker with training in ESL)

3.3.1. Characteristics of the sample

A total of 8 subjects who work in the elementary level participated in this investigation as informants.

The informant speakers included 6 Peruvian native Spanish speakers, who are English teachers that are currently working as preschool teachers. Additionally there are two native speakers from United States (from the same state: New York) so they also have even the same accent as L1 English speakers. The Spanish speakers are called the L2 speakers.

From this total of 8 subjects, 6 of them (Peruvian teachers) whose production abilities in the use of the schwa vowel, were examined. On the other hand, the group of English informants as

L1 speakers (native teachers) produced the vowels to which the L2 speakers' realizations were contrasted to.

Firstly, the Peruvian Spanish speakers were selected from a group of Peruvian English teachers who had been working as English teachers in a Bilingual Education program in Lima Peru for more than 5 years of teaching experience. On the other hand, generally L2 English teachers in Peru usually start learning the language at a later age however this sample could have the possibility to learn the English language in early stages but always in an ESL Peruvian context. This sample is very homogenous.

Only some of them had been trained before in phonetics and phonology in any institution. This will help evaluating the possibility to acquire L2 sounds accurately and, in a more specific way, to identify whether the condition of previous training in phonetics and/or pronunciation can help English teachers to integrate the schwa sound in some way in their level of pronunciation according to the results of this research.

The 6 bilingual teachers work in Preschool level, they are in charge of 2, 3, 4 and 5 years old children. In addition, there are 2 native English teachers who work in kinder level (5 years old) and elementary level (6 years old). According to the Ministry of Education in Peru, early stage is from 0 to 6 years old, so all the sample works in the same level, Infants level (early stage of children education).

Ethnography

The ethnography is grounded as a study of cultural domains, in this sense; Peruvian culture has a particular accent among Spanish speakers. The cultural system is formed by Peruvian teachers from Lima, they teach English as a second language and English language is also their second language, the students are Peruvian, they learn English as a second language and the methodology is based on a bilingual program in a private school in Lima Peru.

On the other hand, the two native teachers are involved in the evaluation in order to compare and contrast the results of voice recordings. These teachers are from United States, (New York), so they have the same accent from their state of residence. These teachers have an American English accent.

In this sense, it has been very important to have a more homogeneous sample of informants.

As it is mentioned before, the sample is represented by Peruvian teachers (Spanish speakers). This sample will be evaluated in two forms: In a classroom context in order to analyse the teachers' pronunciation in the use of the schwa vowel through a storytelling activity and a Phonetic segmental analysis in order to support the Classroom observation research objectively.

Additionally, the sample of American English native teachers from New York City, were also evaluated by the acoustic analysis in order to get the parameters of what is expected for a contrastive analysis.

The classroom research through a classroom video tape recording will be developed under the study of an Ethnography type of research in order to find important features pertaining to the level of pronunciation in a specific tell- a- story activity through a video recording in the spontaneous interaction between students and the teacher.

The classroom research would give us a high level of inference, so in this sense, the phonetic computer analysis will give a low level of inference in order to balance and support the results of the classroom action research.

Age and Gender

The gender of the subjects is female. Usually in the Peruvian educational culture, teachers in early stages of education are women. Due to a gender variation in voice quality and acoustically between female voice and male voice, all participants were women in order to have more objective results.

The sample will be represented by 8 English teachers, 6 bilingual teachers from Lima Peru and 2 native teachers. The age of the sample means teachers between 27 and 42 years old.

Educational and L2 Learning Background

First of all, the sample of these teachers does not show any hearing disability.

The entire sample of these teachers (natives and non natives) is licensed in education with mention in Infants level (early childhood and/or first years of elementary level).

As we know, Peruvian teachers speak English fluently and they are able to teach the 4 language skills: reading, speaking, listening and writing, skills that were evaluated to enroll as teachers in the educational program; some of them have training in phonetics and phonology but not others. Thus, the differentiation is that only some of the Peruvian teachers have training in phonetics and phonology.

Language of all participants: Standard American English.

Table 1. Characteristics of the teachers' sample

#	Informant Name/Code	Age	Gender	English language	Nationality /accent	Training in phonetics/ Phonology
1	Native 1A	29	F	L1	American English (native)	Yes
2	Native 1B	27	F	L1	American English (native)	Yes
3	DIN	35	F	L2	Peruvian (non native)	No
4	ISA	42	F	L2	Peruvian (non native)	No
5	NAT	35	F	L2	Peruvian (non native)	Yes
6	NAN	40	F	L2	Peruvian (non native)	Yes
7	CYN	28	F	L2	Peruvian (non native)	No
8	JAC	32	F	L2	Peruvian (non native)	Yes

3.4. Variables

3.4.1. Independent variable

The independent variable refers to the use of the schwa vowel as L2 sound.

Dimensions of the Independent variable

1. Phonetic training on English vowels that contain the schwa sound.
2. Characteristics of the L1 phonological system (Spanish language)

3.4.2. Dependent variable

The dependent variable refers to the information provided by the Dual phonetic analysis in order to recognize some common errors in the use of the schwa sound that appear in certain articulator movements and in certain words that contain vowel sounds. These possible errors might differ from teachers with pronunciation or phonetic training and teachers without pronunciation or phonetic training.

The analysis is basically in certain words that contain the schwa vowel sound in all its positions on the grounds of a Dual phonetic analysis.

3.5. The Nature of data

The nature of data for the Dual phonetic analysis is represented by two perspectives of study.

There are two areas of study a phonetic analysis based on Praat and a classroom action research based on a storytelling activity.

The quantitative data is extracted from the Phonetic analysis in the application of a phonetic program that provides numerical measurements about the articulator process. The Classroom action research based on an observation process and perceptual analysis, through video recordings in the interaction between teachers and students provide quantitative data and qualitative data.

3.5.1. Words selected criteria and evaluation

For this dual phonetic analysis, 25 English words were chosen for the Phonetic analysis based on Praat and for the Classroom action research there were 14 words chosen.

In a general way, the word chosen criteria for the Dual analysis contains five words chosen for each vowel. Each vowel represents the following vowels in written form (a, e, i, o, u) in English and in Spanish.

Each vowel written may be presented in an English word phonetically as a neutral vowel or schwa sound in different positions (initial, medial or final position) depending on the vowel and the consonant embedded in the word.

For this study, it has considered all the positions of the schwa sound that may appear for each vowel written (a, e, i, o, u). However the selection of words is limited since it follows a certain criteria in order to have a more objective evaluation.

First, the schwa sound is represented by the 5 vowel letters (a, e, i, o, u) which are evaluated for each type of vowel.

All the words included in the evaluation, have only one schwa sound, exceptionally for the word: beautiful. For this reason, this word has evaluated individually for two purposes: i word-medial (ti) and u word-medial (ful). Due to this word contains two schwa sounds, the word *beautiful* has also been considered in the Phonetic analysis based on Praat and in the storytelling activity. See appendix 1.

Beautiful / 'byutəfəl /

Secondly, it has been selected 10 consonants and the number of words for these consonants is as follows: L **3**, b **2**, f **3**, p **2**, s **2**, v **2**, r **1**, w **1**, t **4**, and c **2**. It has been avoided neighboring consonants that are nasals (m/n) and velar nasals (ng) because according to previous researches, the problem of analyzing spectrograms of nasal consonants is that there is energy in the spectrum from a number of different sources so it is very difficult to interpret where the energy originates: whether nasal oral or the result of shifting from anti resonances.

Thirdly, have been eliminated from the stimuli list (English words chosen) words that contain the schwa sound with r ending sound, such as: ar, er, ir, or, ur due to the schwa sound and the r sound pronunciation is more than the pronunciation of a vowel, It has no noticeable vowel, we see a vowel but should not be pronounced so it is difficult to classify such words in terms of vowel sounds especially through a computer program (Praat).

Even though, being important to have information pertaining to this type of schwa sound, only the Classroom action research has been considered the following words:

Butterfly (t**ter**)
cover (v**er**)

In addition, words such as: **a** and **of** were included. These words contain the schwa sound only in specific cases through the process of natural speech. For instance:

a: only as indefinite article.
of: unstressed əv or before consonants.

Hence these words were included only in the Classroom action research in the interaction between teachers and students to recognize these differences.

Finally, in both areas of phonetic study, I also eliminated all the words that have two adjacent vowel letters representing only one schwa sound, such as “famous” or “dangerous”, in order to have a clear result.

The list of words chosen for the present study appears in appendix 1. List of English words chosen.

3.5.2. Phonetic analysis data based on Praat

The analysis of the recorded data was done instrumentally by the Praat program; a phonetic analysis has developed in order to evaluate teachers in a segmental form based on a technological research. By using the Praat phonetic program the intention is to evaluate each vowel position of schwa sound from each word evaluated.

The English words chosen for the evaluation are presented as carrier sentences in a Power point presentation which is used during data collection for the phonetic analysis so each word is inserted in a more natural way of speaking.

An example of a carrier sentence:

Now, I say *butterfly*

The Power point presentation included the 25 English sentences that contain the 25 English words chosen for this investigation.

For each vowel schwa there are 5 words that contain all the positions that can be presented for each vowel in the English language. See appendix 1: List of English words chosen.

The sentence appears twice on the monitor. Informants (teachers) Peruvian and English native speakers can pronounce the sentence shown on the monitor as a slide show. These slides were shown for the subjects and a short break was taken at the end of each pronounced word.

To record the carrier sentences produced by the sample of informants, a microphone was connected to the computer's input jack. Recordings as digital audio files were made using The Gold Wave audio program.

Sound files were stored as WAV files. Each carrier sentence was recorded individually for each wav file. Each WAV file can be read by Praat. Then every single recording of each word (e.g. absent) is analyzed by the latest Praat version program on that time 5.3.46.

For example to evaluate the recognition of **e** medial schwa for the word absent (se) we have the following carrier sentence:

Now I say, *absent*

Then the vowel sound is analyzed by the measurement of the first and second formants (F1 and F2) for each specific vowel sound in which the schwa sound is expected.

Formant measurements were taken from Praat in order to establish the qualities of all the vowels produced in segmental form. To that end, Praat was used to segment the studied vowels; in this case, the schwa vowel is presented in a list of English words chosen in order to extract formants and duration values in order to determine whether these teachers pronounce the schwa vowel or which vowels they pronounce instead of.

3.5.1.1. Formant measurements: F1 and F2

After recording the voices from these selected words, the next process is to download files to the Praat program, and then we program the Praat program to measure only the first and second formants.

Automatically Praat makes the calculation of these two first formants by LPC (*Linear Predictive Coding*), so we can visualize the trajectory along the wave sound.

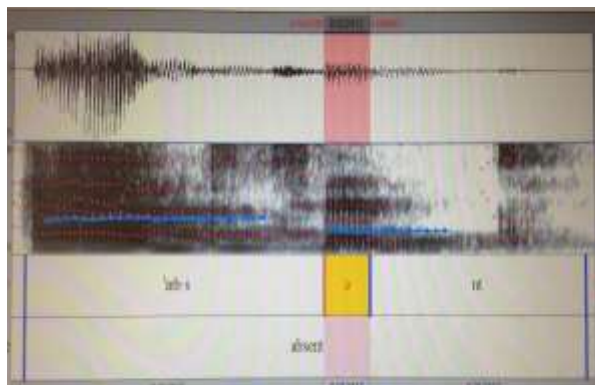
Regarding quality, the algorithm used by Praat takes formant measurements of each of the segmented vowels at a mid point. Additionally, it avoids the consonantal effects on the vowels. Nevertheless, all the measurements extracted from the data by Praat were individually revised in order to ensure the values were correct.

Through this analysis, the measurement of the formants F1 and F2 of each vowel sound was displayed and evaluated.

The following image taken from Praat shows the selection of the vowel sound in which the schwa sound is expected for the case of the word: **Absent**. Besides we can also see the spectrogram and the wave form of the word and the selected sound.

As we see in the picture below, the phonetic alphabet is also integrated for each corresponding sound.

This picture is one of the samples taken from a computer screen for this research that shows graphically the way the segmental analysis operates from one of our informants. There can be seen the spectrogram, waveform and formants of the vowel studied as well as the duration in milliseconds (on the top with red numbers).



The Charis SIL (2011) version 4.110 was used to make scripts for the words evaluated by using the IPA (International Phonetic Alphabet).

The spectrograms in Praat can show the phonetic symbols that correspond to the sounds evaluated in every word.

Then, when the vowel sound is selected, the Praat program helps us to extract automatically the measurements of this segment of speech. Besides we can click again to listen only the vowel to ensure that the sound evaluated is a vowel. The values of each formant are measured: F1 and F2 and the time duration of the vowel when it is spoken.

Praat shows the information in the following way:

Start	end	F1	F2
6.0617	6.1004	856	1

The formants: F1 and F2 are measured for each vowel sound and the values we have to be recorded in an Excel file. Using the EXCEL program we can organize the information for each informant for all the words evaluated.

The following chart explains the same information but in the way in which the information has been organized in an Excel file for each individual informant (teacher). Results from Informant ISA corresponding to the words that contain *schwa* in words with vowel **a** in all of its positions for this vowel, this vowel only has 2 positions a initial and a medial.

Informant ISA		Start	End	F1	F2
a initial	About	6.0617	6.1004	856	1609
	Attractive	3.5888	3.6392	798	1824
a-medial	Breakfast	3.3759	3.4738	650	954
	Was	3.0206	3.1488	956	1409
	Salami	3.1119	3.1973	742	1492
Mean formant value (HZ)				800	1457

After the sound data collection, from Peruvian teachers and Native American teachers in segmental form, the results of these two groups can be compared.

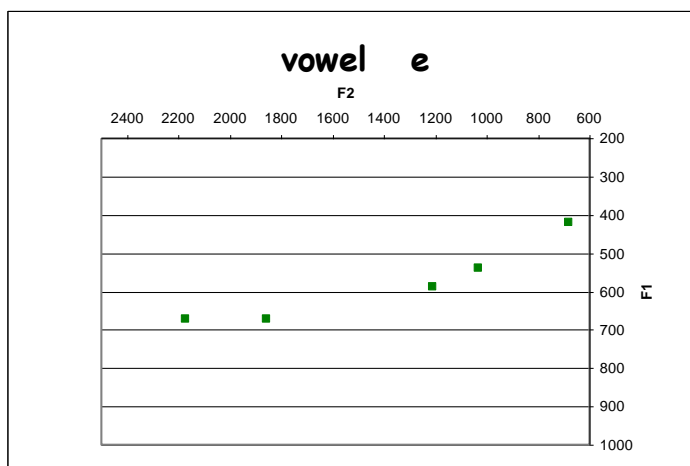
In the same way the information has been organized for all the informants for all the vowels in all the positions expected for them. (See Appendix 8: Individual Formant values for each informant on each vowel position).

Here we have the chart for the **e** vowel for the informant/teacher ISA. In this case the schwa vowel **e** only exists in medial position.

Informant ISA		Start	End	F1	F2
e-medial	Absent	4.7183	4.8356	672	1857
	Item	3.3208	3.3724	673	2171
	Problem	3.3116	3.4271	588	1212
	Heaven	3.1341	3.2041	419	679
	Telephone	3.1005	3.1538	540	1033
Mean formant value (HZ)				578	1390

In the same way all the information of the evaluation of each vowel sound for each word has been organized by these charts in order to plot the formants (F1 and F2).

According to the phonetic position, using these formant values, the information can be plotted by using an EXCEL program that provides the following graphical information. Plotting values by respecting the axis **x** and **y** using the corresponding coordinates in an excel file could help us to analyze the position of the vowels in the informants.



In this sense, in terms of quantitative data, in segmental form, the intention of this analysis is to provide information about teachers' pronunciation in terms of a very common vowel in English, the schwa sound. For this purpose, as we mentioned before, there was specific criteria in the selection of the list of English words that teachers have to pronounce and these words contain all the positions of the schwa sounds that can appear in human speech.

Once it is plotted the formant values for all the vowels of the selected list, from the all the informants, we can analyze the non native speakers' results according to the native speakers' results. Then, by using the native speakers' reference we can analysis the results of trained teachers in pronunciation and/ or phonetics and phonology.

This analysis helped to understand in which way the neutral vowel: schwa sound is expected according to L1 American English speakers.

3.5.1.2. Vowel reduction in terms of vowel duration

The schwa sound may represent the reduced form of any vowel or diphthong in an unaccented position. This

phenomenon that occurs in English is known as vowel reduction. Reduced syllables are said faster and at a lower volume than stressed syllables, as a consequence, vowel sounds usually lose their purity, and often become a schwa sound.

Oppositely, Vera Diettes points that “Spanish language is a syllable-timed language which means that all the syllables have equal length and vowels that are not considerably reduced.”¹⁰⁷ For this reason, there are indicators included in the classroom observation that represent the principal characteristics mentioned before in relation to the schwa sound to evaluate the condition of vowel reduction in a general way.

In the case of the Phonetic analysis based on Praat, according to Fleming and Johnson (2007) one of the important factors that also shapes the extent of reduction is likely to be *vowel duration*. To analyze the *schwa* in the length on its sound, we measured the time duration for each vowel, to have the feature of the sound on its level of reduction. For this condition, the information extracted from the Praat program provides the time duration of each vowel segment required.

For instance, the case of the **a** schwa vowel of informant ISA, is extracted from the data provided between the time (start and end). The time duration of the vowel is the result of the difference between the start time and the end time, so we can have these results automatically:

Start	end	F1	F2	Time duration
6.0617	6.1004	856	1609	0.0387

¹⁰⁷ Vera Diettes, K. (2009). *Perception and production of the vowel Schwa by Colombian Spanish speakers of L2 English*, Master Thesis not published, UK: University of Leeds. 19

Then all the time duration values for each word were organized for each informant.

The following chart shows the way the data for a single informant that has been organized for every vowel in all of its position. This was the procedure to organize the information for each Spanish speaker and native speaker.

Informant ISA		Start	End	F1	F2	Time duration
a initial	About	6.0617	6.1004	856	1609	0.0387
	attractive	3.5888	3.6392	798	1824	0.0504
a-medial	breakfast	3.3759	3.4738	650	954	0.0979
	Was	3.0206	3.1488	956	1409	0.1282
	Salami	3.1119	3.1973	742	1492	0.0854
Mean Value				800	1457	0.0801

Bearing in mind that one of the important characteristics of the schwa sound is its lax vowel condition, in terms of reduction, within this information it is possible to determine the time duration and the formant values of the sound. Then can be easier to compare the length of each vowel sound between Peruvian teachers from the sample and native teachers.

Resources for this Phonetic analysis:

Windows 8 (PC)

External microphone

Microsoft Power point (to show the carrier sentences)

Gold Wave audio program

Microsoft excel (formant values in tables and for plotting vowels)

Praat version 5.3.46 (2013)

Charis SIL version 4.110, (2011)

3.5.3. Classroom action research data

Quantitative data and qualitative data are extracted from the classroom videotape data of a specific storytelling activity through the children story: The Very Hungry Caterpillar, which contains some of the words from the list of English words chosen for the Phonetic segmental analysis (see Appendix 1: English words chosen).

This storytelling activity has the purpose to analyse the level of teachers' pronunciation in the classroom context with the interaction with students and

From this classroom observation we can provide information about teachers' pronunciation in the use of words that contain the schwa sound in the classroom context during the interaction between teachers and students that usually happen during a storytelling activity.

Each Peruvian teacher is recorded performing this activity in her own classroom in interaction with her students. Students can participate spontaneously during the activity.

As it was mentioned previously, for the purpose of evaluation, a list of English words included 14 words were chosen by following the same word criteria of the phonetic analysis based on Praat. However, these 14 words included are not the same words in most of the cases with the words for the phonetic analyses based on Praat, due to we can get more options of different words for the informants. See appendix 1: List of English words chosen

This observational process in the classroom has been developed and supported through a perceptual analysis by two English teacher- evaluators, an English native speaker teacher and a Peruvian ESL teacher, both with previous training in phonetics and phonology.

Additionally, the observers have the observational format with the items expected for each vowel position in the pronunciation of these words in the use of the schwa sound during

the video tape classroom (storytelling activity) by checking the items from the observational format. (See appendix 5: Observational format).

There are many schwa sounds in words from the text but only the highlighted words were evaluated in the use of schwa according to previous criteria for the selection of the English words chosen. See appendix 1: List of English words chosen.

3.5.3.1. Storytelling Activity

Each teacher received a big book with the story: The very hungry caterpillar. The reading activity responds to the methodology these teachers usually practice every day about the principal steps to follow a storytelling activity. (See appendix 4: Steps for a storytelling activity). This story contains some of the words that correspond to the acoustic analysis (See appendix 1: List of English words chosen).

Two bilingual observers participated in this process, one native English teacher (L1 speaker) and ESL English teacher (L2 speaker). The classroom observations were recorded through videotapes that allow a more analytic observation for every single word during the storytelling activity in the interaction between teachers and students.

The data extracted from the video files recorded from the storytelling activity: *The very hungry caterpillar* presents a list of words that contain schwa vowels that were selected from this story. See appendix 1: List of English words chosen, that explains the selection of words and the vowel position assessed for this classroom action research that can happen in the schwa sound.

To evaluate the production of this list of English words chosen, during the video, an observational format was designed for each vowel position individually. (See Appendix 5: Observational Format).

Here we have a sample of one of the informants in the **a** word initial and in the **e** word medial positions of the schwa sound from the observational format.

Word: about	
Vowel position: a word initial	
Items:	
It is said faster	0
Lower volume than stressed syllables	0
the vowel sounds lose their purity	0
stressed syllables maintain the full vowel sound	1
Vowel sound used a - e - i - o - u - uh	0
Total of points	1

This observational format was used as an instrumental tool for recording data that contains five indicators or items that are needed to accomplish the production of the schwa sound.

The criterion for the selection of the first four indicators was based on the principal characteristics that a schwa vowel corresponds phonetically and linguistically under the basis of the theory in American English speakers and the fifth item corresponds to the vowel sound evaluators listen: *a, e, i, o, u*, and the sound *uh* that corresponds to the schwa sound.

Here we have the indicators with their corresponding criteria of validation for each indicator.

Table 2. Criteria of validation for a classroom observation

Indicators	Validation- Criteria
1. It is said faster	1, Vowel duration
2. Lower volume than stressed syllables	2, Unstressed
3. The vowel sounds lose their purity	3, Lax vowel
4. Stressed syllables maintain the full vowel sound	4, Contrast (the vowel sound in the whole word)
5. Vowel sound used a - e - i - o - u - uh	5. Substitution (L1 interference) or schwa

During the observation of the classroom videos by Peruvian teachers, the evaluators analyzed the pronunciation of the vowel sound by listening several times in order to evaluate the accomplishment of the items presented on the Observational format for each informant and for each vowel position.

The evaluators listen carefully to the word several times with attention on the vowel sound. Hence the evaluation is perceptually by hearing and supported by the assessment of the criterion. In this sense, the evaluator has an important guide to validate each vowel sound besides the hearing perception.

Teachers as informants are expected to get one point for each indicator and the total of points is 5 when they pronounce the schwa sound in the word that is evaluated. Due to these indicators are the key components of the schwa sound; informants should earn 5 points to achieve the standard level in the pronunciation of the schwa sound. The results were categorized by YES (5 points) or NO (4 or less).

The process of listening to the words several times through a recording video helped to a more objective evaluation. Besides, two evaluators determined the score under the process of a pair agreement observation.

Another important factor was the fact that the words extracted from the video were performed in an ongoing process of speech. This was really significant and provided natural and spontaneous information in the interaction between teachers and students.

Here, there is a part extracted from the script provided for the informants and the highlighted words assessed for the video. (For the complete information, see appendix 6: The very hungry caterpillar: Script and Vowel position of schwa.

Tomorrow, I 'll build my house",	
said the caterpillar.....	o word-medial: tomorrow (to)
And he built a small house, called cocoon,....	o word-medial: cocoon (co)
around himself.... He stayed inside for more than two weeks.	
Then he nibbled a hole in the cocoon,	o word-medial: cocoon (co)
then he pushed his way out and	
He was a beautiful	i word-medial: beautiful (ti)
Butterfly.....	e word-medial: butterfly (tter)

Resources for this instrument:

1. I pod version 5: Digital video files. (The Very Hungry Caterpillar story)
2. Story book: The Very Hungry Caterpillar

3.6. Reliability and Validity

3.6.1. Reliability

More than one observer analysed the level of pronunciation for the same group of teachers from the same educational context.

In case of the Phonetic analysis using the computer software, there were two evaluators, a native teacher and a Peruvian teacher; they helped to listen to and record the results to codify the vowels presented in the teachers' speech during the evaluation. On the other hand, they were also involved in the classroom observation in order to analyse teachers' pronunciation from the list of English words used including the classroom research. Hence, in both cases of data analysis, the two same observers were involved in order to increment the inter-observer-agreement.

The corpus of data is not too large; there is only a short list of words to be evaluated which is simpler to find an agreement. The phonetic program helps observers to find an agreement because it gives accurate and objective scores of the level of pronunciation.

Consequently, there are two kinds of phonetic evaluation that strongly support the reliability of the results, firstly an acoustic-

segmental level of research (through the computer software program) and secondly, a perceptual level of research through the analysis of classroom videos, that can be watched, repeated and paused several times before the validation of the score.

The results of these two evaluation processes have been calculated by the two same observers. This team resolution provides a degree of reliability under the basis of a combination of a quantitative and qualitative research.

Finally, the classroom action research has been developed under the same conditions, we used the same sample, all the sample is very homogenous in their characteristics, Peruvian teachers are learnt the English language in an early stage, they have more than 5 years of teaching experience in an ESL program, all the informants are females, all teachers native and non native teach in infants level and first years of elementary level and they work in the same educational institution. The unique difference is basically that only some teachers have training in pronunciation or phonetics and phonology.

3.6.2. Validity

The information needed to determine the quality of data collection procedures in this research project is organized as follows.

Internal Validity

Firstly the construct validity need to be verifiable, the construct is the schwa sound, the measurement procedures need to verify if teachers use the schwa sound in their pronunciation by recognizing the common errors presented in the use of schwa sound. There are specific characteristics that constitute the construction of a schwa sound. These characteristics can play as indicators of evaluation by the observers. See appendix 5: Observational Format that enlist for every word from a specific list of English words chosen (see appendix 1).

This observational process is developed under the information provided by a classroom video tape of a storytelling activity.

Secondly, the construct needs to be measured through various measurement procedures. In this research project, we use two ways of measurement: one of them is the classroom action research and the other one is the phonetic analysis based on Praat, which provides quantitative data through a sophisticated computer digital program designed by applied linguistics.

External Validity

Generalization is not crucial in the tradition of action research that is developed through the storytelling activity in the interaction between teachers and students, where the external validity is not a primary focus.

3.7. Interpretive analysis

The intention is to interpret the data through a qualitative investigation and a quantitative investigation.

The interpretation of the recorded data of the Classroom action research has been developed through an Ethnography study based on classroom settings through video tape data. This analysis allows a recorded and transcribed classroom data through an observational process.

In addition the interpretation from the Phonetic analysis was worked by using the Praat software program for a quantitative investigation. The results extracted from the measurements of the specific formants F1 and F2 from the vowels by Praat produced by each word from each informant were organized. Then the measurements of the specific formants F1 and F2 were plotting to analysis the position of the vowel sounds in EXCEL files, through the CHASIL program that provides all the IPA symbols (International Phonetic Alphabet). Thus, this phonetic process provides a category of low inference.

The interpretation of the data of this dual phonetic analysis was supported by two studies: The Phonetic segmental analysis and the Classroom action research.

3.8. Other Instruments for gathering data

In this topic we will be concerned with looking at the additional instruments used for this investigation.

3.8.1. Initial questionnaire

The first initial questionnaire has been developed in order to know the level of English background Peruvian teachers have. This diagnostic form recorded information about personal data and level of English including training in phonetics or phonology that would be useful to know the principal characteristics of every single member of the sample. See appendix 3: English Language Background Questionnaire for Bilingual Teachers.

In order to record this information the type of questions in this initial questionnaire were specifically about personal data: first language, place of born, date of birth and information about training in phonetics and phonology in order to know the principal characteristics of the teachers' sample.

CHAPTER 4

THE FINDINGS

The intention of this research lays on the investigation with reference to the common errors presented in the use of the schwa sound by Peruvian teachers of English.

The findings are shown in 2 ways: through a Computer Phonetic Analysis and a Classroom Action Research.

4.1. Phonetic analysis results based on Praat

The findings from the phonetic analysis based on Praat will be shown according to the formant measurements extracted for this analysis.

4.1.1. Formant value results

The formant values from each word in all its positions of the schwa sound can be found in appendix 8 Individual Formant values for each informant (Peruvian speaker) on each vowel position.

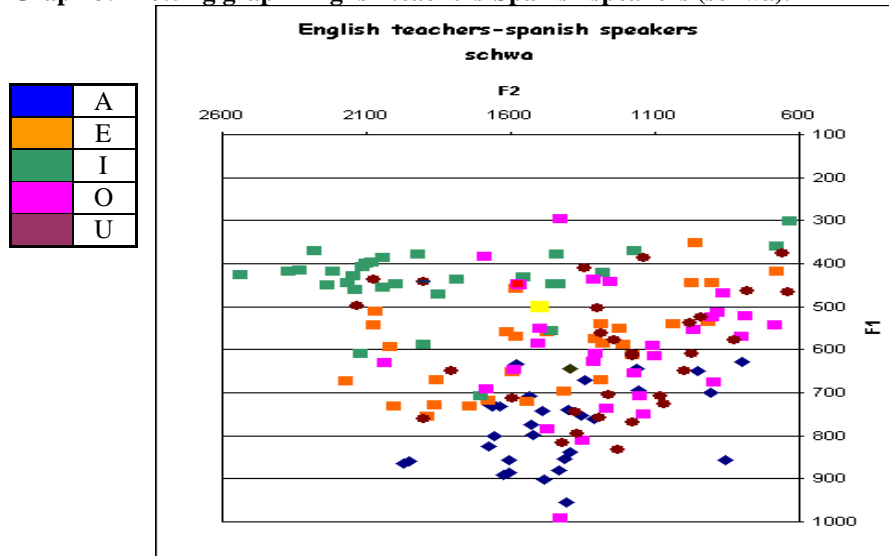
To have a general overview based on the individual results of each informant, the following chart below explains the summary of all the informants and their results extracted from Praat.

Table 3. Mean formant values of all the informants: Spanish Speakers as English teachers.

Mean formant value (HZ)								
Spanish Speakers as English Teachers								
Vowel		ISA	DIN	NAN	JAC	CYN	NAT	Formant Mean value (Hz)
A	F1	800	802	708	768	836	727	773
	F2	1457	1400	1231	1617	1529	1525	1459
E	F1	578	548	522	691	681	527	591
	F2	1390	1262	1582	1627	1552	1462	1479
I	F1	493	375	430	464	431	454	441
	F2	1626	1451	2121	1919	1809	2109	1839
O	F1	574	528	566	717	586	593	594
	F2	1280	985	1340	1389	1125	1419	1256
U	F1	528	563	654	567	659	674	607
	F2	941	1253	1110	1674	1346	1302	1271

Then the formant values for each vowel were plotted in the following graph by using 5 different colors to represent each vowel. These results were extracted automatically by an excel program.

Graph 3. Plotting graph English teachers-Spanish speakers (schwa).

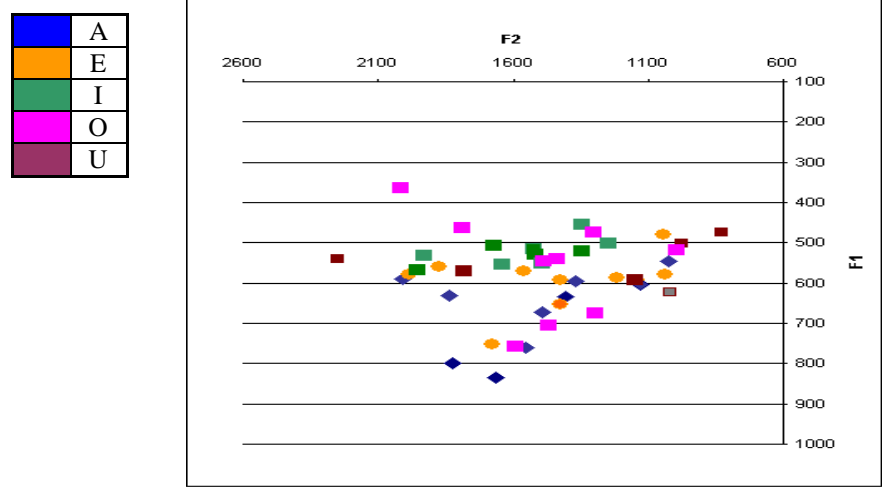


For the same purpose the information from native informants was organized in the following chart and its corresponding plotting vowel chart to measure F1 and F2 respectively.

Table 4. Mean Formant value (Hz) English native speakers as English teachers.

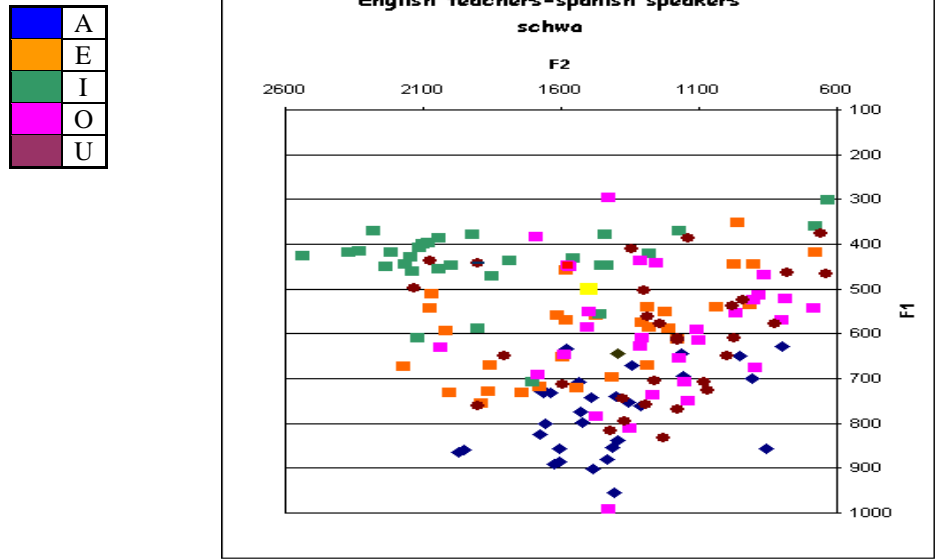
Mean formant value (HZ)				
ENGLISH NATIVE SPEAKERS AS ENGLISH TEACHERS				
Vowel		Native 1A	Native 1B	Mean value
A	F1	675	658	666
	F2	1402	1673	1537
E	F1	562	627	594
	F2	1256	1619	1437
I	F1	512	532	522
	F2	1501	1632	1566
O	F1	536	613	574
	F2	1573	1395	1484
U	F1	594	581	587
	F2	1219	1549	1384

Graph 4. Plotting graph English native speakers (schwas)

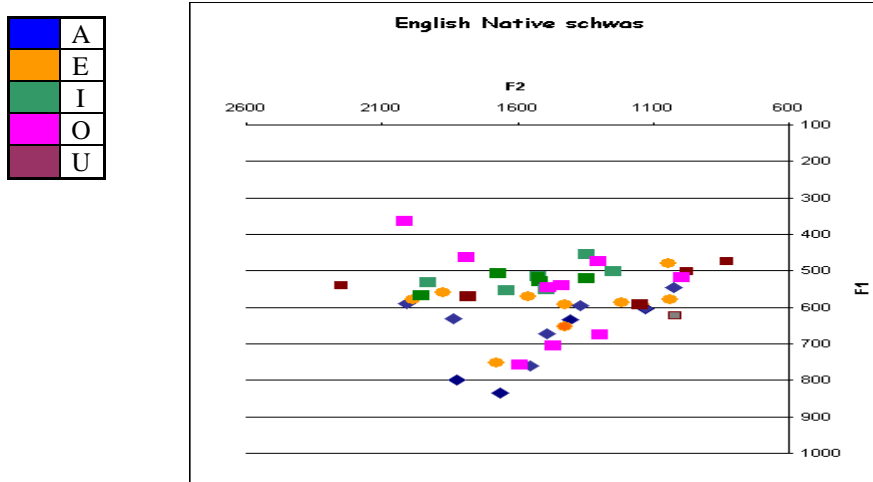


So we have two graphs below that represent the position of the vowel sounds from the list of all the 25 English words chosen. The formant measurements F1 and F2 taken from Praat were plotting for each vowel in the following graphs. A comparison between the plotting graph 1 and the plotting graph 2 are presented below.

Graph 5. Plotting graph English teachers-spanish speakers



Graph 6. Plotting graph English Native Schwas



The findings were based on the formant values from the list of words chosen for the evaluation, these words are organized by the all vowel positions in the production of the schwa sound:

- A (initial and medial position)
- E (medial position)
- I (medial position)
- O (initial and medial position)
- U (initial and medial position).

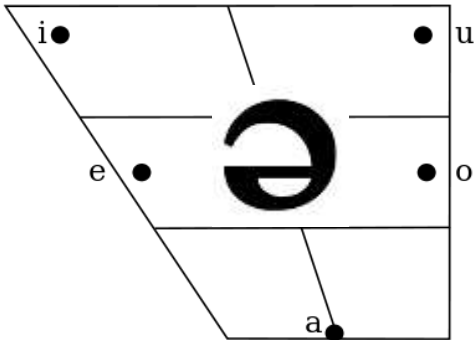
For this purpose, the contrastive analysis between English native teachers and Peruvian teachers explains the use of the schwa sound and sometimes its substitution by using the position of other Spanish vowels.

Theory explains that the English vowel /ə/, called, the schwa sound is a central short vowel. In quality, it is mid sound, halfway between close and open, and central vowel, halfway between front and back.

According to figure above, the position of Spanish vowels is spread all around. The schwa sound is a mid-central sound that is

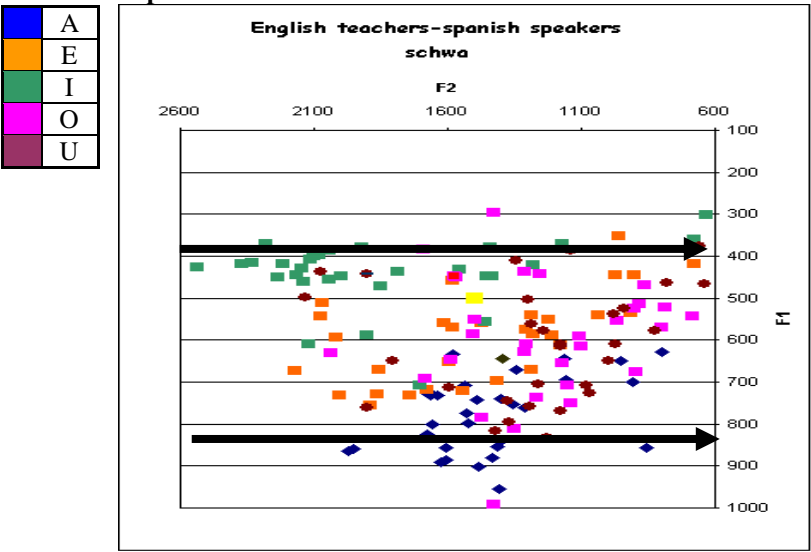
located more focused in the center of the articulator human speech. This information indicates the difference between Spanish vowel inventory and English vowel (schwa inventory).

The following figure 1: Phonetic position of Spanish vowels and the English schwa vowel is shown below.



The observation of the schwa distribution or representation of words that contain the schwa sound by Peruvian speakers and the schwa distribution of native English speakers is seen in these plotting graphs.

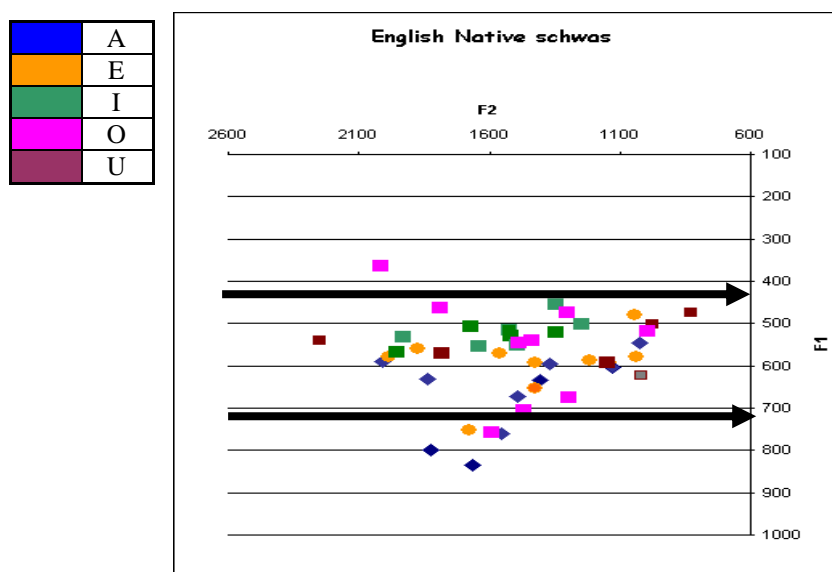
Graph 7. Plotting graph: Schwa distribution for English teachers-Spanish speakers.



Peruvian speakers are influenced by their L1 vowels, since their schwa distribution covers a wider area. In the case of American English speakers' schwa sound, it is obvious that schwa sound is stable for each of the 5 spellings.

The schwa distribution in native speakers represents the schwa area in the vocal track. This fact shows, in terms of formant values, the difference between Spanish vowel inventory and English vowel inventory.

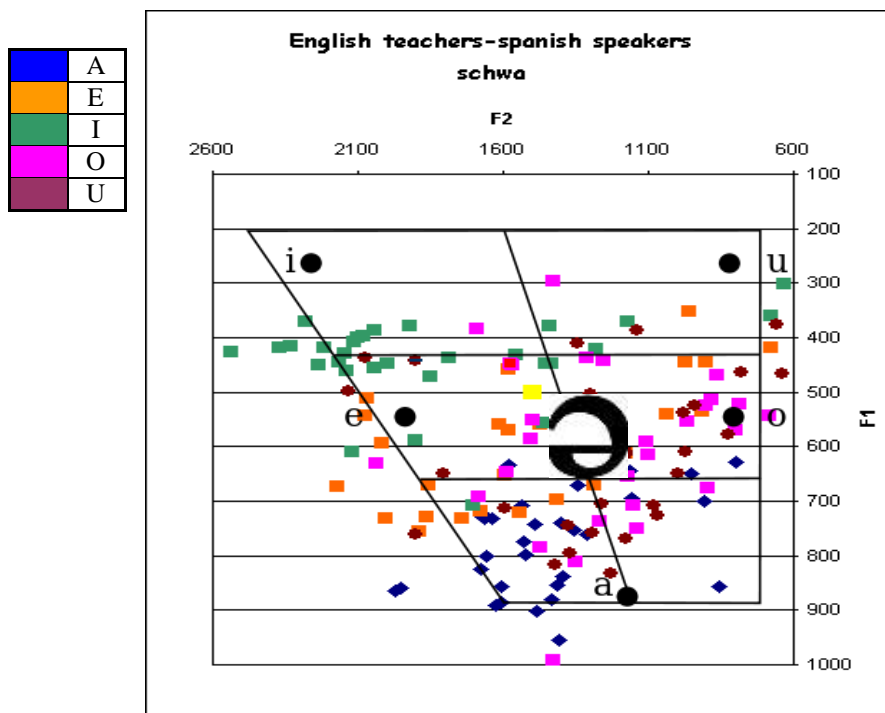
Graph 8. Plotting graph Schwa distribution for English schwas



We can appreciate in the graph below, the results from the Phonetic analysis the position of the Spanish vowels in the phonetic chart and we can notice the location in the pronunciation between English vowels and Peruvian-Spanish vowels (Peruvian vowels).

This representation helps to understand that even though Spanish speakers pronounce English words, the position in the vocal track tries to keep the areas according to the representations of the their L1. The L1 phonological system has a very strong influence.

Graph 9. Plotting graph Position of Spanish vowels and English schwa pronunciation by English teachers-Spanish speakers.



Furthermore another noticeable factor is that the position of **vowel u** that is spread all around and can be in the different quadrants in words such as upon, autumn. However we can appreciate that more substitution is observed in vowels **o** and **a**. as it is shown in the findings.

It is expected the pronunciation of the schwa sound as a central sound in the vocal track, the location of the Spanish vowels are still there as very stable and it is graphically seen since the Spanish vowels are found located in their corresponding colors according to the results.

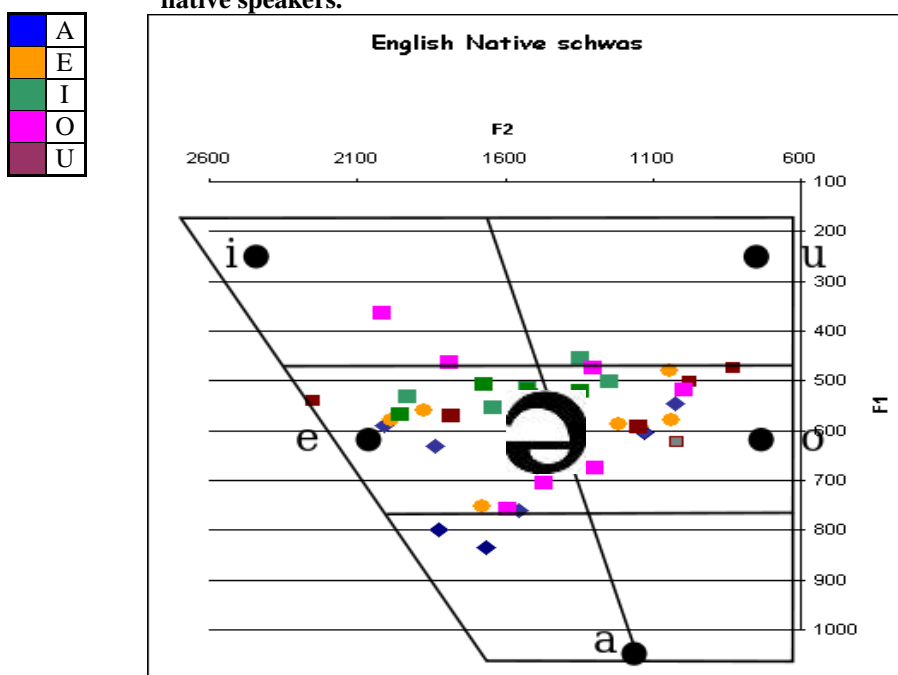
The L1 interference plays a substitution role in the production of the schwa sound and quiet interfere to have an accurate position

in the vocal track. The pronunciation is more focused on the position of the Spanish vowels more than in the central area.

Instead of being concentrated on the central quadrants, they are spread in all areas. Especially in the area of **vowel a**, at the bottom, we can appreciate the **vowel a** in its stronger influence.

Otherwise in the case of the English native schwa sounds the information founded from the native English teacher shows that the positions of the English vowels differ from the position of the colors for each vowel so mainly the distribution is more fully in the two central quadrants.

Graph 10. Plotting graph 6: Spanish vowels and English schwa by English native speakers.

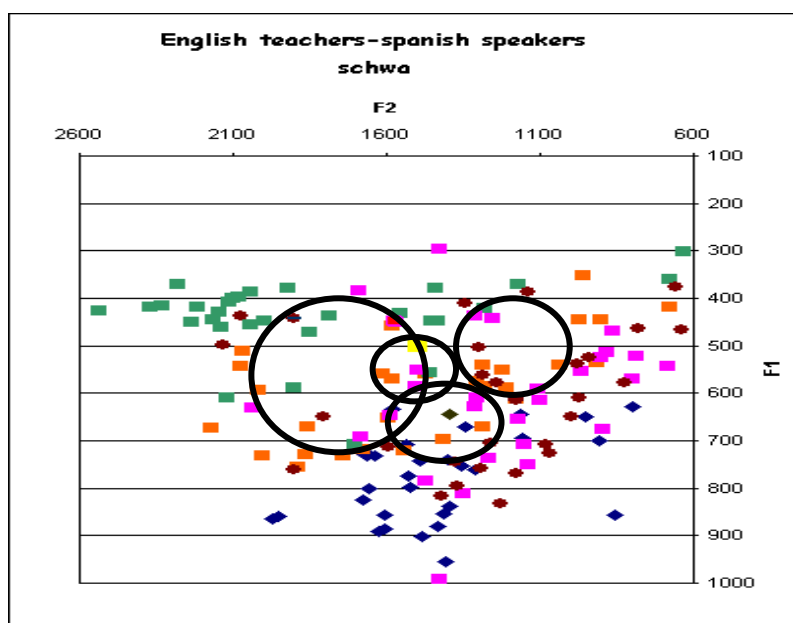


This is a realistic result due to English language has a different linguistic structure in terms of vowels even though the orthography variable, as a written form, can be confused for Spanish speakers to carry out possible substitutions as it is seen in the previous results for our informants Spanish speakers.

This is a very interesting finding that can give us an important approach from the effects of the Peruvian accent, which might also differ from other Spanish accents, and its L1 interference in which the most common use is for: a, e and o Spanish vowels (blue, orange and pink colors respectively). It means that written words in open vowels are harder to pronounce than close vowels such as: i and u. in many English words.

The IPA symbol on the center represents the schwa sound; we can also appreciate, in some parts, empty spaces around it, especially on the horizontal sides.

Graph 11. Plotting graph Area used by English teachers as Spanish speakers



In this case, it means that sometimes there is an empty area in the vocal track that is not used for some Peruvian teachers when they want to pronounce words that contain schwa sounds so they use other positions in the vocal track where they find similarities

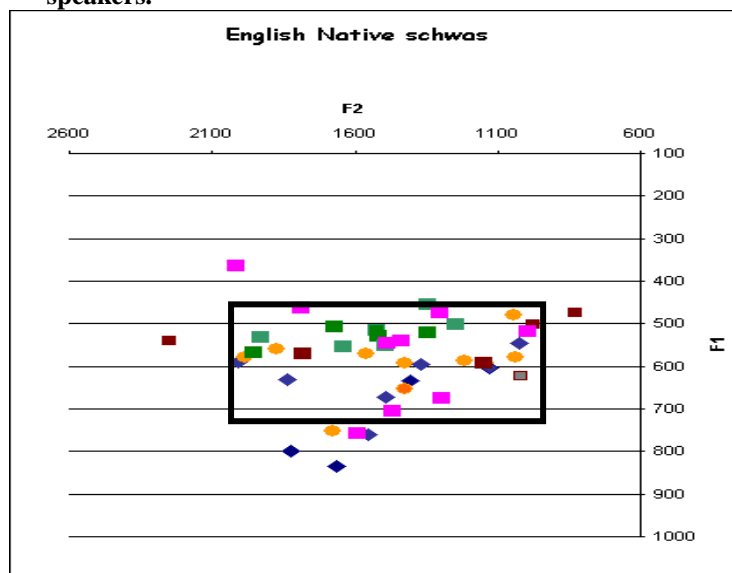
with they own Spanish language, it might happen the possibilities of more substitutions.

The presence of an empty area that is not used by Spanish speakers express in some way the absence of a mid central sound that provides an accurate tongue position when the schwa sound is expected. It also includes the mouth not too open and not too close, for having the sound **uh** (expected for a schwa sound).

At the same time, in the case of English native speakers, these horizontal sides are very concentrated when they pronounce some English words, which is the same area in which Spanish speakers have more empty spaces.

This observation might be shown that there is an empty area in the vocal track that Spanish speakers do not use and it is more commonly used for English teachers.

Graph 12. Plotting graph Area used by English teachers as English native speakers.



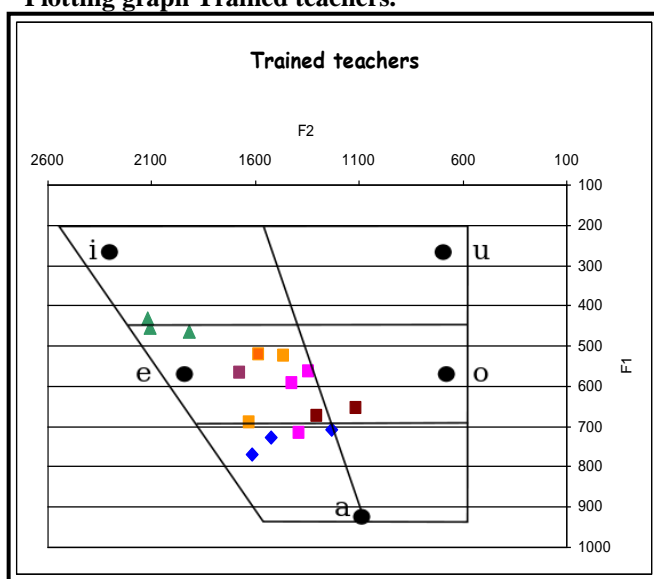
The following chart shows the results for trained teachers.

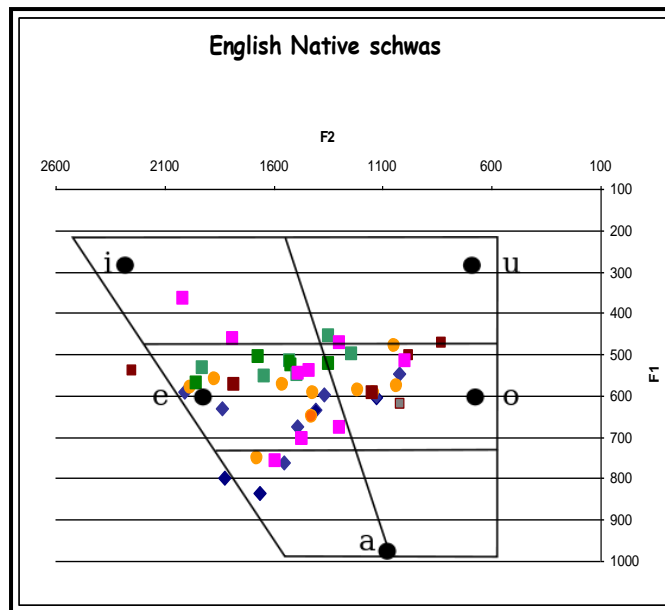
Table 5. Trained teachers- Mean formant value (Hz).

Trained teachers - Mean formant value (HZ)					
vowel	F	NAN	JAC	NAT	MEAN
A	F1	708	768	727	734
	F2	1231	1617	1525	1457
E	F1	522	691	527	580
	F2	1582	1627	1462	1557
I	F1	430	464	454	449
	F2	2121	1919	2109	2049
O	F1	566	717	593	625
	F2	1340	1389	1419	1382
U	F1	654	567	674	631
	F2	1110	1674	1302	1362

The formant values from the information on this chart can help to plot the measurements charts about trained teachers. In the following plotting graph 13: Trained teachers. Then this information can be compared with the English native speakers.

Graph 13. Plotting graph Trained teachers.





By extracting trained teachers' results, the mean values of all the words are shown to compare with native speakers results. The plotting formats that are mostly in the center position come from some of the trained teachers and are actually located in the mid central area. It is noticeable that they use more the **uh** sound to get the schwa sound since this is the way to get the central sound and thus helped them to produce a more accurate pronunciation in terms of schwa vowels in a general way.

Many of the words are located on the central area however words with **vowel i** are on the **vowel e** area and near to the **vowel i** position due to its L1 interference, as well as, words with **vowel u** are influenced in the **vowel a** area.

Besides trained teachers need to practice more in all the words that contain **vowel i** for the position of the schwa sound.

Native teacher use some few words with vowels a, o and e in the area of **vowel a**.

4.1.2. Articulator process results

As it was mentioned in Chapter 1 in regards of the formant values for the vowels, the formant with the lowest frequency is called F1 only when it is in contrast to the other formants, the second F2, the third F3 and so on.

The first formant F1 on its own higher frequency is when a vowel is more open such as **(a)**, **and** its lower frequency for a close vowel such as **(i)** and **(u)**.

The second formant F2 has a higher frequency for a front vowel (such as vowel **i**) and a lower frequency for a back vowel (such as **vowel u**).

Consequently, the higher values for F1 are when the tongue is more down and the mouth is more opened like the vowel **a** in Spanish. On the other hand, F2 has higher frequency when the tongue is in the front position, so as long as the vowel is before, the values of F2 are higher.

By analyzing measurements of the first and second formants, we can find some results from the charts: Mean formant values of L1 English teachers (English speakers as English teachers) and Mean formant values of L2 English teachers (Spanish speakers as English teachers).

From the summary of these 2 previous charts, the following chart makes the comparison.

Table 6. Schwa L2 and Schwa USA

Vowel		Schwa L2	Schwa USA
A	F1	773	666
	F2	1459	1537
E	F1	591	594
	F2	1479	1437
I	F1	441	522
	F2	1839	1566
O	F1	594	574
	F2	1256	1484
U	F1	607	587
	F2	1271	1384

In this chart, we can see that the higher values in F1 are in **(a)** vowel that differentiates from the rest of other vowel positions.

Consequently F1 has higher values than other vowels and in contrast to the values of F1 in native speakers.

In this sense, some Peruvian teachers tend to put the tongue more down than L1 speakers and their mouth is more open. In addition, they open the mouth wider; this impedes the production of a lax vowel sound. It occurs in words such as: *about*, *attractive*, *breakfast* and *salami*.

These findings explain why sometimes it is difficult to achieve the correct pronunciation in words that contain the schwa sound in the vowel **a**.

Another noticeable fact in both figures is that the values of F1 in **vowel i** are lower than native speakers. It reveals that the tongue position in L2 teachers is more down than the tongue position in L1 speakers. In this case L2 speakers have lower values than expected in contrast to native speakers even though the formant values for L1 speakers are expected to be lower as we can see in the following categorization of level of formants in L1 speakers.

In terms of native speakers these are the expectations:

- a) [i] has low F1 and high F2
- b) [a] has high F1 and low F2
- c) [u] has low F1 and low F2

In the case of words that have **u** written vowels such as *upon*, *but*, *beautiful*, *autumn* and *focus*, the pronunciation of the schwa sound is also difficult due to the levels of F1 are also higher than in L2 speakers. L2 teachers articulate the tongue more down again and their mouth is more open when they pronounce English words with this vowel.

In words that contain (o) vowels, such as *of*, *opinion*, *tomorrow*, *cocoon*, *evolution*, where there are no significant differences in F1 values, sometimes, Peruvian teachers tend to get the tongue a little bit more down and they open the mouth more than native teachers.

4.1.3. Trained teachers results

We are going to analyze each vowel considering those teachers to have training in phonetics and phonology or pronunciation in contrast to native speakers.

In the case of trained teachers the following chart shows that the results of the values for **vowel a** and **vowel i** are on average level between L2 teachers and native teachers in F1 and F2 in a general way.

Table 7. Contrastive results: L2 schwas-trained teachers and schwa-Native teachers.

Vowel	Formant values	L2 schwa	Trained Teachers schwa	Native teachers schwa
A	F1	773	734	666
	F2	1459	1457	1537
E	F1	591	580	594
	F2	1479	1557	1437
I	F1	441	449	522
	F2	1839	2049	1566
O	F1	594	625	574
	F2	1256	1382	1484
U	F1	607	631	587
	F2	1271	1362	1384

Vowel a

Even though the results of trained teachers are closer to the results of native teachers, they still tend to open the mouth and the tongue is still down. The values of F2 show us that trained teachers and also L2 teachers tend to put the tongue more at the back than native speakers when they pronounce words with **vowel a**.

Vowel e

As we have seen before the values of F1 are quite similar from non native speakers and native speakers in the position of the mouth and tongue when they pronounced words that contain the **vowel e**, however the values of trained teachers are slightly lower than the others. It means that they closed a little bit more the mouth than it is expected, this might be a consequence that they are consciously about the central sound to get the schwa sound and try not to open the mouth too much.

The F2 values show that trained teachers tend to put the tongue more to the front as long as the vowel is before.

Vowel i

F1 values are lower, trained teachers tend to close the mouth more when they pronounce words with **vowel i**, the same occurs in their Spanish mother tongue so they pronounce words that contain the schwa sound (**vowel i**) in the same way they pronounce Spanish **vowel i**.

F2 values are higher, it means that they put more the tongue in the front position the same happens when Spanish speakers produce the **vowel i**.

Vowel o

Trained teachers tend to open the mouth more in the same way as an open Spanish **vowel o**. However the results of F2 are better than the results of non trained teachers due to they pronounce words with **vowel o** in a more front position, contrary with non trained teachers they put the tongue at the back that is usually pronounced in the Spanish language.

Vowel u

F1 values are higher, trained teachers open more the mouth and the tongue is more down, the same that happens in Spanish words that contain vowels such as **a** and **e**, probably because the schwa sound has similar sounds in words like *upon*, *autumn*, and so on. They might be using **vowel a** to substitute the schwa sound **u**.

F2 values are slightly lower but with no significant differences. The lower F2 values represent that the tongue is in a more back position than the position expected for schwa sound in words that contain the written **vowel u**, this situation occurs necessarily when Spanish speakers have to make the Spanish **vowel u** which shows the influence of the first language.

4.1.4. Time duration results

To analyze the level of vowel reduction it was necessary to investigate the length of time duration during the production of the schwa vowel for each vowel in all positions.

As it was mentioned before, the schwa sound is mostly related to weak syllables, that is; syllables in which the vowels have undertaken a reduction process. On the other hand, it has been seen that all the five Spanish vowels have quite the same duration. It seems that the duration of Spanish vowels are tending to be longer than English vowels.

Consequently, unlike English, Spanish does not have reduced vowels; the time duration when the English vowels are pronounced by L2 speakers might determine the quality of the production of the schwa sound. (See appendix 9: Time duration results for all Peruvian speakers and native speakers).

According to the chart, the findings in terms of time duration results to evaluate in which way the reduction process is introduced when L2 speakers produce the English vowels are variable. However, we can really appreciate that the range values in milliseconds by native speakers can be aligned with the Peruvian teachers in few cases of highlighted values.

There is no significant difference between trained and non trained teachers in the results. In a general way the mean value of the total of words that correspond to the range of native speaker are 7 words with no significant difference between trained and non-trained teachers. By considering the two characteristics of the schwa sound as a lax vowel and in its time duration, the variable in training of phonetics and phonology is not relevant to have a more accurate performance.

Hence in very few cases (6, 7, 8 words) corresponds to the range values native speakers have for each kind of vowel (a, e, i, o, u) that is shown in the highlighted values. In many other cases have a longer duration which means that they are not applying the rule of vowel *reduction* process due to probably the L1 interference.

Furthermore in other cases, Spanish speakers produce the vowel with a very shorter length than native speakers, this might be because they probably are using new categories to replicate the sound but they are not conscious in which really way must be, thus do not represent an accurate length as native speakers have.

As Fleming points there are variables, in terms of the schwa sounds, that assimilate to the context, resulting in substantial contextual variation in vowel quality by native speakers. Learners of English need by learning discriminate when it is appropriate to produce a schwa sound and when it is not, that normally occurs in native speakers by acquisition. “The schwa sound is a vowel that lacks a well-defined target, and so assimilates strongly to surrounding segments, resulting in substantial variation in quality”¹⁰⁸

Even though there are important reasons to justify these heterogeneous and variable results, Roach (2009) explains that is necessary a clear understanding on what really happens in terms of time duration in the production of the schwa sound in non-native speakers.

The need to categorize in some way the length of vowels to get an accurate production in pronunciation might be an important future research to support the English learning as a target language.

4.2. Classroom action research results

According to the observational format, the levels of pronunciation in the use of the schwa sound are shown in the following chart that shows the results extracted from the data provided by the following 5 indicators to evaluate the production of the schwa sound during the storytelling activity and evaluated by two English native teachers by hearing individual assessment.

¹⁰⁸ FLEMING EDWARDS, (2007, October 12th): The Phonetics of schwa. On line May 7th. Retrieved from <http://web.mit.edu/flemming/www/paper/schwaphonetics.pdf>

Each indicator has its own criterion which was considered based on the theoretical validation of a schwa sound.

Indicators	Validation- Criteria
1. It is said faster	Vowel reduction (time duration)
2. Lower volume than stressed syllables	Unstressed
3. The vowel sounds lose their purity	Lax vowel
4. Stressed syllables maintain the full vowel sound	Contrast (the vowel sound in the whole word)
5. Vowel sound used a – e – i – o – u – uh	Substitution (L1 interference) or schwa

Informants should get a total of 5 points only to produce the expected schwa vowel sound for the words provided.

The results were: YES (vowel position sounds like a schwa sound) or NO (vowel position does not sound like a schwa sound) and the chart that provides this information is presented in appendix 10: Results of Storytelling activity.

The NO answers are highlighted and also include the cases when there are substitutions with the Spanish vowels listened by the evaluators instead of the schwa vowel expected.

For this reason, the 2 evaluators were one non-native and one native speaker.

4.2.1. Trained teachers and non trained teachers results

The chart above shows that, the following informants who do not have training in phonetics and phonology: DIN, ISA and CYN have the lowest total score.

On the other hand, in the chart below, we can see that the higher score is for the following teachers (NAT, NAN, and JAC) who have previous training in phonetics and phonology. However the difference between trained and non trained teachers is not significant in a general way.

According to this information, the rate of attainment for each vowel position in Non-trained and trained teachers is shown in the following chart.

Table 8. Chart 6: Rate of attainment - Non trained teachers and trained teachers.

Vowel	Total of totems 100%	Non-trained teachers Rate of attainment		Trained teachers Rate of attainment		Total of substitutions
A	30	5	16%	12	40%	a (11)
E	12	2	16%	4	33%	e (1)
I	6	2	33%	2	33%	i (1)
O	18	4	22%	8	44%	o (2)
U	18	5	27%	7	38%	a (2)

In a general way trained teachers show a higher rate of attainment in all vowel positions, exceptionally for the **vowel i**. Besides when we analyze the case of each vowel position the rate of attainment is higher especially in words with the written **vowel a** and the written **vowel o** between trained teachers and non-trained teachers.

Now a more specific explanation from each vowel position according to vowel word position and the indicators will be presented as follows.

4.2.2. Vowel word position results

The following information explains the results for each vowel word position for English words that contain the schwa sound.

Vowel a

From a total of 5 words, trained teachers only presented one error in this vowel position. These informants have training in

phonetics and phonology and are reflected on a significant variation in their productions.

Besides, we can appreciate that there are substitutions in most of the words, they tend to produce in words such as *breakfast*, *about*, *salami* and this substitution is the **vowel a** in Spanish. This is the most common mistake they have and will not appear in the same way with the other vowel word positions.

Vowel e

There was only one informant who has a total score in this vowel position and also she has previous training.

Vowel i

Four teachers got the score, from the trained teachers, two of them have a total of score but one has a clear substitution in **vowel i**.

Vowel o

From the sample, three teachers had the total score, only one of them has no training the other 2 informants have training, and the other trained teacher got only one word wrong.

Vowel u

All the informants presented errors at least in one word except for one trained teacher. For these words that have **vowel u**, the perception was that the vowel position is listened as a **vowel a** in Spanish instead of a schwa sound.

It means that training helps to avoid more common errors in contrast to those teachers who are not trained, For example, a common substitution using the Spanish vowel a in some words as: breakfast.

CHAPTER 5

DISCUSSION OF RESULTS

The English vowel /ə/, called, schwa sound has important characteristics as a neutral vowel since it is mid, halfway between close and open, a central short vowel and halfway between front and back. It was mentioned before; the schwa sound is mostly related to weak syllables, that is; syllables in which the vowels have undertaken a reduction process.

On the other hand, Spanish vowels are very stable, they have quite the same variation and are very clear: a, e, i, o, u, so they are called strong vowels by other speakers. This is an important fact in the composition of the Spanish words and phrases. Hence, the Spanish vowel inventory has an important influence in the Spanish speakers when they learn a second language.

This great linguistic and phonetic differentiation on both languages, with reference to the vowel inventories, makes a complicated and hard development in the production of an accurate English pronunciation by Spanish speakers. For that reason, the discussion pertaining to the training experience in phonetics and phonology some teachers have, might be a support to improve the English pronunciation as a target language and face up the influence of L1 interference with more successful results that will be also discussed under the findings that this research shows us.

5.1. L1 interference and the production of the schwa sound

The linguistic structure of some Spanish vowels might be influenced in the production of some English vowels. The stronger vowels such as **a**, **e**, and **o** that are considered open vowels, are more difficult to pronounce accurate when they appear in some English words and with more difficulty in **a** vowel since Peruvian speakers tends to open the mouth more when they find English words that contain a vowel in words probably unconsciously.

The tendency to open the mouth more impedes the production of the schwa sound in English words that contain specially the **vowel a** by Spanish speakers. Besides, this increases the tendency to get the tongue more down which make it also more difficult to produce the schwa sound.

Thus, the more common errors are in written words that contain Spanish open vowels, especially in the Spanish **vowel a** in initial and medial position probably since this is one of our strongest vowels in Spanish language and Peruvian accent emphasizes.

In the case of words that contain **vowels i** and **u**, during the evaluation, Peruvian teachers tend to get the tongue more down and again emphasize the sound more than they should do in English words.

One of the important findings is shown especially in the results by Phonetic segmental analysis in which some Peruvian speakers are strongly related by their L1 vowels, since their schwa distribution covers a wider area. As for the American English speakers' schwa sound, it is obvious that schwa sound is stable for each of the 5 spellings.

Peruvian teachers use many of their native vowels. **a**, **e**, **i**, **o** and **u** in order to substitute the schwa sound. It is clear that in some cases, they do not recognize the mid central sound (schwa sound: uh) so they use the position of their vowels in order to find a near sounding space in their vocal tracks. For instance: *apon*, instead of saying *upon*. (the substitution is Spanish **vowel a** instead of **schwa vowel u**).

Another important characteristic L2 speakers deal with is the schwa sound as a lax vowel. According to the results, when some Spanish

speakers produce vowels, the schwa sound in some cases has a very shorter length than native speakers. Regarding this fact, they probably are using new categories to replicate the sound but they are not conscious in which really way should be. At the same time, this does not represent an accurate length as native speakers have. It may depend on the situation and/or context that Spanish speakers are exposed to and probably they are not able to handle it.

As it was mentioned before by Fleming and Johnson, English learners need to learn when it is appropriate to produce a schwa sound and when it is not. This important characteristic occurs progressively without any rule in native speakers but would be more difficult for those English speakers as a second language.

5.2. Trained teachers and non trained teachers in pronunciation

The difference between the results of non-trained teachers and trained teachers in phonetics and phonology shows a significant success in trained teachers in the production of the schwa sound being remarkable in both areas of research: Computer Phonetic Analysis and Classroom Action Research.

The training in phonetics and phonology helps teachers to locate their vocal track position in a more central area than non-trained teachers, probably they are aware of the neutral vowel sound in some words and consequently they understand more that there is a central sound that is located on the vocal track by knowledge and some practice.

However in trained teachers and non-trained teachers there is still a presence of an empty area (that is not used by Spanish speakers) especially in the central area. This empty area shows in some way the absence of a mid central sound that might provide a more accurate tongue position when the schwa sound is pronounced. This fact includes the mouth not too open and not too close, for having the sound *uh* (schwa sound).

Thus, trained teachers make their pronunciation a little bit more accurate. This observation is based on the results provided by the phonetic analysis by Praat.

The following table shows a general overview from the two perspectives this research presents.

Table 9. Overview of two perspectives: Phonetic analysis and classroom action research

Trained teachers	Phonetic analyses -Praat	Classroom action research	Observations
Vowel a	<p>They still tend to open the mouth and the tongue is still down that the measurement expected,</p> <p>Trained teachers and also L2 teachers tend to put the tongue more at the back than native speakers when they pronounce words with a.</p>	<p>From a total of 5 words, trained teachers only presented one error in this vowel position.</p> <p>For the rest of the sample there are many errors and substitutions in most of the words, they tend to produce words such as <i>breakfast</i>, <i>about</i>, <i>salami</i> and this substitution is the Spanish vowel a in Spanish.</p>	<p>Training in phonetics and phonology helps in some way.</p> <p>This is the most common mistake they have for vowel a in contrast to the other vowel positions of schwa sounds in terms of articulator process. Hence the variable of phonetics and phonology is not relevant for this case.</p>
Vowel e	<p>Formant values are quiet similar from L2 speakers and native speakers in the position of the mouth and tongue, however they closed a little bit more the mouth than it is expected, this might be a consequence that they are consciously trained about the central sound to get the schwa sound and try not to open the mouth too much.</p> <p>Trained teachers tend to put the tongue more to the front as long as the vowel is before.</p>	<p>There was only one informant who has a total score in this vowel position and also she has had previous training.</p>	<p>Trained teachers in phonetics and phonology tend to create new categories when it is hard to pronounce the schwa sound in words with the written vowel e.</p> <p>These new categories create more mistakes at the same time.</p> <p>A more profound analysis is needed to be developed in this vowel in the training courses.</p>
Vowel i	<p>Trained teachers tend to close more the mouth more, the same occurs in their Spanish mother tongue. So they pronounce schwa sounds in words with vowel i in the same way they</p>	<p>Four teachers got the total score. From all the trained teachers, two of them have a total score but one has a clear substitution in</p>	<p>L1 interference : Substitution in vowel i</p> <p>In trained teachers the position of the mouth is better than the position of the tongue when they pronounce words</p>

	<p>pronounce Spanish vowel i. However the results are better than the other teachers.</p> <p>They put more the tongue in the front position the same happens when Spanish speakers produce the vowel i.</p>	Spanish vowel i .	with this vowel.
Vowel o	<p>Trained teacher tend to open more the mouth in the same way that happens when they pronounce Spanish vowels.</p> <p>Besides they pronounce words with vowel o in a more front position, contrary with non-trained teachers that put the tongue at the back that is usually pronounced in the Spanish language.</p>	From the sample, three teachers had the total score, only one of them has no training the other two informants have training, and the other trained teacher got only one word wrong.	<p>L1 interference: Substitution in vowel o.</p> <p>In articulator terms, trained teachers had fewer score than the other teachers. However In an ongoing speech process trained teachers had better results than the other teachers.</p>
Vowel u	<p>Trained teachers tend to open the mouth more and the tongue is more down than native speakers, the same that happens in Spanish words that contain vowels such as a and e, probably because English schwa sounds have for Spanish speakers similar sounds in words such as <i>upon</i>, <i>autumn</i>, and so on, They might be using vowel a to substitute the schwa vowel u.</p> <p>The tongue is in a more back position that is expected for Spanish u vowels, that shows the L1 interference again.</p>	All the informants presented errors at least in one word except for one trained teacher. For these words that have vowel u , the perception was that the vowel position is listened as the vowel a in Spanish instead of a schwa sound.	<p>L1 interference: A common substitution in vowel a</p> <p>Since the vowel a is an open Spanish vowel, there are errors in the production, many errors could be found in terms of articulator process even in words with vowel u since its substitution is in vowel a.</p> <p>Hence, it has been found many errors even in trained teachers.</p>

In this table, we can see that some training in phonetics and phonology or pronunciation might help in the production of schwa sounds however it is not really significant when we analyze each vowel position.

This observation might be based on the way trained courses are designed and whether are deeply focused on the important features phonetic English schwa sounds contain that means an understanding in speech recognition and practice speaking.

Another important characteristic to evaluate the schwa sound is as a lax vowel. The findings in terms of *Time duration results* to evaluate in which way the reduction process is introduced when L2 speakers produce the English vowels are variable. However we can really appreciate that the range values in milliseconds by native speakers can be aligned with the Peruvian teachers in few cases.

In a general way, there is no a relevant difference between trained teachers and non trained teachers in the results. In terms of time duration, when we consider the *schwa* as a lax vowel, trained teachers do not present important results that show a better accurate performance.

CONCLUSIONS

After the study of the present investigation, we arrived at the following conclusions:

1. The results taken from the present Dual phonetic analysis in both dimensions : Phonetic analysis based on Praat and Classroom action research confirm once again the strong influence of the L1 phonological system in the use of the target language. Teachers tend to use their Spanish vowels instead of English schwa sounds supported by the influence of the written forms (a, e, i, o, u) in many English words or by adjusting the sounding way more close to the Spanish vowel inventory. The pronunciation patterns of their L1 (Peruvian accent) get transferred to their L2 (English) so as the more remarkable case is that these L2 speakers tend to use their Spanish **vowel a** in words that contain schwa sounds when its written form is the letter **a** in many cases.
2. From the results obtained in this Dual Phonetic analysis with reference to the most common errors in the production of the schwa sound, the difficulty is based on words that contain the Spanish open vowels a, e, o in written form. Specially the pronunciation of English words that contain: /a/ and /e/. Furthermore, to be more specific, the more dramatic results are especially in the production of words that contain **vowel a** as a written form in Spanish due to this vowel is a very strong and open vowel. This situation turns even more complicated by considering that the possibilities to find schwa

sounds in words that contain **vowel an** in written form are more than many in the English language.

3. An error chain process in the production of the written form in the **vowel a** is found. This situation is generated in the production of written words with **vowel u** due to the pronunciation is heard by Spanish speakers as **vowel a**. Once this substitution appears all the mistakes generated for **vowel a** might also appear in words with **vowel u** for the same reason. Thus, if we emphasize training courses in this important error, we can start on words with written **vowel a** to focus pronunciation courses into a more effective training programs. There are many words that contain **vowel a** in English and also have some similarities with the vowel sound in Spanish like written form **u**. For example: apon-upon
4. A strong factor in pronunciation courses would be based on the fact that English words that contain schwa sounds in **vowel a**, are many in the English vowel inventory, and there is a high frequency of incidence in words with this letter so as long as we start working on this phoneme specifically, the opportunities to improve the pronunciation to deal with these errors may be of great evidence in the normal speech.
5. The schwa sound is a “weak” vowel that English speakers pronounce with a relaxed tongue position in natural speech. The schwa sound is also described by Roach (2009) as a lax vowel; that is, not articulated with much energy. On the other side, some Peruvian subjects show a wider schwa distribution in their vocal tracks than the English speakers when they pronounce the schwa sound which indicates that Peruvian speakers have larger lingual movements and they might consume a lot of more energy than L1 speakers when speaking English.
6. Since the Spanish language covers a wider area in their vocal track than the English language, it might be justified by the fact that sometimes when they speak some English vowels there is an empty area in the central part of the vocal track that is not used for some Peruvian teachers, including trained teachers in some cases when they pronounce words with the schwa sound. When some Peruvian teachers are not able to find the vocal position they use another vocal

position in order to get a similar sound. This situation impedes the production of the schwa sound and sometimes promotes the tendency to maintain this modification by using Spanish vowel sounds. The use of other areas or positions in the vocal track was also found in trained teachers and non trained teachers.

7. In articulator terms, when Peruvian teachers pronounce words that contain English schwa sounds, tend to put the tongue more down than L1 speakers and their mouth is more open when they pronounce English vowels. In addition they open the mouth wider; this impedes the production of a lax vowel (schwa sound) especially in words that contains written Spanish vowels such as **a**, **o** and **u**. This phenomenon occurs because these are the positions that happen spontaneously in their L1 language. English teachers need to be aware of these tendencies in their articulator movements inside their vocal track to understand the reason why they occur and in what situations they might be happen. Doing this, teachers can handle their common errors in the use of words that contain schwa sounds and practice by themselves.
8. There are no significant differences between trained teachers' results and non trained teachers' results in a general way. Trained teachers and non trained teachers need help. This can probably explain that pronunciation or training courses could offer more practice in the recognition and speech of words that contain *schwa* vowels. For dealing this situation, training courses might consider the most common errors in the production of the schwa sound to explain which weak areas are needed to direct the training courses in more effective programs for teachers.

Even though there are important reasons in the present investigation to justify the heterogeneous and variable results in terms of time duration, another important weakness is the L1 interference in L2 speakers to have a clear understanding on what really happens in terms of time duration in the production of the schwa sound. These findings, at the same time, make us to investigate more deeply about this important feature. Thus, the need to categorize in some way the length of vowels to get an accurate production in pronunciation might be an important future investigation to support the English learning as a target language.

RECOMMENDATIONS

The schwa sound is the most frequent unit sound in the English language in the speech process. Trainings in phonetics and phonology can be a very important opportunity to improve the English pronunciation if the courses are focused more deeply on the most important features of the English sounds.

Pronunciation training can be more focused on the production of the most common sound in English: The schwa sound. According to this investigation, from the theoretical framework towards the application of the Dual dimensional phonetic analysis is highly recommended to learn the knowledge in regards of the English schwa sound and its foundation to be focused in pronunciation courses on the following areas:

- **Sequence of training:** We can start in words that contain the Spanish open vowels such as **a, e, o** since they present more common errors in words that contain the schwa sound and they are more frequent in English words specially in words with **a**.
- **The reduction process:** The schwa sound is a neutral vowel and a lax vowel; it does not need too much energy in contrast to Spanish vowels. The vowel must be said faster than a Spanish vowel (especially in open Spanish vowels). Practice the rule of lax vowels by listening to exercises, listening to native speakers and listening to themselves.

- **Schwa sound as a mid central sound:** By practicing exercises that contain different schwa sounds in words. The speech recognition of mid central sounds in the vocal track is very important to get the mid central sound (the mouth and the tongue position expected) in different vowel positions. Consider the position of the mouth not too open and the height of the tongue.
- **Schwa sound in context:** There are certain situations, very common in spontaneous speech that sometimes demands the schwa sound even if the rule is not expected, especially in some prepositions. Native speakers are awarded of this naturally. For L2 speakers the examples of these situations are important to know and understand.
- **Two Vowel Inventories:** Teachers need to know and understand the structure of both vowel inventories: English language and Spanish language. The theoretical knowledge about the influence of L1 interference can help their students to understand their own language and move forward to the English phonetic system.
- **Phonetic vs. written discrimination:** The L1 phonological influence plays an important role in the substitution of written forms of a, e, i, o, u since they are the same in English as well as in Spanish. It is very important to present a clear discrimination in regards of what is the written form and what is the segment of sound expected to perform the schwa vowel. Practice written exercises would be useful for this purpose. The IPA symbols also can be included to make associations between the phoneme and the sound expected.
- **Schwa categorization:** By developing a list in which words the schwa sounds are commonly presented. Not all the vowel positions have a schwa sound. Trained teachers need to know where mostly the schwas are in the English language and they also need to organize a categorization about this.
- **Perception of schwa:** By practicing in which words and vowel positions schwa sounds appear by auditory recognition. This is another way to practice by hearing recognition since might avoid substitution process in the written forms. Students will be more focus

on the sound and will try to imitate what they listen and identify the sound in a more spontaneous way. The IPA symbols can be included as visual support.

These suggestions should be considered in pronunciation training courses in order to improve the performance of the schwa sound in teachers of English as second language. These recommendations were strictly based on the final results and conclusions of the present investigation.

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APPENDICES

Appendix 1: List of English words chosen

Symbol Position Stimuli	Storytelling activity	Acoustic analyze	IPA symbols	Consonants
ə				
a word-initial	about	About	ə'baʊt	f,w,s,p,l
		Attractive	ə'træktɪv	
	a		ə	
a word-medial	breakfast(fa)	breakfast(fa)	'brɛkfəst	f,w,s,p,l
	Was	Was	Wəz	
	salami (sa)	Salami (sa)	sə'lami	
e word-medial	* Butterfly (ter)		'bʌtər,flaɪ	s,b,t,v,l,
	* cover (ver)		'kʌvər	
		Absent (se)	/'æb·sənt/	
		Item (te)	/'aɪ·təm/	
		Problem (ble)	/'prɒb·ləm/	
		Heaven (ve),	'hevən	
		Telephone (le)	'telə,foʊn	
i word-medial	beautiful(ti),	beautiful(ti),	'byʊtəfəl schwa 1 st	t,f,r,s,
		definite (fi),	'defənɪt	
		Experiment (ri)	ek'sperə,ment	
		Possible (si)	'pɒsəbəl schwa 1 st	
		Festival (ti)	/'fes·tə·vəl/ schwa 1 st	
o word – initial	of	of	əv	t,c,l,v,p,
		Opinion	ə'pɪnyən	
o word-medial	tomorrow (to)	tomorrow (to)	Tə'mɒroʊ	
	cocoon (co)	Cocoon (co)	kə'kʊn	b,f,t,c,
		evolution(vo),	ˌevə'lʊʃən	
u word-initial	upon	upon	ə'pɒn , ə'pɒn	
u word-medial	But	but (bu)	Bət , bʌt	b,f,t,c,
	beautiful(ful)	beautiful(ful),	'byʊtəfəl 2 nd schwa	
		Autumn(tu)	'ɒtəm	
		focus(cu)	'fəʊkəs	
Number	14	25	39	

Note: *Words that are not included for the collecting data through the Praat software have schwa and r sound due to they might not respond objectively through an acoustic computer analysis. Ex. Butterfly, cover. Number of consonants:

L 3, b 2, f 3, p 2, s 2, v 2, r 1, w 1, t 4, c 2

Appendix 2: Consent Form (sample)

Title of Research Project:

A phonetic analysis in language teachers can determine weaknesses and strengths in teaching English as a SL

Name of Researcher: Veronica Claudia Proaño Ocampo, Id 10317436

Degree Programme: MA of Teaching English as a Foreign Language:
Department of Education. Universidad de Piura

Aim of the project

This research is intended to find out how Peruvian speakers of English as a second language perceive and produce the English vowel schwa /ə/ in reduced syllables in respect to English native speakers.

What will you be asked to do

As Spanish speaker informant, you will be asked to produce and record a number of data sets consisting of English words (inserted in a given sentence). If you are native English speaker, you will be asked to produce and record a list of selected words in your native language (also inserted in a given sentence).

How the data collected will be used

The speech samples obtained during the audio recordings will be analyzed both auditory and acoustically. The aim of the analysis is to define the quality of the vowels that concern to this research. The results obtained after the analysis of all data will help to answer the relationship between the L1 and L2 through a contrastive analyze.

As a responsible researcher, Veronica Claudia Proaño Ocampo, will keep all personal information that you might reveal completely confidential and though I quote, describe and analyze the data, all data will be presented with complete anonymity. Additionally I will immediately withdraw your data if you should decide to withdraw from the project at any time with no need for explanation.

To be completed by the participant

I, _____, agree to participate in the above research project. I have carefully read the above description of the project and understand that I am free to withdraw from the project at any time without giving explanation.

Signature: _____

Date: May, 2013.

Appendix 3: English Language Background Questionnaire for Bilingual Teachers

DATE: _____

PARTICIPANT CODE: _____

1. Is your hearing normal? Yes _____ No _____
2. What is your first language? Spanish _____ English _____
3. Where were you born? Country _____ City _____
4. is your date of birth? _____/_____/_____
Age: Month day year
5. When did you start taking English classes?
____At nursery school ____At primary school ____At secondary school
____At university ____At a private language school ____Any others?
6. Did you take any course related to phonology and phonetics in the English language?
No _____ Yes _____ (specify)
9. How important is it for you to improve your pronunciation?

Not Very												Very
Important												important
	1	2	3	4	5	6	7	8	9	10		

Appendix 4: Steps for a Storytelling Activity

1. Use a natural and relaxed manner and an expressive tone of voice. Hold the attention of the kids with your voice. Speed up, slow down. Lower your voice or raise it. Express delight and surprise. Create suspense.
2. Make eye contact with each person or scan the audience. With children, remember to sit on their level.
3. Make a prediction about the story. Open the book.
4. Grab the listener's attention with the first sentence
5. Portray characters and events with your voice and your gestures.
6. Ask about the story.

Appendix 5: Observational Format

Participant code:

Word: ...about Vowel position: Items:		Word: ...cover Vowel position: Items:	
It is said faster		It is said faster	
Lower volume than stressed syllables		Lower volume than stressed syllables	
The vowel sounds lose their purity		The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound		Stressed syllables maintain the full vowel sound	
Vowel sound a - e - i - o - u - uh		Vowel sound a - e - i - o - u - uh	
Total of points		Total of points	

Word: ...upon Vowel position: Items:		Word: ...the Vowel position: Items:	
It is said faster		It is said faster	
Lower volume than stressed syllables		Lower volume than stressed syllables	
The vowel sounds lose their purity		The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound		Stressed syllables maintain the full vowel sound	
Vowel sound a - e - i - o - u - uh		Vowel sound a - e - i - o - u - uh	
Total of points		Total of points	

Word: a Vowel position: Items:		Word: of Vowel position: Items:	
It is said faster		It is said faster	
Lower volume than stressed syllables		Lower volume than stressed syllables	
the vowel sounds lose their purity		The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound		Stressed syllables maintain the full vowel sound	
Vowel sound a - e - I - o - u - uh		Vowel sound a - e - i - o - u - uh	
Total of points		Total of points	

Word: ...breakfast Vowel position: Items:		Word: ...but Vowel position: Items:	
It is said faster		It is said faster	
Lower volume than stressed syllables		Lower volume than stressed syllables	
The vowel sounds lose their purity		The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound		Stressed syllables maintain the full vowel sound	
Vowel sound a - e - i - o - u - uh		Vowel sound a - e - i - o - u - uh	
Total of points		Total of points	

Word: ...was	Word: ...salami	
Vowel position:	Vowel position:	
Items:	Items:	
It is said faster	It is said faster	
Lower volume than stressed syllables	Lower volume than stressed syllables	
The vowel sounds lose their purity	The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound	Stressed syllables maintain the full vowel sound	
Vowel sound	Vowel sound	
a - e - i - o - u - uh	a - e - i - o - u - uh	
Total of points	Total of points	

Word: ...again	Word: ...tomorrow	
Vowel position:	Vowel position:	
Items:	Items:	
It is said faster	It is said faster	
Lower volume than stressed syllables	Lower volume than stressed syllables	
The vowel sounds lose their purity	The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound	Stressed syllables maintain the full vowel sound	
Vowel sound	Vowel sound	
a - e - i - o - u - uh	a - e - i - o - u - uh	
Total of points	Total of points	

Word: ...cocoon	Word: ...beautiful	
Vowel position:	Vowel position:	
Items:	Items:	
It is said faster	It is said faster	
Lower volume than stressed syllables	Lower volume than stressed syllables	
The vowel sounds lose their purity	The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound	Stressed syllables maintain the full vowel sound	
Vowel sound a - e - i - o - u - uh	Vowel sound a - e - i - o - u - uh	
Total of points	Total of points	

Word: ...butterfly	Word:	
Vowel position:	Vowel position:	
Items:	Items:	
It is said faster	It is said faster	
Lower volume than stressed syllables	lower volume than stressed syllables	
The vowel sounds lose their purity	The vowel sounds lose their purity	
Stressed syllables maintain the full vowel sound	Stressed syllables maintain the full vowel sound	
Vowel sound	Vowel sound	
a - e - i - o - u - uh	a - e - i - o - u - uh	
Total of points	Total of points	

Appendix 6 the very hungry Caterpillar: Script and Vowel position of schwa By Eric Carle

Do you know what the story is **about**? **a word-initial:** about
What do you see on the **cover** page? **e word medial:** cover
Once **upon** a time, **u word-initial:** upon
In the light of the moon
a little egg lay on **a** leaf..... **a word:** indefinite article
One Sunday morning the warm sun
comes **up** and out **of** the egg comes a tiny..... **u word-initial:** up,
o word initial: of.
and very hungry caterpillar.
He started to look for (some food) **breakfast** **a word-medial** (fa)
On Monday he ate through one apple,
but he **was** still hungry..... **u word-medial:** but, **a word medial:** was
On Tuesday he ate through two pears,
but he **was** still hungry..... **u word-medial:** but, **a word medial:** was
On Wednesday he ate through three plums,
but he **was** still hungry..... **u word-medial:** but, **a word medial:** was
On Thursday he ate through four strawberries,
but he **was** still hungry..... **u word-medial:** but, **a word medial:** was
On Friday he ate through five oranges,
but he **was** still hungry..... **u word-medial:** but, **a word medial:** was
On Saturday he ate through one piece of chocolate cake,
one ice- cream cone, one pickle
one slice **of** Swiss cheese,..... **o word initial:** of
one slice **of** **salami**,..... **o word initial:** of, **a word-medial:** salami (sa)
one lollipop, one piece of cherry pie,

one sausage, one cupcake and one watermelon.

That night he had **a** stomach ache **a word:** indefinite article

The next day was Sunday **again** **a word-initial:** again

The caterpillar ate through **a** nice green leaf **a word:** indefinite article

And after that day he felt **a** bit better **a word:** indefinite article

Now he wasn't hungry any more!

And he wasn't a little caterpillar any more; he was a big - fat – caterpillar.

+”**Tomorrow**, I ‘ll build my house”,

said the caterpillar **o word-medial:** tomorrow (to)

And he built a small house,

called **cocoon**, around himself **o word-medial:** cocoon (co)

He stayed inside for more than two weeks.

Then he nibbled a hole in the **cocoon**, **o word-medial:** cocoon (co)

then he pushed his way out and

He was a **beautiful** **i word-medial:** beautiful (ti)

Butterfly **word-medial:** butterfly (tter)

The End

Appendix 7: Formant values of native schwas and Peruvian schwas

Mean formant value (HZ) Spanish speakers as English teachers								
vowel	ISA		DIN	NAN	JAC	CYN	NAT	MEAN
a	F1	800	802	708	768	836	727	773
	F2	1457	1400	1231	1617	1529	1525	1459
e	F1	578	548	522	691	681	527	591
	F2	1390	1262	1582	1627	1552	1462	1479
i	F1	493	375	430	464	431	454	441
	F2	1626	1451	2121	1919	1809	2109	1839
o	F1	574	528	566	717	586	593	594
	F2	1280	985	1340	1389	1125	1419	1256
u	F1	528	563	654	567	659	674	607
	F2	941	1253	1110	1674	1346	1302	1271

Mean formant value (HZ) ENGLISH SPEAKERS AS ENGLISH TEACHERS				
vowel	NAT 1A		NAT 1B	Mean
a	F1	675	658	666
	F2	1402	1673	1537
e	F1	562	627	594
	F2	1256	1619	1437
i	F1	512	532	522
	F2	1501	1632	1566
o	F1	536	613	574
	F2	1573	1395	1484
u	F1	594	581	587
	F2	1219	1549	1384

Appendix 8: Individual Formant values for each informant on each vowel position.

Informant ISA		start	end	F1	F2	Time duration
A initial	about	6.0617	6.1004	856	1609	0.0387
	attractive	3.5888	3.6392	798	1824	0.0504
a-medial	breakfast	3.3759	3.4738	650	954	0.0979
	was	3.0206	3.1488	956	1409	0.1282
	salami	3.1119	3.1973	742	1492	0.0854
Mean formant value (HZ)				800	1457	

Informant ISA		start	end	F1	F2	Time duration
e-medial	absent	4.7183	4.8356	672	1857	0.1173
	item	3.3208	3.3724	673	2171	0.0516
	problem	3.3116	3.4271	588	1212	0.1155
	heaven	3.1341	3.2041	419	679	0.07
	telephone	3.1005	3.1538	540	1033	0.0533
Mean formant value (HZ)				578	1390	

Informant ISA		start	end	F1	F2	Time duration
i-medial	beautiful	3.9972	4.0821	460	2140	0.0849
	definite	2.8847	2.9774	708	1700	0.0927
	experiment	3.1192	3.1663	447	1455	0.0471
	festival	4.0604	4.1638	420	1277	0.1034
	possible	3.0812	3.1291	432	1558	0.0479
Mean formant value (HZ)				493	1626	

Informant ISA		start	end	F1	F2	Time duration
o-initial	of	2.4344	2.5865	751	1139	0.1521
	opinion	2.9985	3.071	469	861	0.0725
o-medial	tomorrow	2.4588	2.5034	450	1568	0.0446
	cocoon	2.6639	2.7103	570	799	0.0464
	evolution	3.1613	3.9133	632	2033	0.752
Mean formant value (HZ)				574	1280	

Informant ISA		start	end	F1	F2	Time duration
u-initial	upon	2.7479	2.7933	770	1175	0.0454
u-medial	but	3.5559	3.6429	525	937	0.087
	beautiful	3.002	3.0614	467	641	0.0594
	autumn	3.1237	3.1739	503	1298	0.0502
	focus	2.6205	2.6663	377	655	0.0458
Mean formant value (HZ)				528	941	

Informant DIN		start	end	F1	F2	Time duration
A initial	about	2.9337	3.0127	853	1412	0.079
	attractive	2.5454	2.5894	890	1624	0.044
a-medial	breakfast	3.1408	3.2052	699	905	0.0644
	was	3.0334	3.1488	838	1394	0.1154
	salami	2.8643	2.9536	730	1666	0.0893
Mean formant value (HZ)				802	1400	

Informant DIN		start	end	F1	F2	Time duration
e-medial	absent	2.973	3.0483	560	1611	0.0753
	item	2.3032	2.3635	445	973	0.0603
	problem	2.4289	2.496	552	1222	0.0671
	heaven	2.9646	3.0318	651	1596	0.0672
	telephone	2.9087	2.9614	535	911	0.0527
Mean formant value (HZ)				548	1262	

Informant DIN		Start	end	F1	F2	Time duration
i-medial	beautiful	2.6108	2.6849	371	1170	0.0741
	definite	4.0073	4.0992	380	1441	0.0919
	festival	2.4006	2.4718	361	677	0.0712
	experiment	2.7352	2.8198	386	2045	0.0846
	possible	2.9867	3.0338	378	1922	0.0471
Mean formant value (HZ)				375	1451	

Informant DIN		start	end	F1	F2	Time duration
o-initial	of	2.3645	2.5186	677	893	0.1541
	opinion	2.3151	2.4349	522	785	0.1198
o-medial	tomorrow	2.54	2.5899	385	1691	0.0499
	cocoon	2.9497	3.0137	543	681	0.064
	evolution	2.4788	2.5281	514	879	0.0493
Mean formant value (HZ)				528	985	

Informant DIN		start	end	F1	F2	Time duration
u-initial	upon	2.4885	2.5587	726	1071	0.0702
u-medial	but	2.3861	2.5062	796	1371	0.1201
	beautiful	2.802	2.897	465	782	0.095
	autumn	2.4462	2.5033	386	1140	0.0571
	focus	2.5133	2.5846	443	1901	0.0713
Mean formant value (HZ)				563	1253	

Trained Informant NAN		start	end	F1	F2	Time duration
a initial	about	3.187	3.2723	760	1309	0.0853
	attractive	1.516	1.6122	708	1533	0.0962
a-medial	breakfast	3.114	3.1958	695	1159	0.0818
	was	1.9802	2.078	754	1356	0.0978
	salami	1.9023	1.9624	627	798	0.0601
Mean formant value (HZ)				708	1231	

Trained Informant NAN		start	End	F1	F2	Time duration
e-medial	absent	2.5202	2.6181	512	2066	0.0979
	item	2.7657	2.8296	543	2075	0.0639
	problem	2.9171	3.0247	571	1579	0.1076
	heaven	2.14	2.2444	540	1288	0.1044
	telephone	1.9703	2.0325	445	904	0.0622
Mean formant value (HZ)				522	1582	

Trained Informant NAN		start	End	F1	F2	Time duration
i-medial	beautiful	2.1326	2.2176	409	2115	0.085
	definite	2.4604	2.5217	451	2233	0.0613
	festval	2.9289	3.0136	446	2167	0.0847
	experiment	2.0907	2.1758	447	1996	0.0851
	possible	2.1564	2.1931	401	2098	0.0367
Mean formant value (HZ)				430	2121	

Trained Informant NAN		start	End	F1	F2	Time duration
o-initial	of	1.9942	2.1499	738	1266	0.1557
	opinion	0.0486	3.1421	616	1101	3.0935
o-medial	tomorrow	2.0532	2.0978	447	1577	0.0446
	cocoon	2.3874	2.4415	442	1255	0.0541
	evolution	2.1782	2.2415	587	1503	0.0633
Mean formant value (HZ)				566	1340	

Trained Informant NAN		start	End	F1	F2	Time duration
u-initial	upon	3.103	3.2306	707	1079	0.1276
u-medial	but	2.2015	2.4402	758	1293	0.2387
	beautiful	2.3259	2.406	577	826	0.0801
	autumn	2.2891	2.387	616	1178	0.0979
	focus	2.2891	2.387	610	1178	0.0979
Mean formant value (HZ)				654	1110	

Trained Informant JAC		start	end	F1	F2	Time duration
A initial	about	2.5991	2.693	865	1971	0.0939
	attractive	2.8696	3.6722	859	1953	0.8026
a-medial	breakfast	2.6765	2.771	802	1657	0.0945
	was	2.9013	3.0857	645	1161	0.1844
	salami	2.7088	2.7834	670	1344	0.0746
Mean formant value (HZ)				768	1617	

Trained Informant JAC		start	end	F1	F2	Time duration
e-medial	absent	2.0785	2.1977	576	1307	0.1192
	item	2.0966	2.1986	728	1864	0.102
	problem	2.4605	2.5193	698	1414	0.0588
	heaven	3.4122	3.4839	733	2007	0.0717
	telephone	2.4913	2.5406	720	1544	0.0493
Mean formant value (HZ)				691	1627	

Trained Informant JAC		start	end	F1	F2	Time duration
i-medial	beautiful	2.3701	2.4758	428	2142	0.1057
	definite	2.7146	2.7534	588	1902	0.0388
	experiment	2.2172	2.2521	449	1435	0.0349
	festival	2.1327	2.1848	438	1785	0.0521
	possible	2.1512	2.1894	417	2333	0.0382
Mean formant value (HZ)				464	1919	

Trained Informant JAC		start	end	F1	F2	Time duration
o-initial	of	2.2817	2.4646	992	1426	0.1829
	opinion	1.8092	1.9331	655	1173	0.1239
o-medial	tomorrow	2.0541	2.0929	437	1314	0.0388
	cocoon	2.3801	2.4458	691	1686	0.0657
	evolution	2.7226	2.846	812	1348	0.1234
Mean formant value (HZ)				717	1389	

Trained Informant JAC		start	end	F1	F2	Time duration
u-initial	upon	2.1752	2.7447	649	1807	0.5695
u-medial	but	2.3063	2.4969	761	1904	0.1906
	beautiful	2.5648	2.6571	579	1240	0.0923
	autumn	2.5467	2.6269	410	1346	0.0802
	focus	2.1492	2.242	436	2076	0.0928
Mean formant value (HZ)				567	1674	

Informant CYN		start	End	F1	F2	Time duration
a initial	about	2.5735	2.6482	881	1433	0.0747
	attractive	2.3178	2.3604	825	1676	0.0426
a-medial	breakfast	2.8037	2.911	775	1529	0.1073
	was	2.3328	2.5101	903	1483	0.1773
	salami	2.7913	2.8538	798	1526	0.0625
Mean formant value (HZ)				836	1529	

Informant CYN		start	End	F1	F2	Time duration
e-medial	absent	2.7538	2.8163	757	1889	0.0625
	item	2.63	2.7562	731	1739	0.1262
	problem	2.5947	2.6477	585	1281	0.053
	heaven	2.2131	2.288	719	1675	0.0749
	telephone	2.3663	2.4079	613	1180	0.0416
Mean formant value (HZ)				681	1552	

Informant CYN		start	End	F1	F2	Time duration
i-medial	beautiful	2.0965	2.1715	455	2045	0.075
	definite	1.8979	2.0789	303	629	0.181
	experiment	2.2378	2.261	556	1462	0.0232
	festival	2.4869	2.5525	427	2538	0.0656
	possible	2.2535	2.2989	418	2372	0.0454
Mean formant value (HZ)				431	1809	

Informant CYN		start	End	F1	F2	Time duration
o-initial	of	1.9059	2.0558	709	1154	0.1499
	opinion	1.8691	1.9525	592	1109	0.0834
o-medial	tomorrow	2.1463	2.1944	550	1499	0.0481
	cocoon	2.1831	2.2474	526	902	0.0643
	evolution	1.8359	1.8854	555	965	0.0495
Mean formant value (HZ)				586	1125	

Informant CYN		Start	end	F1	F2	Time duration
u-initial	upon	2.2439	2.2791	817	1421	0.0352
u-medial	but	2.2854	2.4203	833	1230	0.1349
	beautiful	2.2959	2.3795	538	979	0.0863
	autumn	1.9196	1.9659	610	971	0.0463
	focus	2.1286	2.2122	498	2130	0.0836
Mean formant value (HZ)				659	1346	

Trained Informant NAT		start	end	F1	F2	Time duration
A initial	about	3.9342	4.0405	886	1607	0.1063
	attractive	2.7189	2.7976	732	1641	0.0787
a-medial	breakfast	3.1009	3.2035	645	1393	0.1026
	was	2.7477	2.8977	741	1401	0.15
	salami	3.2897	3.3591	634	1583	0.0694
Mean formant value (HZ)				727	1525	

Trained Informant NAT		start	end	F1	F2	Time duration
e-medial	absent	3.7575	3.8158	459	1578	0.0583
	item	2.7754	2.8395	593	2016	0.0641
	problem	3.7336	3.7985	352	960	0.0649
	heaven	3.021	3.096	559	1472	0.075
	telephone	2.9532	3.004	672	1288	0.0508
Mean formant value (HZ)				527	1462	

Trained Informant NAT		start	end	F1	F2	Time duration
i-medial	beautiful	2.5447	2.5843	398	2078	0.0396
	definite	2.7766	2.8036	609	2122	0.027
	experiment	3.1367	3.1872	472	1847	0.0505
	festival	2.7695	2.8096	372	2282	0.0401
	possible	3.1106	3.1376	419	2216	0.027
Mean formant value (HZ)				454	2109	

Trained Informant NAT		start	End	F1	F2	Time duration
o-initial	of	3.3674	3.6155	785	1470	0.2481
	opinion	3.4134	3.5044	610	1302	0.091
o-medial	tomorrow	2.4705	2.4929	296	1426	0.0224
	cocoon	2.2547	2.284	648	1588	0.0293
	evolution	2.9048	2.9746	629	1310	0.0698
Mean formant value (HZ)				593	1419	

Trained Informant NAT		start	End	F1	F2	Time duration
u-initial	Upon	3.0316	3.1285	745	1377	0.0969
u-medial	But	2.5243	2.6038	713	1594	0.0795
	beautiful	2.7826	2.9238	650	995	0.1412
	autumn	2.4464	2.4914	704	1262	0.045
	Focus	2.5868	2.671	561	1285	0.0842
Mean formant value (HZ)				674	1302	

Informant NATIVE 1 ^a		start	end	F1	F2	Time duration
a initial	about	6.4949	6.5787	835	1667	0.0838
	attractive	3.5888	3.6392	798	1824	0.0504
a-medial	breakfast	3.3436	3.4032	596	1370	0.0596
	Was	3.2076	3.4717	603	1128	0.2641
	salami	2.9597	2.9965	546	1022	0.0368
Mean formant value (HZ)				675	1402	

Informant NATIVE 1 ^a		start	end	F1	F2	Time duration
e-medial	absent	4.0442	4.0967	593	1422	0.0525
	Item	3.2503	3.3971	572	1560	0.1468
	problem	3.1963	3.3192	588	1214	0.1229
	heaven	3.1515	3.2408	480	1046	0.0893
	telephone	3.5478	3.5961	578	1038	0.0483
Mean formant value (HZ)				562	1256	

Informant NATIVE 1A		start	end	F1	F2	Time duration
i-medial	beautiful	2.9042	2.9536	522	1345	0.0494
	definite	2.6542	2.7047	532	1929	0.0505
	experiment	2.8781	2.9151	456	1345	0.0494
	festival	2.9598	3.0292	553	1643	0.0694
	possible	2.684	2.7277	501	1244	0.0437
Mean formant value (HZ)				512	1501	

Informant NATIVE 1A		start	end	F1	F2	Time duration
o-initial	Of	2.9248	3.1998	705	1468	0.275
	opinion	2.5237	2.5815	676	1297	0.0578
o-medial	tomorrow	2.5755	2.6163	364	2018	0.0408
	cocoon	2.5261	2.6291	464	1785	0.103
	evolution	2.8271	2.9152	473	1299	0.0881
Mean formant value (HZ)				536	1573	

Informant NATIVE 1A		start	end	F1	F2	Time duration
u-initial	upon	2.155	2.156	572	1779	0.001
u-medial	But	2.4391	2.6235	804	1489	0.1844
	beautiful	2.7819	3.124	473	829	0.3421
	autumn	2.3842	2.5034	622	1021	0.1192
	focus	3.1822	3.2671	502	978	0.0849
Mean formant value (HZ)				542	1151	

Informant NATIVE 1B		start	end	F1	F2	Time duration
a initial	about	4.1694	4.3034	761	1551	0.134
	attractive	2.8454	2.9486	632	1837	0.1032
a-medial	breakfast	4.4519	4.5195	590	2011	0.0676
	was	2.6343	2.8904	634	1409	0.2561
	salami	2.94	2.993	673	1493	0.053
Mean formant value (HZ)				658	1673	

Informant NATIVE 1B		start	end	F1	F2	Time duration
e-medial	absent	3.1777	3.2952	559	1872	0.1175
	item	2.4092	2.5378	751	1674	0.1286
	problem	2.3979	2.5152	594	1140	0.1173
	heaven	3.2004	3.2845	580	1984	0.0841
	telephone	3.4023	3.4785	652	1425	0.0762
Mean formant value (HZ)				627	1619	

Informant NATIVE 1B		start	end	F1	F2	Time duration
i-medial	beautiful	2.8954	3.001	516	1523	0.1046
	definite	2.5451	2.6093	569	1956	0.0642
	experiment	2.9678	2.9973	507	1672	0.0295
	festival	3.0578	3.141	528	1518	0.0832
	possible	2.9591	3.0157	551	1493	0.0566
Mean formant value (HZ)				532	1632	

Informant NATIVE 1B		start	end	F1	F2	Time duration
o-initial	of	2.9248	3.1998	705	1468	0.275
	opinion	2.9205	3.0828	758	1591	0.1623
o-medial	tomorrow	2.6802	2.7074	545	1487	0.0272
	cocoon	2.51	2.5668	518	994	0.0568
	evolution	2.6709	2.7371	540	1437	0.0662
Mean formant value (HZ)				613	1395	

Informant NATIVE 1B		start	end	F1	F2	Time duration
u-initial	upon	2.155	2.155	572	1779	0
u-medial	but	2.5992	2.6649	898	1583	0.0657
	beautiful	2.6425	2.7719	594	1148	0.1294
	autumn	2.3842	2.5034	622	1021	0.1192
	focus	2.8246	2.9592	539	2251	0.1346
Mean formant value (HZ)				581	1549	

Appendix 9: Time duration results for all Peruvian speakers and native

Time duration									
Vowel position	word	Peruvian teachers L2						Native teachers	
		ISA	DIN	NAN	JAC	CYN	NAT	NATIVE A	NATIVE B
a initial	about	0.0387	0.079	0.0853	0.0939	0.0747	0.1063	0.0838	0.134
	attractive	0.0504	0.044	0.0962	0.8026	0.0426	0.0787	0.0504	0.1032
a-medial	breakfast	0.0979	0.0644	0.0818	0.0945	0.1073	0.1026	0.0596	0.0676
	was	0.1282	0.1154	0.0978	0.1844	0.1773	0.15	0.2641	0.2561
	salami	0.0854	0.0893	0.0601	0.0746	0.0625	0.0694	0.0368	0.053
e-medial	absent	0.1173	0.0753	0.0979	0.1192	0.0625	0.0583	0.0525	0.1175
	item	0.0516	0.0603	0.0639	0.102	0.1262	0.0641	0.1468	0.1286
	problem	0.1155	0.0671	0.1076	0.0588	0.053	0.0649	0.1229	0.1173
	heaven	0.07	0.0672	0.1044	0.0717	0.0749	0.075	0.0893	0.0841
	telephone	0.0533	0.0527	0.0622	0.0493	0.0416	0.0508	0.0483	0.0762
i-medial	beautiful	0.0849	0.0741	0.085	0.1057	0.075	0.0396	0.0494	0.1046
	definite	0.0927	0.0919	0.0613	0.0388	0.181	0.027	0.0505	0.0642
	experiment	0.0471	0.0712	0.0847	0.0349	0.0232	0.0505	0.0494	0.0295
	festival	0.1034	0.0846	0.0851	0.0521	0.0656	0.0401	0.0694	0.0832
	possible	0.0479	0.0471	0.0367	0.0382	0.0454	0.027	0.0437	0.0566
o-initial	of	0.1521	0.1541	0.1557	0.1829	0.1499	0.2481	0.275	0.275
	opinion	0.0725	0.1198	3.0935	0.1239	0.0834	0.091	0.0578	0.1623
o-medial	tomorrow	0.0446	0.0499	0.0446	0.0388	0.0481	0.0224	0.0408	0.0272
	cocoon	0.0464	0.064	0.0541	0.0657	0.0643	0.0293	0.103	0.0568
	evolution	0.752	0.0493	0.0633	0.1234	0.0495	0.0698	0.0881	0.0662
u-medial	upon	0.0454	0.0702	0.1276	0.5695	0.0352	0.0969	0.001	0
	but	0.087	0.1201	0.2387	0.1906	0.1349	0.0795	0.1844	0.0657
	beautiful	0.0594	0.095	0.0801	0.0923	0.0863	0.1412	0.3421	0.1294
	autumn	0.0502	0.0571	0.0979	0.0802	0.0463	0.045	0.1192	0.1192
	focus	0.0458	0.0713	0.0979	0.0928	0.0836	0.0842	0.0849	0.1346
		7	6	6	6	7	8		

Appendix 10: Results of the Storytelling activity

Symbol Position Stimuli ə	Storytelling activity	Din	Isa	Nat	Nan	Jac	Cyn
-a word- initial	About	Yes	No (a)	Yes	yes	Yes	No
	A	No (a)	No (a)	Yes	yes	Yes	Yes
-a word- medial	breakfast(fa)	No (a)	No (a)	yes	No (a)	No (a)	No (a)
	Was	No	Yes	Yes	yes	Yes	Yes
	salami (sa)	Yes	No (a)	No (a)	yes	Yes	No
Score(a)		2/5	1/5	4/5	4/5	4/5	2/5
-e word- medial	* <u>Butterfly</u> (ter)	Yes	No	Yes	yes	No	No
	* <u>cover</u> (ver)	No	Yes	Yes	No	Yes	No (e)
Score (e)		1/2	1/2	2/2	1/2	1/2	0
i word- medial	beautiful(ti),	Yes	Yes	yes	yes	No (i)	No
Score (i)		1/1	1/1	1/1	1/1	0	0
o word- initial	Of	No	yes	yes	yes	yes	Yes
o word- medial	tomorrow (to)	No	Yes	Yes	yes	Yes	No (u)
	cocoon (co)	No (o)	Yes	Yes	No	Yes	No
Score(o)		0	3/3	3/3	1/3	3/3	1/3
u word- initial	Upon	Yes	yes	Yes	yes	No (a)	No (a)
u word- medial	But	No	no	Yes	No	Yes	Yes
	Beautiful(ful),	Yes	Yes	Yes	yes	Yes	No
Score(u)		2/3	2/3	3/3	2/3	2/3	1/3
Total score	14 points	6	8	12	10	10	4