

إدراك وإنتاج طلاب اللغة الإنكليزية في جامعة حمص للتغيرات التي تطرأ على الوحدات الصوتية

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الملخص

يواجه متعلمو اللغة الإنكليزية بوصفها لغة أجنبية صعوبة كبيرة في تطوير مهارات التحدث بسبب ضعف قدرتهم على إدراك وتحليل التغيرات الصوتية عند سماعهم لها كما ينطقها المتحدثون الأصليون. وغالبًا ما يصعب على الطلاب نطق الكلمات بشكل صحيح، خاصةً تلك التي تحتوي على التغيرات الصوتية التي تطرأ على الوحدات الصوتية، وذلك نتيجة عدم تعرضهم الكافي للغة الإنكليزية كما ينطقها المتحدثون الأصليون، بالإضافة إلى تأثير لغتهم الأم على تعلمهم لهذه التغيرات. تتوجه الدراسة الحالية إلى دراسة جانبي الإدراك والنطق لهذه التغيرات الصوتية، حيث تم استخدام أداتين رئيسيتين في جمع البيانات: الأداة الأولى اختبار الإدراك الذي تضمن قياس قدرة ثلاثين طالبًا على فهم التغيرات الصوتية من خلال الاستماع إلى تسجيلات صوتية نطقها متحدثون أصليون. أما الأداة الثانية فكانت اختبار النطق الذي يقيّم قدرة الطلاب على إنتاج كلمات وعبارات تحتوي على هذه التغيرات. وأظهرت النتائج أن طلاب اللغة الإنكليزية في جامعة حمص يواجهون صعوبة كبيرة في إدراك التغيرات الصوتية، كما أنهم غير قادرين على إنتاج نطق دقيق يشابه نطق المتحدثين الأصليين عند لفظ كلمات تحوي هذه التغيرات. كما أكدت النتائج على أهمية السياق في إدراك الكلمات التي تحتوي على التغيرات الصوتية، وكذلك على دور التعرض المسبق لنطق المتحدثين الأصليين في تحسين القدرة على إنتاج هذه التغيرات. وعلاوة على ذلك، تبين وجود علاقة قوية بين إدراك التغيرات الصوتية وإنتاجها. بناءً على هذه النتائج، وختامًا تم اقتراح عدد من التوصيات التي من شأنها مساعدة الطلاب في تحسين قدرتهم على فهم وإنتاج التغيرات الصوتية في اللغة الإنكليزية.

الكلمات المفتاحية: التغيرات الصوتية، متعلمو الإنكليزية كلغة أجنبية، إدراك الكلام، النطق، مهارة الاستماع.

Perception and Production of Allophonic Variations by Students of English at Homs University

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Abstract

English as a Foreign Language learners encounter challenges in acquiring spoken English, largely due to their limited ability to perceive English produced by native speakers. They often struggle with producing many words, particularly those involving allophonic variations. Insufficient exposure to native speech, combined with interference from their first language, contributes to various errors in both the perception and production of allophones. This study affiliated to the field of phonetic perception and pronunciation, aims to investigate how English language students at Homs University perceive and produce allophonic variations. To achieve this, two main instruments were utilized. The first was a perception test designed to assess the ability of thirty students to recognize allophonic variations after listening to recordings by native speakers. The second was a production test, which evaluated the students' ability to

articulate words and phrases containing allophonic variations. The analysis of both tests provided insights into the students' areas of weakness and the possible causes behind their poor performance in both perceiving and producing these variations. The findings clearly indicate that the students struggle with recognizing allophonic variations and fail to produce native-like pronunciation when the words or phrases contain allophonic variations. Moreover, the results highlight the significance of contextual cues in accurate perception, and emphasize the role of frequent exposure to native speech in improving production. Notably, a strong correlation was found between the students' perceptual skills and their production abilities. The study concludes with several recommendations that aim to enhance learners' perception and production of English allophones.

Keywords: allophones, EFL learners, allophonic variation, flapping, speech perception, pronunciation, listening skill.

1. Introduction

Learning English can be a challenge for non-native speakers. To achieve success in understanding and producing spoken language, learners of English as a Foreign Language (henceforth, EFL) have to deal with the English phonological system including different units and segments, i.e. phonemes and allophones. They have to be aware of allophonic variations' presence. Learning allophones is an important step to master spoken English since it has an effective role in understanding native speech and producing native-like speech. Phonemes are articulated in different ways

according to the context. The different pronunciations of the same phoneme are called allophones. For instance, the phoneme /t/ may be pronounced as aspirated [t^h], unreleased [t̚], normal [t] or flap[r]. Nevertheless, learners have to be aware that changing the pronunciation of the phoneme does not change the meaning of the word.

Learners who are not aware of allophonic variations' presence may not realize the different ways of producing the same word, and that normally leads to lexical confusion. They will not have a native-like pronunciation, and in most cases, their speech may be incomprehensible. EFL learners often struggle to perceive allophones due to challenges in understanding proper pronunciations. Scholars have linked the weak proficiency in Foreign Language (henceforth, FL) pronunciation to a number of reasons such as pedagogy, curriculum, and teachers. In Arab countries, EFL classes tend to neglect the importance of understanding English pronunciation due to the influence of traditional teaching methods like grammar-translation, which considers pronunciation irrelevant in EFL classes. As a result, minimal attention has been paid to pronunciation, spoken language, listening skills, and communicative abilities. Only in the recent years, some efforts were carried out to teach pronunciation in EFL courses, but the focus was mainly on production rather than perception (Mustafa, 2019).

In addition, the different ways of dealing with sounds between First Language (henceforth, L1) and FL can cause difficulty in understanding and producing allophonic variations by EFL learners since in Arabic there

are no phonological processes or variants that are quite similar to those in English. According to Al-Badri (2014), the variations in the pronunciation of the glottal stop between Arabic and English speakers can be explained by noting that in Received Pronunciation (henceforth, RP) and other English varieties, the glottal stop is considered an allophone, whereas in standard Arabic, it is a phoneme. It is only in some dialects of Arabic that the glottal stop is considered an allophone. In Arabic, the equivalent of the glottal stop is referred to as hamzat al qat'.

1.2 Significance of the Study

This study is important since it examines how the students of the English Department at Homs University perceive and produce spoken English, offering insights into their linguistic competence. It explores the challenges they face with allophonic variations and highlights how understanding these variations can improve their pronunciation and listening skills. The research also emphasizes the role of allophones in lexical processing and their impact on the clarity and comprehension of spoken English. This study addresses both perception and production across several allophonic variations offering a more comprehensive perspective.

1.3 Objectives of the Study

This study aims at examining whether the intended research sample (i.e., students of English at Homs University) can understand spoken English containing allophonic variations and if they can produce them correctly. It is an attempt to determine the relationship between perception and production as it attempts to identify the influence of students' perception on

their production and vice versa by detecting the correlation between perception and production of allophonic variations.

1.4 Research Questions

The research aims to answer the following questions:

- 1) Can students of English at Homs University perceive allophonic variations within a word or a phrase produced by native speakers of English?
- 2) Can they accurately produce allophonic variations?
- 3) Is there a correlation between the perception of allophonic variations and its production?

1.5 Limitations of the Study

This study is limited to fourth-year students of English at Homs University, as they have completed coursework in phonology and phonetics and are more familiar with allophonic variations. It specifically examines certain English allophones such as flapping, aspiration, glottalization, nasal flap, assimilation, /l/ variants, and palatalization.

2. Literature Review

2.1 Introduction

This section introduces a brief review of concepts and processes that are relevant to allophonic variations' perception and production, and it focuses on specific studies on allophonic variations.

2.2 Allophone and Phoneme

Cruttenden (2008, p. 41) defines the term phoneme as "the smallest contrastive linguistic unit which may bring about a change of meaning. Indeed, the word 'contrast' is regularly used in linguistics to indicate a change of meaning". Allophones, however, as defined by Shea (2010, p.1), are some segments that "are used as variants of a single phoneme".

2.3 Variation

Allophonic variation depends on the position of the sound in the word or the sentence. The variant is produced spontaneously by speakers. As Cruttenden (2008, p.78) explains, "Where variation within phonemes is concerned, most speakers are unaware of their own changing speech patterns". It is well known that the main English accents are American, British, and Australian. Some variants are connected to a specific accent. For instance, flap/ r/ as a variant of /t/ sound is connected to American accent.

2.4 Connected Speech Processes

A connected speech process (CSP) may lead to changes in sound quality. Alameen & Levis (2015, p.1) states "The pronunciation of words in

connected speech may leave vowel and consonant sounds relatively intact, as in some types of linking, or connected speech may result in modifications to pronunciation that are quite dramatic, including deletions, additions, or changes of sounds into other sounds, or combinations of all three in a given word in context". Here are some CSPs that related to this research work.

2.4.1 Palatalization

Palatalization is a modification to consonant's articulation. In some languages, such as, Russian, palatalization is phonemic while in some other languages is morphophonemic. However, in English palatalization is allophonic. Before front vowels, phonemes palatalize allophones in specific contexts. Zsiga (1994, p.67) states that "in American English, alveolar obstruents (/t, d, s, z/) become palatoalveolars (tʃ, dʒ, ʃʒ) before the (palatal) glide /j/. Palatalization is obligatory at the lexical level, as illustrated by pairs such as habit / habitual, grade / gradual, confess / confession, and please /pleasure. Palatalization also appears to apply, optionally, at the post-lexical level, as in the phrases hit you, made you, press your point, and please yourself".

2.4.2 Assimilation

In an assimilation processes, a sound changes to become similar to a nearby sound. This process occurs within a single word or between two words. McMahon (2002,p.4) states that "processes of assimilation like this

involve two sounds close together in a word becoming closer together in terms of pronunciation, making life easier for the speaker by reducing vocal tract gymnastics. Assimilation is an everyday occurrence in every human language; and it is particularly common for nasal sounds".

2.4.3 Flapping (Flap [r])

The use of the alveolar flap [r] is a key feature of American English pronunciation. Picard (1997) notes that Alveolar oral and nasal stops are undergoing a process called flapping or tapping in certain well-defined environments for some varieties of English, including the majority of North American dialects.

2.4.4 Glottalization

Glottal stop or glottal plosive refers to the sound that is produced by the glottis. Glottalization is a process in which "the glottis may be held tightly closed, with the lung air pent up below it. This 'glottal stop' [ʔ] frequently occurs in English, e.g., when it precedes the energetic articulation of a vowel as in apple [ʔ] or when it reinforces /p, t, k/ as in clock [ʔ] or even replaces them, as in cotton [ʔ]" (Cruttenden, 2008, p.9).

2.5 Variants of /t/

Hung (2014, p. 27) discusses the allophonic variations of the English phoneme /t/, noting that its articulation changes depending on its position within a word. The plosive /t/ can appear at the beginning (initial position), in the middle (medial position), or at the end (final position) of a word. He also highlights differences between British and American pronunciations of /t/. To clarify the distinction between British and American pronunciation of /t/, Hung (2014, p. 27) notes: "For example, in BBC pronunciation, we find the following: hit, set. Those with the American accent may say turn /t/ into /d/ when it is in final position".

2.6 Aspiration

Aspiration typically occurs in voiceless stops such as /p/, /t/, and /k/ when they appear at the beginning of a stressed syllable. McMahon (2002) simplifies the understanding of the aspiration process when he suggests that in order to observe aspiration, hold a sheet of paper in front of your mouth by its lower edge, allowing the upper part to move freely. Then, pronounce the words *Paul*, *tall*, and *call*. You will notice a slight puff of air released after the initial sounds /p/, /t/, and /k/, which causes the paper to move. This is known as aspiration and is represented in IPA transcription with a superscript [h] following the consonant symbol.

2.7 Variants of /l/

The English phoneme /l/ is commonly categorized into two allophones: the clear (light) /l/, which occurs in syllable-initial positions, and the dark [ɫ], which typically appears in syllable-final positions (Ladefoged & Johnson,

2014). The difference between the dark [ɫ] and clear /l/ lies in their place of articulation, as "the clear and dark /l/s exhibit different sequence and magnitude concerning the tongue tip and tongue dorsum" (Nagamine, 2022, p. 644).

2.8 Previous Studies on Allophonic Variations

A number of research works have been conducted to study production and perception of allophonic variations. Shea (2010) explores how learners acquire allophonic variations through a series of perception and production experiments. The study investigates whether learners can associate specific allophones with their appropriate phonological contexts and how language experience affects this ability. Results show that learners gradually learn to track the distribution of allophones and link them to their phonological environments. Additionally, learners appear to store detailed phonetic information and use it more effectively as they gain experience. The study emphasizes the importance of recognizing context in allophone acquisition and highlights the interaction between perception, production, and experience. It is related to the current study in its dual focus on perception and production of allophonic variation.

Several studies have been conducted by Syed to examine how Pakistani learners acquire allophones of English. Syed (2014) explores the impact of a learner's first language (hence, L1) laryngeal features on their ability to acquire allophonic differences in English plosives. It focuses on how aspects such as voice onset time (hence, VOT) and aspiration in English are shaped by the phonetic characteristics of the learner's native language.

The findings indicate that these L1 laryngeal contrasts significantly influence how second language learners produce and perceive English plosive sounds. The researcher employs an experimental design, utilizing acoustic analyses to compare the VOT of plosives produced by participants who are adult Pakistani learners of English, with a focus on those whose L1 exhibited laryngeal contrasts. The findings indicate that the presence or absence of laryngeal contrasts in the L1 significantly influenced the learners' acquisition of English plosive allophones. Learners whose L1 lacks such contrasts face challenges in acquiring the English aspiration contrast, leading to deviations from native-like pronunciation.

However, Syed's (2015) subsequent study centers on how second language learners acquire allophonic variation in English lateral sounds. It examines the influence of the phonetic system of the learners' L1 on their ability to recognize and produce different forms of the English /l/ sound. The results show that L1 phonetic patterns have a strong effect on learning English lateral allophones, as learners frequently apply articulatory habits from their native language when speaking English. This study utilizes both perceptual and production tasks to assess the learners' ability to perceive and produce allophonic variations of English lateral sounds. Acoustic analyses are also conducted to examine the phonetic realizations of these sounds. The participants are adult Pakistani learners of English, specifically focusing on those whose L1 exhibited lateral sounds with distinct allophonic variations. The findings indicate that learners' L1 lateral allophonic patterns influences their perception and production of English lateral allophones. Learners whose L1 had more complex lateral allophones demonstrated

greater sensitivity to English lateral variations, leading to more accurate production. Conversely, those with simpler L1 lateral systems exhibited more pronounced deviations from native English lateral pronunciation. These studies are relevant to the current study as they explore perception and production of allophonic variations in English.

A study conducted by Viebahn and Luce (2018) explores how increased exposure and phonetic context influence the recognition of words produced with nasal flaps in American English. It focuses on listeners' ability to adapt to allophonic variation, particularly flapped variant. Two experiments were conducted: the first tested whether increased exposure alone helps with recognition, showing improvement over time among sixty native English speakers. The second experiment involved forty-eight participants and tested recognition in different phonetic contexts, revealing that words with flapped variants are recognized more quickly in casually spoken sentences than in carefully spoken ones. The study concludes that nasal flap variants, especially the flap /r/, remain challenging even for native speakers to perceive accurately.

Mustafa (2019) investigates how Arab EFL learners perceive and produce the American English allophonic variant /r/ (flapping). The study includes 119 participants taught by non-native English-speaking teachers and uses three experimental tests, each with versions containing flapped and non-flapped words, along with informal interviews. A reading test with flapped words is used to assess production. Results from a paired t-test show that participants struggle to perceive flapping and that there is a positive

correlation between perception and production of the /r/ variant. The study highlights the challenges Arab learners face with allophonic variations and emphasizes the importance of perception for accurate pronunciation.

Finally, Tišma (2019) examines how Serbian EFL learners perceive and produce various English allophonic variations such as tapping, l-velarization, syllabicity, aspiration, and glottal stopping, highlighting their importance for native-like pronunciation. The study involves 35 second-year English majors selected based on their performance on a mid-term test focused on allophones and connected speech. Tišma (2019) conducts both perception and production tasks, testing seven types of allophones using different sentences for each task. The findings reveal that learners performed better in perception than in production. The study also explores the relationship between perception and production, making it relevant to the current research.

3. Methodology and Data Collection

This section outlines the methodology adopted in this research, including the instrument, the sample, the items, and the procedure.

3.1 The Instrument

I designed two original tests to assess students' ability to perceive and produce allophonic variation: a perception test and a production test. The perception test evaluated participants' ability to identify allophonic

variations, while the production test assessed their accuracy in producing these variations.

3.2 The Sample

The perception and production tests were administered to 30 fourth-year students of English at Homs University. Participants were selected randomly, with no consideration given to gender or academic performance.

3.3 Material

3.3.1 The Perception Test Items

Twelve audio files were prepared for the perception test, featuring phrases and sentences produced naturally (at a normal speaking rate) by a native English speaker. The test included two lists: one with target words and phrases in isolation, and another with the same items embedded in context. The audio content was selected from authentic English sources (documentaries, talk shows, and news clips) using YouGlish website. A written list accompanied the audio, organized into 12 categories. Each representing one audio file. For each item, participants chose between a correct and incorrect pronunciation. The test targeted various allophonic processes, including flapping (within words and phrases), aspiration, glottalization (medial and final), nasal flap, assimilation (progressive and regressive), /l/ allophones (clear and dark), and palatalization (within words and phrases).

3.3.2 The Production Test Items

Two lists were prepared for the production test. The first list was presented in written form along with an audio file to assess students' ability to produce allophonic variations after exposure. The second list included different lexical items but maintained the same allophonic processes (flapping, aspiration, glottalization, nasal flap, assimilation, dark [ɫ], clear /l/, and palatalization) in the same sequence to examine students' ability to produce allophonic variations without exposure.

3.4 Procedure

3.4.1 Perception Test Procedure

Thirty students were informed about the purpose of the perception test and agreed to participate voluntarily. After receiving instructions, each was given a paper with two word lists and asked to listen to an audio recording. While listening, they underlined the words or phrases they recognized. The test was conducted over five days, with six students per day, due to time constraints. Each participant used my mobile phone in a quiet classroom to ensure clear audio.

3.4.2 Production Test Procedure

Participants were given two written lists for the production test. First, they listened to an audio of the first list, read by native speakers, while reading along with the written version. This helped assess the perception–production link, as the list matched that used in the perception test.

After recording the first list, they were asked to read the second list without prior audio exposure, allowing comparison between production with and

without exposure to native input. Recordings were done individually in a quiet classroom using my mobile phone to ensure clear audio. Data collection took place over five days, with six participants per day.

4. Results and Discussion

This section presents the participants' performance in both perception and production tests, assessing their familiarity with the target words and phrases those with allophonic variations. The results of the two tests are analyzed and displayed through illustrative tables, followed by a detailed discussion. A quantitative approach was employed, with participants' responses statistically analyzed using the Formula Bot program. Descriptive statistics were used to calculate the percentages of correct and incorrect responses in each category.

Perception and production scores were compared using a Student's t-test via the DATAtab program. The same software was employed to assess the significance of correlation coefficients, examining the relationship between the two tests. The participants' speech production was compared to that of native speakers. I conducted a subjective analysis of the recordings by listening to and assessing their performance. This approach aligns with previous research, including studies by Bradlow (2015), Bin Hussein (2022), and Barzilai (2023), which examined the perception and production of allophonic variations through auditory evaluation rather than using speech analysis tools such as Praat.

It is important to note that the following data analysis procedures were applied exclusively to the results of the main study. The results of the pilot study, which involved a limited sample of ten fourth-year students, are reported separately (see **Appendix IV**) and were not included in the main analysis. The pilot study was conducted to assess the reliability of the research instruments.

4.1 Perception Test Analysis

4.1.1 First List (words and phrases with allophonic variations in isolation)

Table (1) and Figure (1) present the twelve categories in the first test list. Table (1) shows each category's name, the total number of participants, the numbers and percentages of correct and incorrect responses. The first five categories represent /t/ variants (word-level flapping, phrase-level flapping, nasal flap, and glottalization in medial and final positions), while the remaining seven cover other allophonic processes: aspiration, progressive and regressive assimilation, light /l/, dark [ɫ], and palatalization within words and phrases.

The most challenging categories were word-level flapping, nasal flap, and phrase-level palatalization, each with a 100% error rate. These were followed by final-position glottal stop (90%) and medial glottal stop (86.67%). Phrase-level flapping and dark [ɫ] showed 66.67% errors, while word-level palatalization had 63.33%, and aspiration 53.33%. In contrast,

light /l/ (16.67%), regressive assimilation (13.33%), and progressive assimilation (10%) had the lowest error rates.

Categories	The total number of the participants	The number of correct answers	The percentage of correct answers	The number of wrong answers	The percentage of correct answers
1.Flapping within a word	30	0	0%	30	100%
2.Flapping within a phrase	30	10	33.33%	20	66.67%
3.Nasal flap	30	0	0%	30	100%
4.Glottalization medial	30	4	13.33%	26	86.67%
5.Glottalization final	30	3	10%	27	90%
6.Aspiration	30	14	46.67%	16	53.33%
7. Progressive Assimilation	30	27	90%	3	10%
8. Regressive Assimilation	30	26	86.67%	4	13.33%
9. Light/l/	30	25	83.33%	5	16.67%
10. Dark{t}	30	10	33.33%	20	66.67%
11. Palatalization within a word	30	11	36.67%	19	63.33%
12. Palatalization within a phrase	30	0	0%	30	100%

Table (1) the first list of Perception test

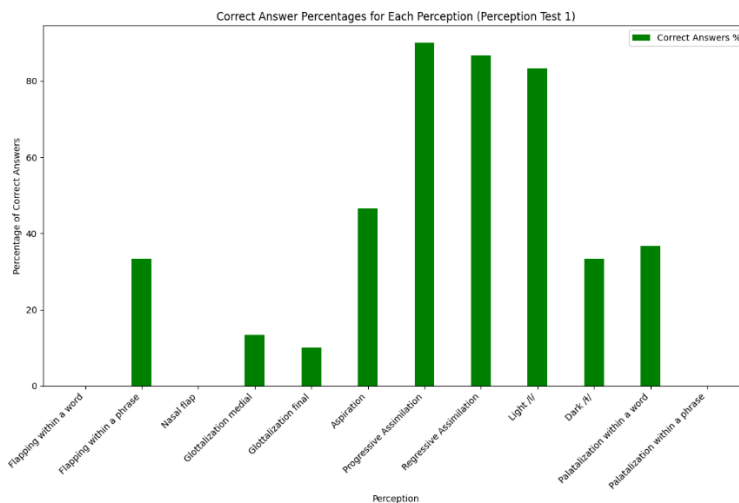


Figure 1. Column chart illustrating the percentage of correct answers of perception test

4.1.2 Second List (words and phrases with allophonic variation in context)

Table (2) and Figure (2) present the twelve categories from the second test list, showing the percentages of correct and incorrect responses for each allophonic variation (as detailed in 4.2.1). Overall performance improved when words and phrases appeared in context. The most difficult category was palatalization within a phrase (93.33% error), followed by nasal flap (90%) and flapping within a word (80%). Glottalization in final and medial positions also showed high error rates (70% and 63.33%, respectively). Errors declined in categories like dark [ɫ] (53.33%), palatalization within a word (50%), flapping within a phrase (50%), and clear /l/ (40%). Aspiration showed moderate difficulty (36.67%), while progressive assimilation (13.33%) and regressive assimilation (10%) were the least challenging.

Categories	The total number of the participants	The number of correct answers	The percentage of correct answers	The number of wrong answers	The percentage of wrong answers
1.Flapping within a word	30	6	20%	24	80%
2.Flapping within a phrase	30	15	50%	15	50%
3.Nasal flap	30	3	10%	27	90%
4.Glottalization medial	30	11	36.67%	19	63.33%
5.Glottalization final	30	9	30%	21	70%
6.Aspiration	30	19	63.33%	11	36.67%
7. Progressive assimilation	30	26	86.67%	4	13.33%
8. Regressive assimilation	30	27	90%	3	10%
9. Light/l/	30	18	60%	12	40%
10. Dark[ɫ]	30	14	46.67%	16	53.33%
11. Palatalization within a word	30	15	50%	15	50%
12. Palatalization within a phrase	30	2	6.67%	28	93.33%

Table 2. The second list of perception test

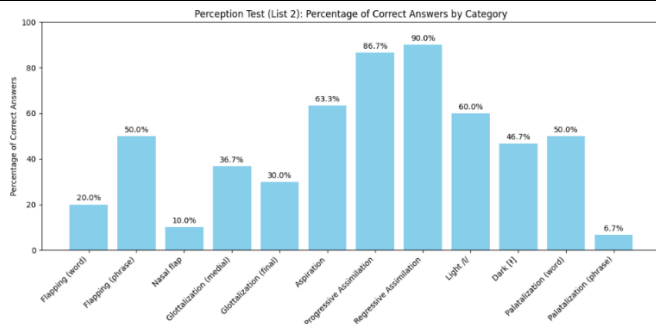


Figure 2. The second list of perception

A paired-sample t-test was conducted to determine whether there was a significant difference in the perception of allophonic variations in isolation versus in context. The t-test revealed no statistically significant difference between the two lists (isolation vs. context), as the p-value (0.19) is greater than the common alpha level of 0.05, indicating failure to reject the null hypothesis. However, the mean difference indicates improved accuracy when allophonic variations were presented in context, compared to when they appeared in isolation.

4.2 Discussion of the Perception Test

In the first list, students found phrase-level flapping easier to perceive than word-level flapping, while glottalization was more challenging, and all participants failed to recognize the nasal flap. In the second list, /t/ variants were perceived more accurately, suggesting that context aided recognition. Aspiration, clear /l/, and dark [ɫ] scored higher than /t/ variants in both lists. Assimilation showed the highest scores overall, likely due to its familiarity across languages. For example, participants had no difficulty perceiving the assimilation in *information* ([ɪnfəmeɪʃən]), as it sounded natural. Thus, assimilation was the easiest variant to identify in both lists.

When comparing the two lists, it is found that the second list scores higher than the first list. This emphasizes the importance of the context and its effect on the perception of allophonic variations. For instance, in the audio, the word 'weighted' is produced in American accent (with the allophonic variant flapped/t/). The context was very important to help some students understand the words contained allophonic variations and avoid confusion.

The results revealed that even after audio exposure and contextual support, participants continued to struggle with certain variants particularly palatalized variants, flapped variants, and glottal stop that scored lower than others. This difficulty stems from their reliance on the adapted English typically used in EFL classrooms and limited awareness of distinctions between phoneme allophone. As Brown (1990) notes, L2 learners must learn to make informed guesses using contextual cues and adjust their interpretation dynamically much like native speakers do during real-time listening.

4.3 Production Test Analysis

Tables (4) and (5), along with Figures (4) and (5), present the twelve production categories, showing participant totals and the percentage of correct and incorrect pronunciations for both test lists. In the first list, several categories—including flapping within a word, final-position glottalization, aspiration, regressive assimilation, and dark [ɫ]—had 0% correct production, while progressive assimilation recorded the highest accuracy at 83.33%. Similarly, in the second list, progressive assimilation remained the most accurately produced variant (83.33%), whereas nine

categories, including various flapping, aspiration, and palatalization forms, showed 0% accuracy.

Categories of allophonic variations	The total number of the participants	The number of correct answers	The percentage of correct answers	The number of wrong answers	The percentage of correct answers
1.Flapping within a word	30	0	0%	30	100%
2.Flapping within a phrase	30	3	10%	27	90%
3.Nasal flap	30	6	20%	24	80%
4.Glottalization medial	30	4	13.33%	26	86.67%
5.Glottalization final	30	0	0%	30	100%
6.Aspiration	30	0	0%	30	100%
7. Progressive assimilation	30	25	83.33%	5	16.67%
8. Regressive assimilation	30	0	0%	30	100%
9. Light{/}	30	22	73.33%	8	26.57%
10. Dark{/}	30	0	0%	30	100%
11. Palatalization within a word	30	4	13.33%	26	86.67%
12. Palatalization within a phrase	30	0	0%	30	100%

Table 4. The first list of the production test

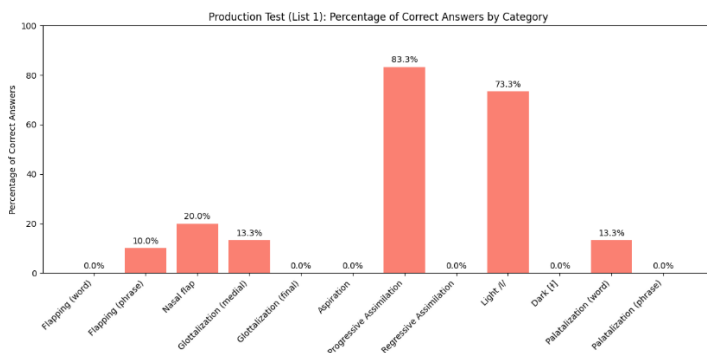


Figure 5. Percentage of correct answers in the first list of production test

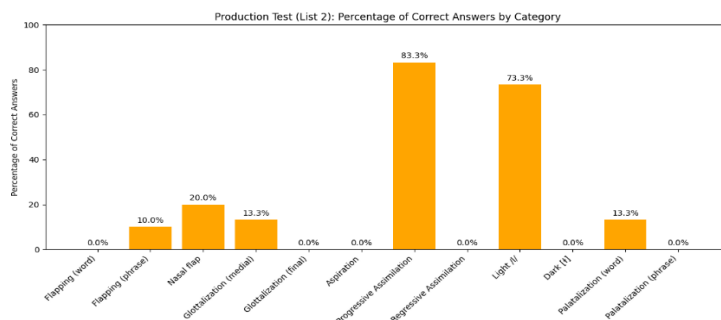


Figure 6. Percentage of correct answers in the second list of production test

To determine whether there was a difference between the first list (production after exposure) and the second list (production without exposure), a paired-samples t-test was conducted to compare participants' ability to produce allophonic variations in both conditions.

The t-test revealed a statistically significant difference between the two production lists since the p-value (0.024) is less than the typical significance level of 0.05. The null hypothesis was rejected. There was a statistically significant difference between students' scores in the first list and the second list of production test. This indicates that students performed significantly better in producing allophonic variations after exposure compared to without exposure.

4.4 Production Test Discussion

Students at the English Department at Homs University face noticeable challenges in producing certain allophonic variants, mainly due to negative L1 interference. Many of these variants, such as dark [ɫ] and aspiration, are absent in Syrian Arabic. As a result, all participants mispronounced

dark [ɫ] as clear /l/ or laam, and replaced aspirated /p/ with /b/, reflecting a transfer of L1 phonological features into L2 production. Another contributing factor is the students' limited listening and speaking skills, which hinder accurate reproduction of these variants. Mustafa (2019) notes that learners who struggle with recognizing and producing allophonic variations tend to be inactive in language use, rarely engage with English outside the classroom, and show low motivation to improve their pronunciation or speaking skills.

Notably, participants were more successful in producing allophonic variations in familiar words. For example, after exposure, four participants correctly produced *forgotten* [fɔrgʔen], while none produced *kitten* ['kɪʔn] with a glottal stop, as it was unfamiliar. These findings highlight the role of exposure in developing native-like pronunciation.

4.5 Perception–Production Link

In this section the research question (Is there a correlation between perception and production?) will be answered. I used a Pearson correlation coefficient to find the correlation between the perception of allophonic variations and their production. After combining the two lists for each test (perception and production), the correlation was computed. The Pearson correlation coefficient of 0.8391 indicated a strong positive correlation between the perception and production tests. This suggests that as the performance on one test increases, the performance on the other test tends

to increase as well. The p-value of 6.95e-09 is much smaller than 0.05, indicating that the correlation is statistically significant.

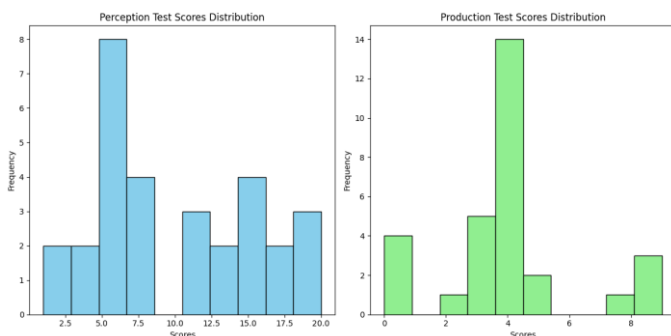


Figure 7. The difference between perception and production tests' scores

When comparing perception and production scores, the perception test scored higher. The findings of the current study align with previous research, showing consistent results across both tests. Tišma (2019) notes that it is expected to find perception scores higher than production, as perception generally precedes production. Moreover, Alshangiti (2015) reported a strong correlation between perception and production among EFL learners. Also, Mustafa (2019, p.134) found that "there was a positive correlation between the perception of flapping scores and the degree of its production by the participants". Additionally, Derwing and Munro (2005) emphasized the importance of the perception–production link, arguing that perception significantly influences production and that a strong correlation exists between the two. In contrast, Almbark (2010) argued that accurate

perception does not always result in accurate production. Similarly, Buali (2010), studying EFL learners' perception and production of /p/, also reported a weak relationship between the two.

5. Pedagogical Implications

Based on the findings of this study, several recommendations are proposed to enhance the performance of Syrian students of English:

1. Students need greater awareness of the distinction between phonemes and allophones. Phonological transcription practice can improve their pronunciation accuracy and reduce difficulties in spoken English learning.
2. Understanding allophones theoretically is insufficient for recognizing them in natural native speech. Learners should be trained to sharpen their listening skills and become more aware of the presence of allophonic variations.
3. The Syrian curriculum should focus on developing students' perception and production abilities by incorporating regular exposure to native speakers and speaking practice within phonetics courses. Additionally, listening and speaking skills should be formally assessed in exams. Mustafa (2019) stresses the importance of using authentic native speech in phonology lessons while guiding students to identify and reproduce allophones, thereby raising their awareness of phoneme variations.

4. English teachers in Syria should aim to maintain a native-like accent to be as effective pronunciation models for their students.
5. Since EFL learners benefit from practicing allophone pronunciation by imitating native speakers, the use of shadowing technique in classrooms can facilitate producing a more native-like accent.
6. Students should be encouraged to regularly listen to authentic English content produced by native speakers.
7. Watching subtitled English materials such as documentaries, TV shows, or movies on platforms like YouTube or YouGlish can help learners connect written and spoken language, thereby enhancing both their perception and production skills.

6. Recommendations for Further Research

This study may be conducted at English departments at other Syrian universities to validate the findings across a broader range of academic contexts. While the current study focused on specific allophones such as the flapped /t/, aspirated sounds, glottal stop, nasal flap, assimilated variants, allophones of /l/ (dark [ɫ] and clear /l/), and palatalized variants, further research could explore additional types, such as devoiced allophones. Moreover, future studies could investigate the causes of misperception and mispronunciation of these variants, including how perception difficulties may lead to specific verbal errors.

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Appendices

Appendix I

Perception test items

I The First list of the perception test

Please listen to the audio then choose the word which you heard:

- | | |
|-------------------|----------------|
| 1. a) Weighted | b) waded |
| 2. a) get up | b) ger up |
| 3. a) sinner | b) center |
| 4. a) Forgotten | b) Forgoen |
| 5. a) lay | b) Late |
| 6. a) phik | b) pick |
| 7. a) bagz | b) bags |
| 8. a) information | b) imformation |
| 9. a) white | b) light |
| 10. a) hope | b) help |
| 11. a) bless you | b) blesh you |
| 12. a) chree | b) tree |

II. The second list of the perception test

Please listen to the audio then choose the right word which stands for the word you heard in the context:

1. A massive -----net is dragged along the seafloor.

a) weighted b) waded

2. We have got to ----- within 35 feet of the vehicle.

a) get up b) ger up

3. We lost eleven employees who worked in the world trade -----
.

a) sinner b) center

4. You 've -----heading one on this page.

a) Forgotten b) Forgoen

5. It is based upon -----Roman types of helmet.

a) Lay b) Late

6. You----- a handful of them.

a) phik b) pick

7. We are going to place it into the----- that are provided.

a) bagz b) bags

8. Giving us-----about when they were diagnosed

a) information b) imformation

9. They had developed a special low-----.

- a) white b) light

10. We need ----- in calming down at key moments.

- a) hope b) help

11. Bits of -----, old blankets, plastic sheeting.

- a) chree b) tree

12. With joyful hearts and minds we----- for your mercy.

- a) bless you b) blesh you

Appendix II

Production test items

I The First list of the production test

Please listen to the audio then read the following words and phrases

1. Weighted: ['weɪrəd].

2. Get up: [gerəp].

3. Center: [ˈsɪrə].

4. Forgotten: [fɔrgɪn].
5. Late: [leɪ]
6. Pick: /pʰɪk/
7. Bags: [bægz].
8. Information: [ɪnfəmeɪʃən]
9. *Light* /laɪt/
10. Help: [heɪp].
11. Tree: [t ri:].
12. Bless you:[bleɪyou].

Appendix III

II The second list of the production test

Please read the following words and phrases

1. Butter ['bʌrə]
2. I got it [aɪ ga: ɪt]
3. Twenty ['twɛɪ]

4. Kitten ['kɪʔn]
5. Right: [raɪʔ]
6. Keel /khi:l]
7. Legs /legz/→ [legz]
8. Ten points /tɛn pɔɪnts/ → [tɛmpɔɪnts]
9. Live [lɪv]
10. Real [ri:əɫ]
11. Education [edʒə'keɪʃən]
12. Let you [letʃ ju]

Appendix IV

In Appendix IV, the results of the pilot study of the two tests (test of perception and the test of production) are given. Moreover, since the pilot study was only preliminary, the test items were not scored for assessment, not least because the data of the pilot study are practically insufficient to carry out detailed analysis. Credible comparison between the performances of different tests requires a large sample. The following tables (from 1 to 4) illustrate the performance of the respondents in the pilot study. In the first table, the responses to the first list of perception are given. The numbers of correct and wrong pronunciations of the first list and second list of production are reported in third and fourth tables.

Categories	The total number of the participants	The number of correct answers	The number of wrong answers
1.Flapping within a word	10	0	10
2.Flapping within a phrase	10	2	8
3.Nasal flap	10	0	10
4.Glottalization medial	10	1	9
5.Glottalization final	10	1	9
6.Aspiration	10	4	6
7. Progressive assimilation	10	8	2
8. Regressive assimilation	10	7	3
9. Light{/l/}	10	8	2
10. Dark{/ɫ/}	10	5	5
11. Palatalization within a word	10	3	7
12. Palatalization within a phrase	10	0	10

Table 1. The first list of perception test

Categories	The total number of the participants	The number of correct answers	The number of wrong answers
1.Flapping within a word	10	3	7
2.Flapping within a phrase	10	5	5
3.Nasal flap	10	1	9
4.Glottalization medial	10	3	7
5.Glottalization final	10	2	8
6.Aspiration	10	4	6
7. Progressive assimilation	10	7	3
8. Regressive assimilation	10	6	4
9. Light{/}	10	8	2
10. Dark{/}	10	4	6
11. Palatalization within a word	10	5	5
12. Palatalization within a phrase	10	1	9

Table2.The second list of perception test

Categories	The total number of the participants	The number of correct pronunciations	The number of wrong pronunciations
1.Flapping within a word	10	0	10
2.Flapping within a phrase	10	1	9
3.Nasal flap	10	3	7
4.Glottalization medial	10	1	9
5.Glottalization final	10	0	10
6.Aspiration	10	0	10
7. Progressive assimilation	10	7	3
8. Regressive assimilation	10	0	10
9. Light{/}	10	6	4
10. Dark{/}	10	0	10
11. Palatalization within a word	10	2	8
12. Palatalization within a phrase	10	0	10

Table 3.The first list of production test

Categories	The total number of the participants	The number of correct pronunciations	The number of wrong pronunciations
1.Flapping within a word	10	0	10
2.Flapping within a phrase	10	0	10
3.Nasal flap	10	0	10
4.Glottalization medial	10	0	10
5.Glottalization final	10	0	10
6.Aspiration	10	0	10
7. Progressive assimilation	10	8	2
8. Regressive assimilation	10	1	9
9. Light/[l]	10	2	8
10. Dark[ɫ]	10	0	10
11. Palatalization within a word	10	0	10
12. Palatalization within a phrase	10	0	10

Table 4.The second list of production test