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Long vowels versus diphthongs in North American English: Which one is easy to recognize and hear?

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Abstract

The aim of this presentation is to measure to what extent long vowels are confused with diphthongs by Turkish English majors. A diphthong is made of two components. By definition and sound structure, diphthongs are a combination of two separate vowel sounds that, when uttered, the first vowel glides onto the second vowel forming a single syllable, as heard in /aɪ, aʊ, eɪ, oʊ, ɔɪ/. By nature, diphthongs happen to be long vowels. Long vowels, on the other hand, do not include two vowels that do not glide, as in /ɑ:, i:, u:, ju:, ɔ:, ɜ:/. No vowel sound has a fixed length and many other factors affect length, such as the voiced consonant sound directly after a vowel sound will affect its length (voicing), reduction and intonation. It is said that to hear vowel sounds within words is easier than it is to hear the sound alone. Long vowels are generally said to be the easiest vowels for non-native English speakers to distinguish and hear correctly. This assumption will be tested with 30 instructors of English language education who are enrolled for MA degree at a foundation university in Ankara. The perception of long vowels vs diphthongs in written words and the audition of them in oral forms were measured within two separate applications of a pre-test and a post-test. It was discovered that the Turkish English instructors perceived the diphthongs (86, 3%) better than long vowels (73,3%). It was deduced that the main cause of learning difficulty behind the diphthongs and long vowels, apart from L1 intervention, was the fact that Turkish learners of English suffer from a psycho-orthographic trauma created by the spelling of the diphthongs and long vowels by means of several letters.

Keywords: Long vowel, diphthong, gliding, monophthong, vowel length, checked vowels

1. Introduction

The present study investigates the perception of English long vowels and diphthongs by 30 Turkish English instructors. The perception of North American English (henceforth, NAE) long vowels and diphthongs has never been an easy task for Turkish English teachers and students. It is said that to hear vowel sounds within words is easier

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than it is to hear the sound alone. Long vowels are generally said to be the easiest vowels for non-native English speakers to distinguish and pronounce correctly. Most theories of L1 speech perception postulate that non-native learners establish speech to sound categories based on the distribution of acoustic properties in their native language (Maye, Werker & Gerken, 2002). The perception of vowel height, backness, frontness, roundedness, unroundedness, and length are mostly triggered by the L1.

L1 phonological system operates as a filter that accommodates linguistic input to its structure. Best's Perceptual Assimilation Model (Best 1995, and Best & Tyler 2007) emphasizes native language / second language perceptual similarity as a predictor of difficulties in the discrimination of non-native contrasts. Cross language speech perception models such as PAM (Best 1995, 1999) and L2 learning models such as SLM (Flege 1995; Flege, Bohn,& Jang, S.,1997).) are also encountered in the investigation of sound perception.

1.1. The diphthongs and long vowels in spelling

Discuss Vowels sounds of English are represented by the letters a, i, e, u, and o. "y" is a vowel when it sounds as /ɪ / such as in the words bit, city, kin, it, sit, etc." Also, "y" is form a letter is a consonant when it sounds as /j/ such as in the words yeast /ji:st/ and yield /ji:ld/. The most common letter in the English language is the letter **e**. The vowels a, **o**, **i** and **u** are also among the top five most used letters in English. These vowels are used in the spelling of long vowels and diphthongs in English.

The following chart represents the frequency of English letters in NAE:

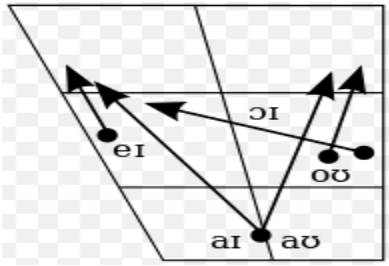
Letter	Relative frequency in the English language
e	12.702%
a	8.167%
o	7.507%
i	6.966%
u	2.758%

Adapted from Mička ("Letter frequency (English)". Algoritmy.net.)

The phonemic vowel chart of English language, as given below, houses 12 vowel phonemes whose place, point and manner of articulation can be demonstrated as follows:

	FRONT	CENTER	BACK
HIGH	i:		u:
	ɪ		ʊ
MID	e:	ə	oʊ
	ɛ	ʌ	ɔ
LOW	æ		ɑ

NAE vowel chart:
Demirezen (2017:263)



NAE diphthong chart: Adapted from
(https://www.google.com.tr/search?q=)

1.2. The sound structure of long vowels and diphthongs

After Vowels are also one of the hardest parts of English when it comes to pronunciation there just seem to be so many ways to articulate them. A vowel sound is created when air flows smoothly, without interruption, through the throat (pharyngeal and laryngeal cavities) and mouth (oral cavity). In their articulation, there is no blockage while air stream coming out of the mouth. Different vowel sounds are produced as a speaker changes shape and placement of articulators in the parts of the throat and mouth. The pronunciation of each vowel is determined by the position of the vowel in a syllable, and by the letters that follow or come before or after it. Vowel sounds can be short, long, or silent. Most vowels have two pronunciations, a long sound and a short sound. In NAE, <r> in or /ɔːɹ/ is always pronounced while in BrE it is not pronounced after vowels.

1.3. The sound structure of long vowels and diphthongs

A long vowel is a single vowel sound which gets lengthened during its articulation. Therefore, in phonology, vowel length is the perceived duration of a vowel sound. Some dictionaries use the diacritical mark to demonstrate a long vowel and it is called a macron (¯). In NAE Long vowel sounds are /eɪ/, /iː/, /aɪ/, /ɑː/, /oʊ/, /juː/, /uː/, /ɜː/, /ɔː/, and /ɔɪ/.

1.4. The nature of diphthongs

A As opposed to long vowels, diphthongs are vowels that change throughout their pronunciation. They start as one vowel and end as another. In the International Phonetics Alphabet (henceforth, IPA), diphthongs are transcribed with two different symbols, whereas the short part of diphthongs called monophthongs are transcribed with just one symbol. The term diphthong literally means 'two voices' or 'two sounds'. The vowel sound of each diphthong is composed of two different kinds of vowel sounds in syllables; therefore, a diphthong happens to be two vowels, which are completely two

different vowels occurring in the same syllable whose vowel quality changes within a syllable. Two vowel sounds which consist of a movement or glide from one vowel to another are called diphthongs. In terms of length, diphthongs resemble long vowels. In most diphthongs, the first component is much longer and stronger than the second component. The process of moving from one vowel sound to another is called gliding, and thus another name for diphthong is the term gliding vowel. Therefore, a diphthong is also known as a compound vowel, a complex vowel, and a moving vowel. For example, in the word time /tˈaɪm/, while /a/ receives the primary stress, the /ɪ/ vowel glides to become a noticeable /ɪ/. As the gliding incident happens, /ɪ/ gets weakened by losing its loudness with an audible decrease in its articulation. A sound change that turns a single vowel into a diphthong is called diphthongization. As a result, the /ɪ/ component of the diphthong /aɪ/ is shorter and quieter Thus, the second component of a diphthong is just extended version of the first component. So, these dual vowels are called diphthongs, which merge together during the articulation and heard as a single long vowel. That's why long vowels are generally confused with long vowels.

1.5. Differences in quality between long and short vowels

In terms of length, diphthongs look like vowels. The distinct differences in quality between long and short vowels depend on the tongue shape, tongue position, and the lip position. The length is demonstrated by the length mark is represented by the two dots, as in beat /bi:t/,/, bird /bɜ:ɹ/, boil /bɔɪl/, boat /boʊt/, board /bɔ:ɹd/, card /kɑ:ɹd/, coat /koʊt/, cool /ku:l/, fool /fu:l/, hard /hɑ:ɹd/, hoarse /hɔ:ɹs/, needle /ni:dle/, noon /nu:n /, post /poʊst/ seat /si:t/, and toilet /ˈtɔɪlɪt/. The "short" vowel sounds cannot occur at the end of a syllable in English. They must be followed by a consonant. In linguistics, they are also called "checked" vowels.

1.6. Long vowels of north American English: /ɑ:, i:, u:, ju:, ɔ:, ɜ:/

The long vowel frequencies can be singled out as following in NAE; the frequencies go in lie with https://cmloegcmluin.wordpress.com/2012: "The phoneme frequency of some of the long vowels Relative Frequencies of English Phonemes by cmloegcmluin who correlated the Carnegie Mellon University Pronouncing Dictionary with Adam Kilgarriff's unlemmatized frequency list for the British National Corpus by using the former as a phonemic lexicon and the latter as a sample set, weighting the phonemes by the totals of the relative frequencies of each of the words they appear in. The data did use an American accent."

Long vowel	Frequency %
/i:/	3.61%

/u:/	1.93%
/ɑ :/	1.45%
/ju:/	?????
/ɜ :/	?????
/ɔ :/	1.18%

The following vocabulary items demonstrate the existence of long vowels in NAE:

/i:/ able /ˈeɪbəl/ beat /bit:/, bee /bi:/, breathe /bɹi:ð/, deal /di:l/, eat /i:t/, feel /fi:l/, fleece /fli:s/, field /fi:ld/, free /fɹi:/, heal /hi:l/, key /ki:/, leave /li:v/, meat /mi:t/, need /ni:d/, needle /ˈni:dl/, seat /si:t/, sheep /ʃi:p/, sleep/sli:p/, seize /si:z/

/ju:/ beauty /ˈbju:Di/, cute /ˈkju:t/, cue /ˈkju:/, cube /ˈkju:b/, evacuate /ɪˈvækju:ˌeɪt/, feud /ˈfju:d/, fume /ˈfju:m/, fuel /ˈfju:əl, fju:l/, fume /fju:m/, fusion /ˈfju:ʒən/, huge /hju:dʒ/, mute /mju:t/, mule /mju:l/, you /ju:/, new /nju:/, music /ˈmju:zɪk/, use /ju:z/, union /ˈju:njən/, uniform /ˈju:nəˌfɔɹm/, unique /ju:ˈnik/, use /ju:s/, unicorn /ˈju:nəˌkɔɹn/, youth /ju:θ/, value /ˈvælju:/

/ɔ:/ abroad /əˈbɹɔ:d/, afford /əˈfɔ:ɹd/, always /ˈɔ:lweɪz/, autumn /ˈɔ:Dəm/, August /ˈɔ:gəst/, author /ˈɔ:θəɹ/, born /ˈbɔ:ɹn/, board /ˈbɔ:ɹd/, cloth /klɔ:θ/, force /ˈfɔ:ɹs/, hoarse /ˈhɔ:ɹs/, launch /ˈlɔ:ntʃ, ˈlɑntʃ/, lawn /ˈlɔ:n/, more /ˈmɔ:ɹ/, north /ˈnɔ:ɹθ/, recall /ɹɪˈkɔ:l/, roar /ˈɹɔ:ɹ/, or /ˈɔ:ɹ/, soar /ˈsɔ:ɹ/, score /ˈskɔ:ɹ/, shawl /ˈʃɔ:l/, store /ˈstɔ:ɹ/, story /ˈstɔ:ɹi/, warm /ˈwɔ:ɹm/,

/u:/ boo /ˈbu:/, coo /ˈku:/, blue /ˈblu:/, bruise /ˈbɹu:z/, canoe /kəˈnu:/, coup /ˈku:/, coupon /ˈku:pɑn/, cuckoo /ˈku:ku:/, cruise /kɹu:z/, food /fu:d/, flue /flu:/, flute /flu:t/, igloo /ˈɪglu:/, guru /ˈgu:ɹu:/, juice /dʒu:s/, loose /lu:s/, loop /ˈlu:p/, rue /ɹu:/, stupid /ˈstu:pɪd/, Lulu /ˈlu:lu:/, lose /ˈlu:z/, proof /ˈpɹu:f/, route /ˈɹut:/, rule /ˈɹu:l/, rude /ɹu:d/, shampoo /ʃæmˈpu:/, stool /ˈstu:l/, suit /ˈsu:t/, through /ˈθɹu:/, tulip /ˈtu:lɪp/, tune /ˈtu:n/, tooth /tu:θ/, view /ˈvyu:/, who /ˈhu:/, zoo /ˈzu:/

/ɑ:/ alarm /əˈlɑ:ɹm/, arm /ɑ:ɹm/, calm /ˈkɑ:m/, card /ˈkɑ:ɹd/, carpark /kɑ:ɹpɑ:ɹk/, document /ˈdɑ:kjəmənt/, hard /ˈhɑ:ɹd/, coupon /ˈku:pɑ:n/, farm /fɑ:ɹm/, father /ˈfɑ:ðəɹ/, guard /gɑ:ɹd/, harm /ˈhɑ:ɹm/, harmonica /hɑ:ɹˈmɑ:nɪkə/, modern /ˈmɑ:dəɹn/, remark /ɹɪˈmɑ:ɹk/, psalm /ˈsɑ:m/, plaza /ˈplɑ:zə/, rocket /ˈɹɑ:kɪt/, robbery /ˈɹɑ:bəɹi/, robot /ˈɹoʊbɑ:t/

/ɜ:/ bird /ˈbɜ:ɹ/, concern /kənˈsɜ:ɹn/, burn /ˈbɜ:ɹn/, burden /ˈbɜ:ɹdn/, burst /ˈbɜ:ɹst/, church /ˈtʃɜ:ɹtʃ/, curve /ˈkɜ:ɹv/, curtain /ˈkɜ:ɹʔn/, curtail /kɜ:ɹˈteɪl/, early /ˈɜ:ɹli/, earn /ˈɜ:ɹn/, journey /ˈdʒɜ:ɹni/, learn /lɜ:ɹn/, occur /əˈkɜ:ɹ/, person /ˈpɜ:ɹnsən/, prefer /pɹɪˈfɜ:ɹ/, turn /ˈtɜ:ɹn/, research /ˈɹi:sɜ:ɹtʃ/, work /ˈwɜ:ɹk/, were /ˈwɜ:ɹ/, worm /ˈwɜ:ɹm/

Diphthongs of North American English: /aɪ/, /aʊ/, /eɪ/, /oʊ/, /ɔɪ/

In British English (BrE, RP), there are 8 diphthongs whose list (RP) can be given as follows:

/eɪ/ as in 'take' /eə/ as in 'care'
/aɪ/ as in 'buy' /əʊ/ as in 'go'
/ɔɪ/ as in 'boy' /ʊə/ as in 'poor'
/ɪə/ as in 'fear' /aʊ/ as in 'cow'

Ranging from 6 to 8, there are conflicting opinions about exactly how many English diphthong sounds exist in English. As it is apparent, the BrE /eə, ɪə, ʊə/ diphthongs do not exist in NAE. In this research, five diphthongs of NAE, which are /aɪ, aʊ, eɪ, oʊ, ɔɪ/, will be taken under scrutiny. The frequency calculations of NAE are given below in line with https://cmloegcmluin.wordpress.com/2012 given below:

Diphthongs	Frequency %
/eɪ /	1.79%
/aɪ /	1.50%
/oʊ /	1.25%
/aʊ /	0.50%
/ɔ ɪ /	0.10%

For the calculations, cmloegcmluin had stated that "My methodology was messy. CMU's Pronouncing Dictionary conflated schwa with the near-open central vowel, and had several noticeable errors. The BNC list had multiple entries different parts of speech of words, and formatting issues prevented me from using any words with accents or apostrophes, including common contractions (though I found that the counts were so unreasonably low for these entries, that Kilgarriff must have split all of them up already except for the ones in the spoken 'demog' component). I believe my manual error checking on the top few hundred words (accounting for 47 million of the 81 million total word usage instances) helped significantly" (https://cmloegcmluin.wordpress.com/2012/11/10/relative-frequencies-of-english-phonemes).

The following vocabulary items represent the existence of diphthongs in NAE:

/eɪ/ ache /ˈeɪk/, ape /ˈeɪp/, bake /beɪk/, cake /ˈkeɪk/, date /ˈdeɪt/, explain /ɪkˈspleɪn/, gate /ˈgeɪt/, hate /ˈheɪt/, lake /ˈleɪk/, make /ˈmeɪk/, mayday /ˈmeɪdeɪ/, mayonnaise /ˈmeɪəˌneɪz/,

painstaking /ˈpeɪnzˌteɪkɪŋ/, play /pleɪ/, rain /ɹeɪn/, remain /ɹɪˈmeɪn/, take /ˈteɪk/, tailor /ˈteɪləɹ/, weight /weɪt/

/aɪ/ ice /aɪs/, bite /bɑɪt/, dime /daɪm/, drive /dɹaɪv/, eye /aɪ/, eyesight /ˈaɪsaɪt/, fine /faɪn/, flight /flaɪt/, tie /taɪ/, time /tɑɪm/, climb /klaɪm/, guidelines /ˈgaɪdlaɪnz/, highlight /ˈhaɪlaɪt/, pipeline /ˈpaɪplaɪn/, price /pɹaɪs/, sideline /ˈsaɪdlaɪn/, sight /saɪt/, sign /saɪn/, signify /ˈsɪgnəˌfaɪ/, tight /taɪt/

/aʊ/ around /əˈɹaʊnd/, arouse /əˈɹaʊz/, brown /bɹaʊn/, ground /gɹaʊnd/, out /aʊt/, plow /plaʊ/, house /haʊs/, housebound /ˈhaʊsbaʊnd/, mouth /maʊθ/, out /aʊt/, plow /plaʊ/, house /haʊs/, housebound /ˈhaʊsbaʊnd/, mouse /maʊs/, mouth /maʊθ/

/oʊ/ boat /ˈboʊt/, blow /ˈbloʊ/, boatshow /ˈboʊtʃoʊ/, bone /ˈboʊn/, coast /koʊst/, cold /ˈkoʊld/, coat /ˈkoʊt/, though /ˈðoʊ/, go /ˈgoʊ, /, gold /ˈgoʊld/, home /ˈhoʊm/, hope /ˈhoʊp/, oat /ˈoʊt/, own /ˈoʊn/, overcoat /ˈoʊvəɹˌkoʊt/, overdose /ˈoʊvəɹˌdoʊs/, overflow /ˌoʊvəɹˈfloʊ/, postpone /poʊsˈpoʊn/, propose /pɹəˈpoʊz/, roadshow /ˈɹoʊtʃoʊ/, roast /ɹoʊst/, slowpoke /ˈsloʊpoʊk/, snow /ˈsnoʊ/, toast /ˈtoʊst/, tobacco /təˈbækoʊ/, zone /ˈzoʊn/

/ɔɪ/ annoy /əˈnɔɪ/, avoid /əˈvɔɪd/, boil /ˈbɔɪl/, coin /ˈkɔɪn/, oil /ˈɔɪl/, point /ˈpɔɪnt/, choice /ˈtʃɔɪs/, boy /ˈbɔɪ/, oyster /ˈɔɪstəɹ/, Detroit /ˈdɪtɹɔɪt/, enjoy /ɪnˈdʒɔɪ/, employ /ɪmˈplɔɪ/, joy /dʒɔɪ/, joint /dʒɔɪnt/, noisy /ˈnɔɪzi/, join /ˈdʒɔɪn/, spoil /spɔɪl/, toy /ˈtɔɪ/, Toyota /tɔɪˈjoʊtə/, turmoil /ˈtɜːɹmɔɪl/, voyage /ˈvɔɪjɪdʒ/

1.7. Review of literature

According to Tsiga (2013: 17), "In English, especially the pronunciation of vowels is problematic." Very few studies have been conducted to identify the difficulties of perception English long vowels and diphthongs. A recent research made by Demirezen (2017) identified the /ɑ:/ phoneme of English as recognition and articulation difficulty for Turkish learners of English. He worked with a group of ELT participants (N=39) who had an ELT background. After the application of a pre-test on problem causing vowels to Turks, he created exercise samples in a period of three hours. Two weeks later, he gave the participants the pre-test as a post-test and found out that they had a recognition hardship with a rate of 48,72%. Also, the [ɔ:] and [oʊ] sounds had been singled out by Demirezen (2005) and Hişmanoğlu (2007) as problem-causing sounds for Turks. Demircioğlu (2013) indicated that some of the 8 English diphthongs are problematic for Turkish learners of English.

A recent study that investigated the interference of L1 in the acquisition of vowels is conducted by Nikolova (2010) in which she deals with the differences in the phonological systems of Arabic and English and their effect on the acquisition of vowels by EFL learners from Saudi Arabia. Another study that examined the perception and production of Standard Southern British English (SSBE) vowels by Syrian Arabic EFL learners was conducted by Almbark (2012).

The mispronunciations of English vowels were investigated by many researchers. Many of the faulty articulations stem from the defective perception of point, place, and manner of articulations by the non-native speakers of English. For example, the Polish learners of English incorrectly pronounce the vowel /ɜ:/, whose place of articulation in Polish is not the same with English. This long vowel "is articulated with the center of the tongue raised between close-mid to a mid-position, no firm contact being made between the tongue and upper molars; the lips are neutrally spread" (Cruttenden, 2008:130). He also adds that "the quality of /ɜ:/ often coincides with that of /ɔ:/, the difference between the two being only one of length" (Cruttenden, 2008:130)

Mispronunciation of incorrect pronunciation of /ɔ:/ can be perceived in the speeches of Polish speakers of English, due to the reasons of different place and manner of articulations. /ɔ:/ is described as a long vowel which is "articulated with medium lip-rounding; the back of the tongue is raised between the open-mid and close-mid positions, no contact being made between the tongue and the upper molars" (Cruttenden, 2008:130).

Similarly, Czech speakers of English mispronounce the diphthong /əʊ/ in BrE and /oʊ/ in NAE. It is a glide beginning "at a central position, between close-mid and open-mid, and moves in the direction of /ʊ/, there being a slight closing movement of the lower jaw; the lips are neutral for the first element, but have a tendency to round on the second 24 element. The starting-point may have a tongue position similar to that described for /ɜ:/" (Cruttenden, 2008:140).

In the light of the aforementioned information, the perceptibility of long vowels and diphthongs is explored by the following research questions:

1. Is there a meaningful difference between the pre-test and post-test?
2. What is the general overall success rate of all participants?
3. What is the success rate of questions from 1 to 12 (long vowels)?
4. What is the success rate of questions from 13 to 22 (diphthongs)?
5. What is the success rate of success for each vowel?
6. Do the students need a treatment?

2. Method

2.1. Setting and Participants

Present study examined the perception of English long vowels and diphthongs by 30 Turkish English instructors. 30 MA instructors who enrolled to an MA course called ELT 507 Educational phonology and intonation analysis of English took place as participants at a foundation university in Ankara in 2018. Of the 30 Turkish English instructors, 25

of them were females while 5 of them were males. Their age range changed from 24 to 36. This research was conducted in the course of the teaching period of the aforementioned course.

2.2. Measures

The data for this study were collected using a multiple-choice test with five alternatives. The first goal of this research was to explore perceptions of the participants on the long vowels and diphthongs of English language. A committee of three experts examined the test items and made the required modifications. After getting a unanimous consent of the committee, a pre-test of 24 items that included 12 items for long vowels and 12 items diphthongs was administered to the participants. While the participants worked on the questions to answer, no auditory input was given to them. They just saw each question with five alternatives on pages and answered them.

After the administration of the pre-test, the test results were submitted to 21 software package. By analyzing the pre-test results, a three-hour intense teaching and exercising process took place. In terms of exercises, broad transcriptions gathered from Longman Dictionary of American English (2008) and Longman Dictionary of Contemporary Dictionary English (2012) and practiced in class. In addition, Baker's book (2000) Ship or Sheep-An Intermediate Pronunciation Course and Baker and Goldstein's book (2008) Pronunciation pairs: An introduction to the sounds of English were reviewed and their exercises were practiced in class

Adequate imitations, repetitions, and reinforcement giving took place in class. In addition, certain spelling rules were reviewed, exemplified by using many vocabulary items whose grammatical category shifts were demonstrated in classroom practices. All of the questions asked by the participants were analyzed, exemplified and answered in class. After waiting 15 day, the pre-test was administrated again as the post test

2.3. Data Collection Instruments and Data Analysis

The data obtained from the post-test was entered into the SPSS 21 software package.

3. Results and Discussion

The collected data from pre-test and post-tests were analyzed by SPSS 21. According to data analysis, the general findings in line with the research questions are presented below.

3.1. Is there a meaningful difference between the pre-test and post-test?

In order to find out whether there is a statistically significant difference between pre-test and post-test scores of the participants' a Paired Samples T-Test was conducted assuming that the case for this sample group requires parametric tests in use. Accordingly, there was a statistically significant difference between pre-test scores (M= 5.636, SD=.12), and post-test scores (M=7.924, SD=.13) t(29) = 6.036, p =.000 as can be seen in the table 1 below:

Table 1: Paired Samples T- Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	post_overall - pre_overall	,22879	,20761	,03790	,15127	,30631	6,036	29	,000

As mentioned, the mean score of the post-test is **%79** and pre-tests' is **% 56.** Therefore, the percentage of ascent is **% 23.**

3.2. What is the general overall success rate of all participants?

For the sake of understanding the participants' success rate on identification of long vowels and diphthongs, pre-test and post-tests, descriptive statistics were used for identifying the mean score for valid cases. First of all, Table 2 shows, the mean score of pre-test is 5.636 out of 10 (SD =.12). According to that it can be said that the participants' success rate is % 56 for the pre-test. On the other hand, the mean score of post-test is 7.924 out of 10 (SD = .13). Namely, the participants' success in post-test can be regarded as % 79. As mentioned, it can be concluded that participants' post-test scores are higher than their pre-test scores. In terms of overall success rate, the mean is 6.705 out of 10 (SD = .07), namely the percentage of overall success is % 67.

Table 2: Descriptive statistics for pre-test and post-test results

Descriptive Statistics

	N	Min	Max	M	SD	%
pretest	30	0	6	5.636	.12	56
posttest	30	3	8	7.924	.13	79
overall	30	5	8	6.705	.07	67
Valid N (listwise)	30					

Table 3: Descriptive statistics including all the items in ascending order

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
item 5	30	,00	1,00	,1667	,37905	16
item 8	30	,00	1,00	,1667	,37905	16
item 18	30	,00	1,00	,2000	,40684	20
item 9	30	,00	1,00	,4333	,50401	43
item 11	30	,00	1,00	,5000	,50855	50
item 17	30	,00	1,00	,5667	,50401	56
item 12	30	,00	1,00	,7000	,46609	70
item 6	30	,00	1,00	,7333	,44978	73
item 3	30	,00	1,00	,9000	,30513	90
item 7	30	,00	1,00	,9000	,30513	90
item 13	30	,00	1,00	,9333	,25371	93
item 16	30	,00	1,00	,9333	,25371	93
item 1	30	,00	1,00	,9667	,18257	96
item 2	30	1,00	1,00	1,0000	,00000	100
item 4	30	1,00	1,00	1,0000	,00000	100
item 10	30	1,00	1,00	1,0000	,00000	100
item 14	30	1,00	1,00	1,0000	,00000	100
item 15	30	1,00	1,00	1,0000	,00000	100
item 19	30	1,00	1,00	1,0000	,00000	100
item 20	30	1,00	1,00	1,0000	,00000	100
item 21	30	1,00	1,00	1,0000	,00000	100
item 22	30	1,00	1,00	1,0000	,00000	100
Valid N (listwise)	30					

Table 3 includes all the sentences in ascending order. The highest score belongs to items 2, 4, 10, 14, 15, 19, 20, 21, 22 and the lowest scores belong to Item 5. The other items also demonstrated in the table

3.3. What is the success rate of questions from 1 to 12?

Table 4 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
item5	30	,00	1,00	,1667	,37905	16
item8	30	,00	1,00	,1667	,37905	16
item 9	30	,00	1,00	,4333	,50401	43
İtem 11	30	,00	1,00	,5000	,50855	50
item12	30	,00	1,00	,7000	,46609	70
item6	30	,00	1,00	,7333	,44978	73
item3	30	,00	1,00	,9000	,30513	90
item7	30	,00	1,00	,9000	,30513	90
item1	30	,00	1,00	,9667	,18257	96
item2	30	1,00	1,00	1,0000	,00000	100
item4	30	1,00	1,00	1,0000	,00000	100
item10	30	1,00	1,00	1,0000	,00000	100
Valid N (listwise)	30					

The table 4 displays the post-test scores of the long vowels. As one can understand, the higher score belongs to Item 10, 4, 2 and the lower score belongs to Item 5.

Table 5 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
item8	30	,00	1,00	,1000	,30513	10
item5	30	,00	1,00	,1667	,37905	16
item9	30	,00	1,00	,1667	,37905	16
item6	30	,00	1,00	,2667	,44978	26
item11	30	,00	1,00	,3000	,46609	30
item12	30	,00	1,00	,5000	,50855	50
item3	30	,00	1,00	,5667	,50401	56
item7	30	,00	1,00	,6667	,47946	66
item10	30	,00	1,00	,7667	,43018	76
item1	30	,00	1,00	,8667	,34575	86
item2	30	,00	1,00	,9000	,30513	90
item4	30	,00	1,00	,9667	,18257	96

Valid N (listwise)	30

The table 5 displays the pre-test scores of the topic sentence at the beginning in ascending order. As one can understand, the higher score belongs to Item 4 and the lower score belongs to Item 8. One can conclude that all the scores increased.

3.4. What is the success rate of questions from 13 to 22

For

Table 6 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
item18	30	,00	1,00	,2000	,40684	20
item17	30	,00	1,00	,5667	,50401	56
item13	30	,00	1,00	,9333	,25371	93
item16	30	,00	1,00	,9333	,25371	93
item14	30	1,00	1,00	1,0000	,00000	100
item15	30	1,00	1,00	1,0000	,00000	100
item19	30	1,00	1,00	1,0000	,00000	100
item20	30	1,00	1,00	1,0000	,00000	100
item21	30	1,00	1,00	1,0000	,00000	100
item22	30	1,00	1,00	1,0000	,00000	100
Valid N (listwise)	30					

The table 6 displays the post-test scores of the diphthongs. As one can understand, the highest score belongs to Item 22, 21, 20, 19, 15, 14 and the lowest score belongs to Item 18.

Table 7 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
pre18	30	,00	1,00	,1333	,34575	13
pre17	30	,00	1,00	,1667	,37905	16
pre13	30	,00	1,00	,5667	,50401	56
pre21	30	,00	1,00	,5667	,50401	56
pre16	30	,00	1,00	,6333	,49013	63
pre22	30	,00	1,00	,7333	,44978	73
pre14	30	,00	1,00	,7333	,44978	73
pre15	30	,00	1,00	,8333	,37905	83
pre20	30	,00	1,00	,8667	,34575	86
pre19	30	,00	1,00	,9333	,25371	93

Valid N (listwise)	30

Table 7 displays the pre-test scores of the diphthongs in ascending order. As one can understand, the highest score belongs to Item 19 and the lowest score belongs to Item 18. One can conclude that all the scores increased.

3.5. What is the success rate of success for each vowel?

Table 8 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	%
/ju:/	30	,50	1,00	,9833	,09129	98
/u:/	30	,50	1,00	,9500	,15256	95
/ɑ:/	30	,00	1,00	,4500	,24033	45
/ɜ:/	30	,00	1,00	,5333	,26042	53
/ɔ:/	30	,50	1,00	,7167	,25200	71
/i:/	30	,00	1,00	,6000	,33218	60
/aɪ/	30	,50	1,00	,9667	,12685	96
/eɪ/	30	,50	1,00	,9667	,12685	96
/oʊ/	30	,00	1,00	,3833	,36397	38
/aʊ/	30	1,00	1,00	1,0000	,00000	100
/ɔɪ/	30	1,00	1,00	1,0000	,00000	100
Valid N (listwise)	30					

Table 8 displays the scores of each vowel in variable order. As one can understand, the highest score belongs to **/aʊ/** and **/ɔɪ/** and the lowest score belongs to **/ɑ:/**. One can conclude that all the scores increased.0

3.6. Do the participants need a treatment?

According to the findings of the present study, even though the participants' post-test scores were higher than their pre-test scores, a treatment should be conducted by taking the sampling context into consideration as the sample group consisted of the Turkish English lecturers who enrolled in a Foreign Language Teaching program for Master's Degree.

In addition, there are some items which have low scores such as Items 8, 9, 5, and 18. They can be the focal point for remedial treatment, too. Besides, further research can be done on the reasons why the participants had low scores on these specific items.

4. Discussion and findings

After After the application of the post-test**,** the overall success on the perception of longing vowels and diphthongs can be stated as follows:

Phoneme	Perception%
/aʊ/	100
/ɔɪ/	100
/juː/	98
/aɪ/	96
/eɪ/	96
/uː/	95
/ɔː/	71
/iː/	60
/ɜː/	53
/ɑː/	45
/oʊ/	38

It must be noted that **/iː, oʊ, ɑː, ɜː/** phonemes happen to be the most confusable long vowels and diphthongs to Turkish English lecturers. "While /ɑː/ phoneme does not sound too much foreign to Turks, the /æ/ phoneme does not exist in Turkish vowel inventory at all, and therefore the students feel a bit strange in hearing and using it in their speech" (Demirezen 2017: 261). Up until now, the difficulty of the /ɑː/ phoneme was measured as 48% in an earlier research by Demirezen (2017: 262).

A three-hour practice and exercising on long vowels and consonants does not seem to be sufficient enough for the perceptual maturity. Therefore, the participants must undergo a treatment perhaps three hours more on the perception of long vowels and diphthongs.

The following figures indicate the perception of diphthongs as 86%.

Diphthongs	Perception rank order %
/aʊ/	100
/ɔɪ/	100
/aɪ/	96
/eɪ/	96
/oʊ/	38

Similarly, the overall perception percentage of long vowels is 73,3.

Long	Perception

vowels	rank order %
/ju:/	98
/u:/	95
/ɔ:/	71
/i:/	60
/ɜ:/	53
/ɑ:/	45

Apparently, the success rate like **73,3** % on long vowels demonstrate that they are not perceived satisfactorily by Turkish English lecturers.

As a diphthong /oʊ/ exposes a specific articulation difficulty for Turkish learners of English because they neglect or overlook at the fact that /oʊ/ and /ɑ:/ phonemes require a specific backward movement of the dorsum muscles of the tongue, as indicated by figure 1:

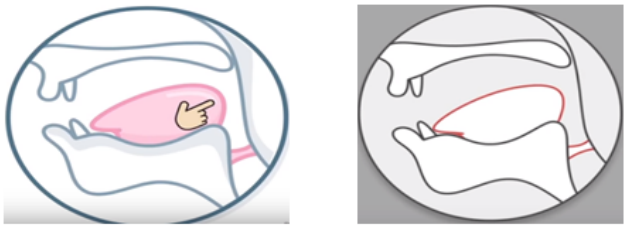


Figure 1: Articulatory position of dorsum for /oʊ/ and /ɑ:/ phonemes of English. Adapted from: https://www.youtube.com/watch?v=7EdRAfOMfnU

In Turkish, there is no /oʊ/ diphthong whose /ʊ/ part of it has been never heard and therefore not properly noticed by Turks. Moreover, /oʊ/ is spelled by several letters in English orthography:

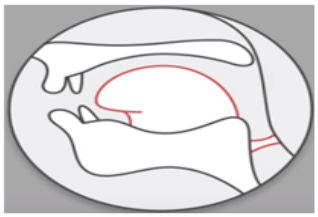
Letter(s)	Examples
o	as in *bone*, gold, *joke, home, hope, most, rope, post, told, vote*,
oa	as in *boat, boast, coat, goat, road, soap, toast*,
ow	as in *blow, crow, flow, grow, snow, slow,*
oe	as in *foe, toe, Joe*

The multi-representation of the /oʊ/ diphthong by different letters creates a ***pycho-ortographic trauma*** to Turkish learners of English and leads them not to notice it clearly.

In fact, the long vowel /ɑ:/ exists in Turkish, as in *aza* /ɑ:zɑ:/(member), *asa* /ɑ:sɑ:/(baton), *dava* /dɑ:vɑ:/(lawsuit), and *vaha* /vɑ:hʌ/(oasis), its spelling in English must have distracted the participants since it is spelled by the a bunch of letters:

Letter(s)	Examples
a	as in *barn*, car, carpark, *cart, card***,** *carp***,** *clock, far, father, hard, watch,*
o	as in *apologize, apostle, cop, box biology, job, got John, top, stop*
ea	as in *heart, hearth*

Likewise, the long vowel /i:/ requires a tongue position just in the middle of the oral cavity in which the tongue must be stand just in the middle of the mouth and glide to the front of the mouth, as indicated by figure 2; even though there is long /i:/ phoneme in Turkish, as in *emin* /emi:n/(sure), *emir* /emi:ɾ/ (emir), *metin* /meti:n/ (gritty), and *velî* /veli:/(patron), the participants got distracted over the Turkish- English articulatory similarity on /i:/.



/i:/

Figure 2: Articulatory position of the tongue for /i:/ phoneme of English. Adapted from: (https://www.youtube.com/watch?v=7EdRAfOMfnU)

Again, the long vowel /i:/ is the represented by a bunch of letters in spelling, which distracts attention of Turks who cannot pay due attention to the recognition and production of /i:/. Letter(s) Examples

e	as in *b**e**, **e**qual, **e**vening, h**e**, sh**e**, P**e**ter, **E**dith, m**e**,*
ee	as in *bee, beer, cheese, coffee, deep, eel, feed, feel, leek, need, peel, sheep, three*
ea	as in *bean, cheap, dean, deal, eat, easy, leak, leaf, leave, meal,* peace*, seal, tea*
ie	as in *belief, believe, hygiene, movie, piece, relief, sieve*
i	as in *machine, pique, pistachio, pizza, police, ski, taxi, visa, automobile*
io	as in *portfolio, polio, radio, pistachio, Pinnochio, ratio*
ia	as in amnesia, *aviator, cafeteria, piano, pizzeria,* Romania,
ei	as in *deceive, either, perceive, receive, seize,* weird, *weirdo*
ey	as in *attorney,* hey, heyday, *honey, key, money, prey, trey*
y	as in *airy, bury, carry, early, funny, only, mostly, ready, sunny, very,*

As for the /ɜ:/ sound, during the articulation process while the dorsum is raised a bit up towards the dorsum, the apex should be elevated to the alveolar ridge and never touch there, as indicated by figure 3; there is an /ɜ:/ sound in Turkish, but we never curve the tip of the tongue towards upper alveolar ridge and back of the tongue up to uvula, which must have forced the participants attention.

Figure 3: Articulatory position of the tongue for /ɜ:/ sound of English. Adapted from: https://www.youtube.com/watch?v=7EdRAfOMfnU

In English, /ɜ:/ is spelled many different ways; it is also accepted as a reflex of the /ɹ / phoneme; that is why it is called as a /ɹ /-controlled sound.

Letter(s) Examples

er as in *certain, concern, determine, her, person, personal, personnel, prefer, were*
ir as in *bird, birth, birch, circle, dirt, first, flirt, girl, girdle, girder, girth, third, sir*
ur as in *burden, burn, bury, curtain, hurdle, hurt, occur, nurse, purse, turn, Thursday, urn,*
or as in *word, work, world, worst, worth*
ear as in *earn, earl, earnest, earth, heard, learn, pearl*

5. Conclusions

You The current study had as a primary aim the question of how NAE long vowels and diphthongs are perceived by Turkish English instructors. Further research is needed to improve the perception rate of NAE long vowels and diphthongs by the Turkish English instructors who perceived the long vowels by a rate 73,3 % while they perceived the diphthongs by a rate of 86 % after a three-hour concentrated study. Apparently, in order to improve the recognition levels of / i:, oʊ, ɑ:, ɜ:/, a three-hour more study is required to mature the participants' perceptional skills.

In terms of perception and articulation of vowels, no discussion of English vowels is complete unless it includes long vowels and diphthongs, which are confusable. Turkish English instructors perceive the diphthongs (86,3%) better than long vowels (73,3%). Apart from L1 intervention, the main cause of inadequate perception both behind the diphthongs and long vowels is the fact that Turkish learners of English suffer from a psycho-orthographic trauma created by the varied spelling of them by means of several letters.

6. Limitations to the research

As with the majority of studies, the design of the current research is subject to limitations. Therefore, the statistical results reported herein should be considered in the

light of some limitations, such as number of the participants (30 instructors of English language education), the period of instruction, and a questionnaire with 22 items. So, it must be borne in mind that no study is completely flawless or inclusive of all possible aspects.

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https://www.youtube.com/watch?v=7EdRAfOMfnU

https://www.google.com.tr/search?q=The+chart+of+North+American+english+diphthongs&

Appendix A. Questionnaire

FIND OUT THE INDICATED VOWEL PHONEMES IN THE FOLLOWING WORDS

In which of the following words is there an /juː/ phoneme?

1.a) behavior b) bureaucracy **c) beautiful** d) bulletin e) bulldozer

2. a) unjustified b) unknowingly c) unlicensed d) uninterested **e) universe**

In which of the following words is there an **/uː/** phoneme?

3.**a) enthusiasm** b) etiquette c) eruption d) equator e) equality

4. a) attraction **b) attitude** c) attentive d) attendance e) authentic

In which of the following words is there an **/ɑː/** phoneme?

5.a) phonetics b) phlegmatic c) philanthropy d) photogenic **e) photography** 6.a) hysteria b) hypocrite c) hypertension **d) hypothesis** e) hypnosis

In which of the following words is there an /ɜː/ phoneme?

7. **a) commercial** b) commission c) communal d) commentary e) committed 8**.** a) encounter **b) encourage** c) endeavor d) endanger e) endurance

In which of the following words is there an **/ɔː/** phoneme?

9.a) auxiliary b) available c) auditorium d) opposition **e) authority**

10**.**a) perfume b) perfectionist c) perception **d) performance** e) permission

In which of the following words is there an **/iː/** phoneme?

11.a) assumption **b) associate** c) astonished d) assimilate e) assistance

12. a) automatic b) automation **c) automobile** d) automotive e) audiovisual

In which of the following words is there an **/aɪ/** phoneme?

13. **a) enterprise** b) entertain c) enumerate d) entailment e) instalment

14.a) assemble b) aspiration c) assimilate d) asparagus **e) assignment**

In which of the following words is there an **/eɪ/** phoneme?

15. **a) integrate** b) intellect c) intensify d) intentional e) intellectual

16. a) evidence b) example **c) examination** d) existence e) experience

In which of the following words is there an **/oʊ/** phoneme?

17. a) environment b) epilogue c) entrepreneur d) interpreted e) **envelope**

18**.** a) assumption b) astonishing c) astronaut **d) associate** e) astrology

In which of the following words is there an **/aʊ/** phoneme?

19. a) surrender **b) surrounding** c) surveyor d) surprising e) survivor 20. **a) allowance** b) alcoholic c) alphabet d) allegory e) alternative

In which of the following words is there an **/ɔɪ/** phoneme?

21. a) empower b) emotion **c) employer** d) empower e) emergent
22. a) enormous b) enlighten c) environment d) enlighten e) **enjoyable**
