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On the Efficacy of a Communicative Framework in Teaching English Phonological Features Absent in Persian to Iranian EFL Learners

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Abstract

Although Persian and English share many common phonemes, some phonological features are present in English but absent in Persian which tend to lead to mispronunciation on the part of Persian learners of English, mostly through negative transfer. The present research assesses the efficacy of a communicative framework in improving Iranian adult EFL learners' pronunciation of five English phonological features (four phonemes and initial double consonant clusters starting with /s/) which are absent in the phonological system of Persian. Thirty EFL learners, divided into experimental and control groups, participated in the training course which lasted 22 sessions (330 minutes). The experimental group was instructed using the communicative framework for teaching pronunciation while the control group received traditional methods of pronunciation teaching. The pronunciation quality of these sounds was then assessed by four native and four non-native English teachers as well as by the PRAAT speech analysis software in the case of the vowels. Although no significant difference was detected between the experimental and control groups with regard to post-test results, a positive trend was observed in favor of the experimental group regarding specific features (e.g., formant, frequencies, duration, the center of gravity) of the problematic sounds.

***Keywords*:** Pronunciation, Communicative framework, Iranian EFL learners, Consonant cluster, Epenthesis, Formant, Center of gravity

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INTRODUCTION

Pronunciation plays a major role in both personal and social lives of the speakers of any language, including second language (L2) speakers' (Celce-Murcia, Brinton, Goodwin & Griner, 2010; Gluszek & Dovidio, 2010; Pennington & Rogerson-Revell, 2019; Seidlhofer, 2001); it is a crucial component of L2 proficiency (Gilbert, 2018; Hismanoglu, 2006, Thir, 2020) and contributes significantly to speech intelligibility and thus effective communication (Brown, 2014, Chun, 2012). Despite its importance, teaching and learning pronunciation was not high on the L2 researchers' and educators' agenda up until the recent past. Derwing and Munro (2005, p. 389) note that "Other aspects of pedagogy [e.g., grammar and, vocabulary] receive extensive attention in teacher preparation courses and materials, but in many instances, L2 instructors are left to teach themselves how to address pronunciation with their students." Pronunciation also presents L2 learners with a serious challenge because acquiring the skill engages cognitive, and affective as well as psychomotor domains (Celce-Murcia et al., 2010).

ELT, then, seems to be on shaky grounds when it comes to teaching pronunciation, especially in EFL contexts where access to authentic materials and good models are rather limited and teachers are hesitant to dedicate themselves to the practice of pronunciation (Baker, 2011). The reasons for this hesitation can be their own experience as a language learner or factors such as inexperience, lack of specialized training, resources, and institutional support (Murphy, 2014).

Considering the obstacles in the teaching of pronunciation, presenting EFL teachers with a practical communicative framework that can segmentize the process into manageable phases to help the learners can be a productive step forward; a framework which is regrettably missing among the more popular methods of teaching pronunciation within the ELT literature. The present research, therefore, aims to employ a communicative framework devised by Celce-Murcia, Brinton, Goodwin, and Griner (2010) to teach Iranian EFL learners five phonological features, that is, four

phonemes and initial double consonant clusters (CCs) starting with /s/ sounds of the English language which are absent in Persian, their first language (L1), therefore causing noticeable pronunciation difficulties for them (Moradi & Chen, 2018).

The present research can help illustrate the efficacy of a well-defined communicative framework on the pronunciation of the Iranian adult EFL learners. Results from this research can encourage L2 teachers and material developers to apply similar frameworks in their syllabi in order to help the students gain a better command of pronunciation and become more confident in their oral production and reception.

LITERATURE REVIEW

Although not having a native or native-like pronunciation in an L2 may not necessarily interfere with communicating meaning, good pronunciation can increase the effectiveness of communication (Levis, 2018; Richter, 2019). It is also worth mentioning that although the main goal in pronunciation training is to improve L2 learners' oral production, pedagogical focus on pronunciation can also have a positive effect on the speech perception of the learners, that is, it helps learners by making them familiar how to interpret speech perceptually. This view has been investigated through the Motor Theory of Speech Perception (Liberman, Cooper, Shankweiler & Studdert-Kennedy, 1967, see also Whalen, 2019). Studies have shown that pronunciation practices can, in fact, help the students with their perception of language and in turn enable them to develop bottom-up skills needed in perceiving the message (Trofimovich & Baker, 2006; Kartushina, Hervais-Adelman, Frauenfelder & Golestani, 2015).

Despite pronunciation being an important component of a learner's proficiency in L2 (Gilbert, 2018; Loewen, 2015), ELT has yet to achieve a fail-safe way to incorporate it in the English as a Second/Foreign Language (EFL/ESL) classes. Issues such as workload, time constraints and lack of adequate training for the teachers in regard to pronunciation are some of the

reasons behind the lack of devotion to and success in teaching pronunciation (Celce-Murcia et al., 2010; Derwing & Munro, 2015; Elliott, 1997). A possible reason for the present situation can be found in the way in which pronunciation had been approached before the introduction of communicative language theories in the 1970s and 1980s. While pronunciation is now considered a component of communicative competence, it was just a component of linguistic competence in those times (Pennington & Richards, 1986).

Pronunciation Problems among Iranian Learners

Seddighi (2012) conducted a research to probe more about the Iranian EFL learners' pronunciation problems. She studied pronunciation problems among 30 female learners in three levels of proficiency. The learners' pronunciation was analyzed through read-aloud tasks and interviews. The results showed that in case of vowels, all participants tended to replace /ə/ with /e/ or /a:/, thus replacing an absent sound in Persian, their first language (L1), with those they are already familiar with. Instances of epenthesis were also observed as the learners inserted vowels in CCs. Mistakes in pronunciation of the diphthong /aʊ/ were also observed in all three levels. In the case of consonants, the pronunciation of /θ/ and /ð/, both absent in Persian, was erroneous. These two consonants were mostly replaced with /t/ and /d/ sounds. The velar nasal /ŋ/ and the past morpheme (ed) were another source of consonant mispronunciation in all proficiency levels.

Navehebrahim (2011) has also researched common segmental errors among Iranian adult learners. He has found four common vowel errors that arise from the replacement of the correct vowel with the faulty one. These pairs include /ɛ/ with /æ/, /ʌ/ with /ɑ /, /ɪ/ with /i/ and /ʊ/ with /u/. Regarding the consonants, he points out to the errors in pronunciation of dental fricatives /θ/ and /ð/, epenthesis (e.g., /tereɪn/ instead if /treɪn/) and prosthesis (e.g., /esku:l/ instead of /sku:l/), stronger puff of air when stop consonants such as /p/, /t/ or /k/ are pronounced, problems in pronunciation

of voiced velar nasal sound /ŋ/ and the replacement of the glide sound /w/ with voiced labiodental fricative /v/. The source of many of these pronunciation errors has been attributed to the influence of the learners' L1 known as interference or negative transfer (Bardovi-Harlig & Sprouse, 2017).

Negative Transfer among Iranian EFL Learners

Studies conducted to examine the effects of the negative transfer on the oral production of Iranian EFL learners (e.g., Fatemi, Sobhani & Abolhasani, 2012; Seddighi, 2012) support the idea of L1 interference in pronunciation. An instance that supports this idea is the pronunciation of /p/ phoneme which in similar studies causes problems among Arab learners who do not have the sound in their L1 (Elmahdi, 2015) in contrast with the Iranian students who do and therefore pronounce it more effortlessly in English. In his research on phonological difficulties of Persian-speaking learners of English and in an attempt to track the L1 transfer, Namaziandost (2017) found out that the learner's L1 had a great effect on their production of English sounds. He observed the following segmental pronunciation errors:

1. Substitution of the English /w/ by /v/ due to the fact that /w/ does not exist in Persian;
2. English /ŋ/ being substituted by Persian /ŋg/, probably due to its orthography as the written form of this consonant includes the letters "n" and "g" together;
3. The replacement of verbalized /ɬ/ with a non-verbalized version, therefore dark /ɬ/ being replaced with clear /l/ in a word like "full";
4. Substitution of English syllabic /n̩/ by Persian /-en/ which is due to negative transfer rooting in the absence of syllabic consonant /n̩/ in Persian;
5. Substitution of liquid English syllabic /r̩/ with the Persian /r/;
6. Initial CCs pronunciation difficulties due to the fact that Persian phonological system does not allow such a combination in word-

initial position;

7. Replacement of the English /ɛ/ vowel with /e/ sound;
8. Replacement of the English schwa sound with a variety of other vowels;
9. Tendency toward the use of the vowel /a:/ instead of /o:/ (e.g., pronunciation of "taught" as /ta:t/); and,
10. Replacement of the English /Λ/ with the Persian /a[1]/ as in words such as "done" and "Enough".

Namaziandost (2017) concludes that although anxiety might have had a role in influencing the learners' erroneous oral production, the interference of L1 can quite reasonably be the major reason for errors in the pronunciation of the participants.

The effects of the negative transfer on segmental and suprasegmental aspects of Iranian EFL learners' language production was studied by Toghyani Khorasagani, Toghyani Khorasagani, and Keshti Aray (2015) who associate the pronunciation problems of the learners with three areas concerning vowel production: a. the number of vowels, b. tense/lax distinction and c. the pure/glide. Regarding consonants, the researchers associated the problem to the difference in numbers, CCs, and their manner and place of articulation. The difference between stress patterns in words and sentences are also among the suprasegmental factors for the Iranian EFL learners' pronunciation errors. Based on the results of this study in order to decrease the number of pronunciation problems among Iranian EFL learners, three suggestions can be made: 1. Increasing the learners' knowledge about English sounds which are absent in their Persian inventory of sounds, 2. teaching the rules of combining consonants in English, and, 3. teaching different stress patterns of English, especially when stress can change the part of speech and the meaning of the word.

[1] Unlike Namaziandost (2017), the authors of this article believe the /ɑ/ phoneme seems to be more accurate.

PURPOSE OF THE STUDY

The present study, utilizing a quasi-experimental design with pretest, post-test control group, investigated the effectiveness of a communicative framework to assist Iranian adult EFL learners with the production of five English phonological features (four phonemes and initial CCs starting with /s/) which are difficult to pronounce because they do not exist in their L1. Those phonological features were chosen based on previous studies on Iranian learners' pronunciation difficulties (Fatemi, Sobhani & Abolhassani, 2012; Gilakjani, 2016). They included: 1. voiced dental fricative consonant (eth /ð/), 2. voiceless dental fricative consonant (theta /θ/), 3. schwa (/ə/), 4, the short (/ɪ/), and 5. initial CCs starting with the /s/ sound. The independent variable of the study was Celce-Murcia et al.'s (2010) communicative framework for teaching pronunciation and the dependent variable was the learners' ability to correctly pronounce the five phonological features presented in Table 1.

Table 1: The five problematic phonological features which are the focus of the present study

Phonological Features	Descriptions	Examples
Consonants	1. voiced dental fricative: /ð/	**th**at – **th**erefore
	2. voiceless dental fricative: /θ/	**th**orn – for**th**
	3. initial CCs starting with /s/	**sm**ell – **st**ay
Vowels	4. mid-central vowel: /ə/	**a**gain – s**u**pport
	5. close front vowel: /ɪ/	sh**i**p – s**i**t

Research Question

Thus, the research question of the study was: "Does the application of Celce-Murcia et al.'s (2010) communicative framework of teaching pronunciation significantly improve Iranian EFL learners' pronunciation of five problematic phonological features (i.e. /ð/, /θ/, /ə/, /ɪ/, and initial CCs starting with /s/)?"

To provide an objective answer to the question, the following null hypothesis was posited: "The application of Celce-Murcia et al.'s (2010) communicative framework does not have any significant effect on the pronunciation of the five problematic English phonological features by Iranian adult EFL learners." The hypothesis was broken down into two sub-null hypotheses for the four phonemes (i.e. /ð/, /θ/, /ə/, /ɪ/): 1. the post-test production of (features of) each phoneme by the learners is not different from native speakers', and 2. there is no significant difference between the participants' pre- and post-test scores regarding the production of each phoneme. In case of the consonant clusters, which were directly related to the presence or absence of vowel epenthesis, the results were not compared with the native/standard criteria and only one null hypothesis was considered: there is no significant difference between the post-test results of the experimental and control groups regarding the production of the five phonological features.

METHOD

Participants

Thirty adult EFL learners at a male and a female branch of a single language institute in Tehran were chosen to participate in this study. The age of the participants ranged from 18 and 43 years, averaged about 28 years old; they all spoke Persian as their first language. The participants, 20 male, and 10 female, did not have a history of any language disorders and were not participating in any other accent training program during the research. The learners were randomly assigned to either the control or experimental group but they were not aware of the experimental and control categorization. By blinding the study this way, the researchers hoped to reduce the participant bias (subject bias) and increase the validity of the experiment.

The researchers used the institute's own placement test as a basis for choosing and placing the learners in three groups of basic, intermediate, and advanced. The male participants were chosen through cluster sampling. The

female participants were chosen through convenience sampling since it was not feasible for the researchers, both being male, to visit and teach the classes in the girls' branch due to some gender-related restrictions set by the Ministry of Education of Iran. The researchers' associates in one of the girls' branches of the institute thus advertised the research and 10 female students in three levels answered the call. The female learners underwent the same procedure in the nearly identical environment in a class in a kindergarten which was both accessible to the participants and the researcher-teacher (the second author of this article). All the necessary permissions were obtained and the proper protocols were implemented for the learners' participation in this study, which was on a completely voluntary basis. The learners attended 22 research sessions (including the pre- and post-test recordings), usually after their class time had finished. Each session lasted approximately 15 minutes.

The experimental group practiced pronunciation using the communicative framework and the control group practiced through techniques used most commonly by Iranian EFL teachers. The techniques, which were gathered through interviews with a sample of teachers each with more than 15 years of experience, consisted of A. presenting the sound, B. mechanical repetitions and controlled drills, and C. error correction by the teacher. The amount of time each group underwent the practice was equal.

Instrumentation

Placement Test

The institute, from which the participants were selected, has specialized in teaching English to adult male students for more than five decades and has an in-house placement criterion to determine the proficiency of its learners. The researchers used that test to ascertain the homogeneity of the participants and to help find a correlation between proficiency and pronunciation and place them in three groups of basic, intermediate, and advanced.

Pretest and Post-test

The pre- and post-test each consisted of six reading passages (a pair for each level) and included several target words that contained the problematic sounds. The leaners had to read these passages out loud. Possible improvement of participants' pronunciation was measured through a comparison of their pre- and post-test results.

The authenticity of the materials has proven to be an imperative attribute of communicative approaches (Beckman & Kinghammer, 2006; Nunan, 1988; Widdowson, 1990). The authenticity of the task is also important for it is linked with the construct validity of the test (Bachman & Palmer, 1996). As the texts used in the pre- and post-test of the research needed to include a certain number of target words, extracting an authentic text from print media that contained all those words was not possible. The researchers thus chose the target words and composed pieces of writing based on authentic templates (e.g., advertisements, movie reviews, news clips, essays, etc.). Two experienced Iranian EFL teachers and three native English speakers (an Australian and two Canadian college students) were consulted to analyze the texts in terms of their authentic and realistic tone. Based on the feedback received from these five evaluators, two of the original texts were completely replaced due to a high level of difficulty, and the rest underwent minor changes. After receiving confirmation that the texts were as authentic as the real-life cases, they were used as the data extraction tools.

As mentioned before, each of the passages included some target words that carried the problematic phonological features (see Table 1). The target words were chosen through a randomization process to eliminate the possibility of decreasing the validity of the research by unintentionally choosing specific words. This process was as follows:

- A: For words containing CCs and /ɪ/ and /i/ sounds:
  A large sample of words containing the problematic phonemes was

extracted from the English File Project [2]online dictionary based on the Common European Framework of Reference for Languages (CEFR) levels (basic user, independent user & proficient user). This sample included 3740 words containing the /ɪ/ and /i/ sounds and 1507 words with initial CCs.

- The words were fed into the MS Excel program. Each was issued a number. The program was then used to extract a list of random numbers whose corresponding words were used in the composition of the text.
- B. For words containing the schwa and dental fricatives:
  A dictionary was consulted: It was opened on random pages and words containing the target sounds were recorded and grouped by their level of difficulty.

After the target words were chosen, they were used for the composition of the six pre- and post-test texts. The CEFR references were consulted to grammatically structure the texts to make them appropriate to the students' levels. These texts were later read by the participants and their voices were recorded.

Digital and printed copies of the texts in which the target words were highlighted were sent or emailed to four Iranian and four native English-speaker raters (two Americans and two Canadians). All Iranian and English-speaker raters were experienced teachers with more than 10 years of experience in the fields of EFL and ESL. They were asked to place a checkmark in a box above the keywords which they judged to have been pronounced correctly. By calculating the number of these errors, an objective and measurable evaluation of each participant's general pronunciation was attained. Objectivity is an evasive goal to reach when the scores are given through personal decisions, even if those decisions are controlled by the research. Apart from this objective estimation, each

[2] English Vocabulary Profile is a collaborative project between University of Cambridge, British Council, University of Bedfordshire and English UK institute, currently in its pilot level.

examiner stated his/her subjective, personal view of the participants' overall pronunciation of the text by giving a score on the scale of one to five, from *unintelligible* to *highly intelligible.*

Celce-Murcia et al.'s (2010) Communicative Framework for Teaching Pronunciation

In a reaction to the traditional identification of phonology as an accurate production of individual phonemes (Pennington & Richards, 1986) and with the advent of communicative approaches to language teaching which considered pronunciation as an important part of the communicative competence, Celce-Murcia et al. (2010) proposed teaching pronunciation based on the tenets of CLT, specifically through what they called a Communicative Framework for Teaching Pronunciation. They have listed five key principles on which the framework is based :

1. Language is best learned within a larger framework of communication.
2. Classroom materials and associated tasks create a desire for the students to communicate.
3. Language acquisition happens more effectively by making learners active participants.
4. Language syllabus enables the students to express notions through functions (social interactions)
5. Taking risks is encouraged and students' errors are seen as a natural part of the communicative process.

The communicative framework divides the pronunciation lesson into five phases which include: 1. Description and analysis, 2. listening discrimination, 3. controlled practice, 4. guided practice, and 5. communicative practice. This framework aims to move the learners from controlled to automatic production of L2 phonology.

Data Collection Procedure

Data was collected through the pretest and post-test reading tasks. Reading was used as a data collection tool as it gave the researcher focus on a stable framework to do his measurement. Avoidance is a common strategy that is applied by the learners to compensate for their lack of knowledge. (Bai, Nei & Lee, 2020). Preparing a reading test for date collection also enabled the researcher to make sure that the tokens from all the speech sounds were collected. In order to refrain from collecting the phonological features in isolation, real-life samples of advertisements, movie revisions, memories, newspaper clippings, and funny stories that can be found in magazines or weblogs were collected. The texts were produced based on randomly generated keywords containing problematic phonemes and were examined by two experienced Iranian EFL teachers and three native English speakers for authenticity. Based on their review, the first two pre-and post-test texts for the advanced level (a movie review and a memoir) were discarded and replaced by easier texts, and a few minor changes were also made to the rest of the texts. In order to notice and address any unaccounted problems, the study was piloted using three participants (one from each level of proficiency). The feedback received from these pilot sessions were used to add some minor changes to the design of some phases of the framework. As stress could have been deconstructive in their verbal performance, to make sure that the participants were as stress-free as possible, the researchers made certain that they know the meaning of all the vocabulary items in the text and were allowed to read the text one or two times to familiarize themselves with the topic and ask any questions they had. Their voice while reading the text was then recorded in a very quiet room in one of the locations of this study.

The experimental group underwent 22 sessions in three months, using the communicative framework designed by Celce-Murcia et al. (2010) to learn how to pronounce the 6 target phonemes. The control group spent the same number of sessions using a traditional, non-communicative method

of presentation, practicing the sounds in isolation and through mechanical drills with a strong emphasis on error correction on the side of the teacher. This traditional framework was designed based on suggestions of experienced EFL teachers after years of teaching English in their classes.

Following the final phase of the communicative framework, the post-test was administered in much the same manner as the pretest, considering the comfort of the participants as a priority. The results were coded and sent to four native and four non-native English teachers as well as being fed to PRAAT speech analysis software in the case of the vowel samples. The examiners where given marking sheets to mark the target words which were mispronounced. The numbers, percentage, and ratio of errors concerning each phonological feature were then produced to provide an objective estimation of the results as well as the general subjective (yet still on the scale of 1 to 5 to enable statistic maneuvers) overview of the examiners regarding the quality of the subjects' oral production of problematic sounds.

Data Analysis

Eight raters were invited to judge the accuracy of the production of each sound. Four of the raters were native-speaking English teachers while the other four were experienced Iranian EFL teachers. It was thus expected that comparing the ideas of natives with those of non-native English teachers might reveal if there is a difference between native and nonnative teachers' perceptions of learners' pronunciation. The raters were informed of the target phoneme and the criteria on how to judge their pronunciation. While this could have been possible using a single examiner, the researcher decided to reduce the chances of observer error by increasing the number of examiners to eight. Doing so increased the interrater reliability to an acceptable level (over 85%).

The scoring process was done through listening to the recorded speech of each participant and placing a checkmark above the intended phoneme which had been highlighted in keywords throughout the text

(Figure 1). Each judge rated 15 tests. The study was a double-blind one and neither the raters nor the participants were aware of which groups each participant belonged.

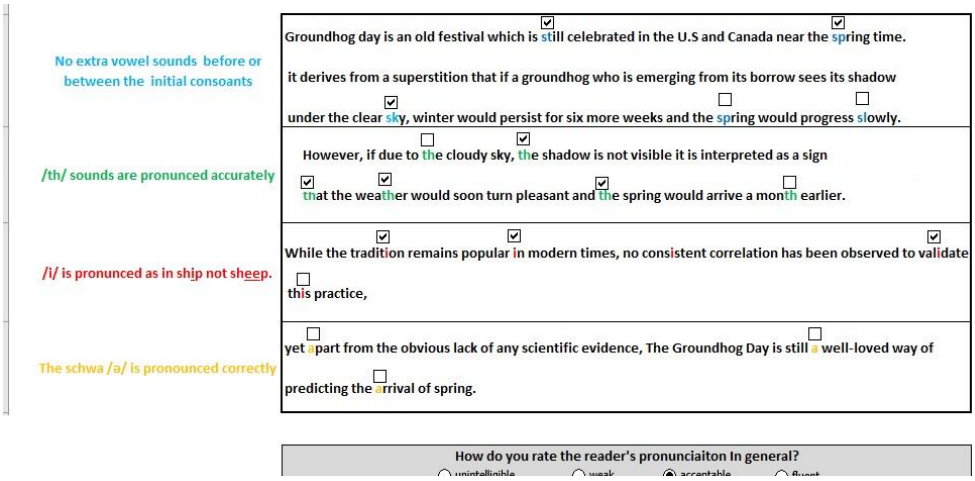


Figure 1: A sample of a scoring sheet that belongs for the intermediate pretest level

The measurement was done by assigning a score of 1 or 0 to the pronunciation of each phoneme in a target word. The total score of each participant was calculated by dividing the number of 1 score by the total number of target sounds in the text, returning a single score between 0 to 1. As an example, the score of a participant who had 6 correct pronunciations out of 11 would be 0.54. This made the quantitative analysis of the dependable variable (i.e. pronunciation improvement) possible.

The eight raters listened to the pre- and post-test recordings and judged the pronunciation of participants based on the criteria presented to them by the researchers. The research was double-blind as the examiners did not know to which group their samples belonged.

Due to the evasive nature of sounds when it comes to definition and evaluation (especially regarding characteristics of vowels), the researchers decided to use a speech analyzing software alongside human examiners to

analyze the quality of problematic features in subjects' speech samples. The speech samples of the participants were recorded using a Sony ICD-UX523F Stereo IC recorder with a bi-directional microphone. The voices were digitized in 44.1 kHz/128 kbps bits. The PRAAT speech analyzer program (ver. 6.0.49) was used to compare the spectrograms of the participants (more specifically by measuring their F1 and F2 formants frequency values, as they are in direct relation with the articulatory muscles and manner of articulation of vowels). The gathered data was then compared with the existing criteria such as Stevens (1998) or Ladefoged and Johnson's (2014) segmental characteristics of the North American speech for the /ɪ/ sound or was compared with the oral production of a native speaker of the same sex reading the same sentence. The results gathered from the human raters and the speech analyzer program were then compared and contrasted.

RESULTS

Human Rating Analysis

Descriptive analysis of the scores given by the Iranian and native English-speaking raters showed an increase in the mean scores of the participants in the experimental group from 0.53 on their pretest to 0.67 on the post-test (SD = 0.14, SE = 0.37) (see Table 2). In contrast and to the researchers' chagrin, a slight decrease was observed in the mean scores of the control group moving from 0.59 to 0.55 on the post-test, with a slightly larger standard deviation and standard error of the mean (SD = 0.201, SE = 0.05).

Table 2. Descriptive Results of the Analysis of the Ratings by Iranian and Native Speaking English Raters

Groups	Tests	N	Mean score	Standard Deviation	Standard Error of the Mean
Experimental	Pretest	15	0.53	0.19	0.05
	Post-test	15	0.67	0.14	0.03
Control	Pretest	15	0.59	0.14	0.03
	Post-test	15	0.55	0.20	0.05

The descriptive results of the raters' scores divided into three proficiency levels suggest a crude conclusion that the treatment within the experimental group was effective as the mean scores of all but the advanced learners on the post-test increased (see Table 3). This conclusion was put to test using a more technically reliable method such as applying speech analyzing software (those results will be discussed shortly).

Table 3. Level-Based Descriptive Results of the Pre- and Post-tests by the Raters

Groups		Tests	N	Mean score	Standard Deviation	Standard Error of the Mean
Basic	Experimental	Pretest	5	2.30	0.447	0.2
		Post-test	5	2.75	0.273	0.12
	Control	Pretest	5	2.75	0.65	0.29
		Post-test		2.50	0.5	0.22
Intermediate	Experimental	Pretest	5	2.70	0.57	0.25
		Post-test	5	3.00	0.00	0.00
	Control	Pretest	5	2.83	0.41	0.18
		Post-test	5	3.20	0.27	0.12
Advanced	Experimental	Pretest	5	3.60	0.54	0.24
		Post-test	5	3.41	0.50	0.22
	Control	Pretest	5	2.91	0.22	0.10
		Post-test	5	2.90	0.41	0.18

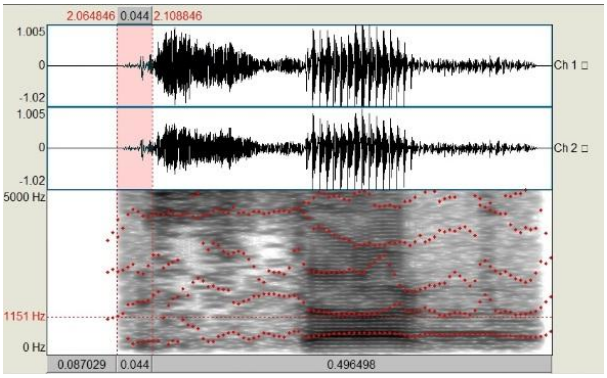
However, the results of the independent-samples t-test of the raters' scores of the experimental and control group showed no statistically significant difference between the pretest (M = 0.53, SD = 0.19) and post-test scores (M = 0.67, SD = 0.14); t(14) = 1.81, p = 0.800 within the experimental group. Likewise, there was no significant difference between the pretest (M = 0.59, SD = 14) and post-test scores (M = 0.55, SD = 20) within the control group: t(14) = -0.98, p = 0.335 (Tables have not included here due to space limitation).

Computerized Analysis of the Target Phonological Features

The pronounced tokens recorded in 44.1 kHz -128kbps stereo quality was analyzed using the PRAAT speech analysis software. The results are reported below:

Initial Double Consonant Clusters Starting with /s/

As with the similar research in the field (Funatsu, Fujimoto, Imaizumi & Imagawa, 2014; Olson, 2018), vowel epenthesis in the present research was assessed by visual inspection of waveforms and spectrograms of the pronounced tokens. As a precautionary measure, the participants' spectrograms were also compared with the production of the same tokens by native speakers of the same gender and relative age. The epenthetic vowel, if present, would manifest itself both in the spectrogram and the waveform, either before or within the initial cluster. In case of uncertainty, where the presence of a vowel was difficult to observe, measurement of the formants of the suspicious sound was also performed to prove the presence or absence of a vowel with greater confidence (Figure 2).



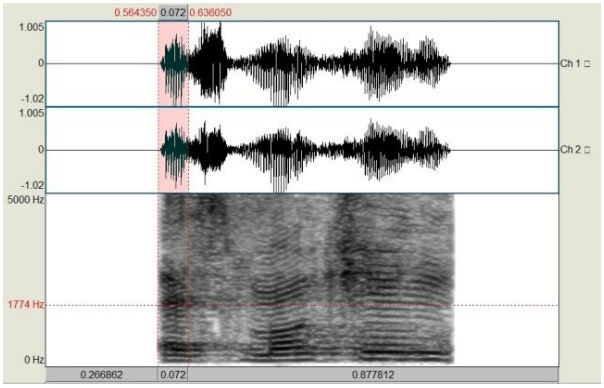


Figure 2. Epenthesis of a mid-front vowel in pronunciation of the word *start* is difficult to discern without measuring the formants of the inserted sounds represented by small red dots (top photo). The same phenomenon is much easier to observe both in the waveform and spectrogram in the pronunciation of the word *smoking* by another participant (bottom photo).

The null hypothesis for the initial CCs starting with /s/ assumed that there is no significant difference between the post-test results of the experimental and control groups. To test this, a series of paired-sample t-tests were conducted to compare the pretest and post-test scores of both groups in each of the three different proficiency levels. In the basic level the t-test did not show any significant difference in the scores for the experimental (M = 0.80, SD = 0.27) and control group (M = 0.70, SD = 0.27) scores: t(4) = 0.41, p = 0.704. In the intermediate level, the t-test did not show any significant difference for either the experimental (M = 1.0, SD = 0.00) or the control group (M = 0.73, SD = 0.25) scores: t(4) = 2.36, p = 0.07. Similarly, the results of the advanced participants did not reveal any significant difference between the experiment (M = 0.85, SD = 0.13) and control group (M = 0.90, SD = 0.223) scores: t(4) = -.053, p = 0.621. Although neither group showed significant results in their favor, the intermediate learners in the experimental group gained a *p*-value which was far closer to the significant level than any other group. This finding might

suggest a potential for a positive direction and could call for more comprehensive research.

Near-close Front Unrounded Vowel (/ɪ/)

The participants' pronunciation of the /ɪ/ phoneme was assessed via measurement of the participants' F1 and F2 formant frequencies. The measurements were then compared with Ladefoged and Johnson's (2014) measurements of North American speech characteristics. Ladefoged and Johnson (2014) estimated the first formant (F1) at 400 and the second formant (F2) at 1920 Hz, regardless of the gender of the speaker. Measurement of the participants' F1 and F2 formants in the post-test results showed that after receiving training both the experiment and control groups had been able to produce frequencies closer to Ladefoged and Johnson's (2014) criteria (F1 = 400, F2 = 1920).

F1 frequency analysis

F1 frequency of a vowel is inversely related to its highness (Hoemeke & Diehl, 1994). If no significant difference was observed between the participant's post-test production of F1 formant and Ladefoged and Johnson's (2014) stated frequency, the first sub-null hypothesis would be rejected. In the case of its rejection, the second sub-null hypothesis, which stated that the pre- and post-test results of the groups had been the same, would be tested. The comparison of the participants production of F1 frequencies with Ladefoged and Johnson's (2014)'s criteria (400 Hz) showed no significant difference for the basic learners in the control group ($M = 397$, $SD = 36.7$), $t(4) = -2.1$, $p = 0.902$, but a significant difference was observed for learners of that level in the experimental group; ($M = 363$, $SD = 22$), $t(4) = -3.74$, $p = 0.020$.

In the intermediate level, the first sub-null hypothesis was rejected; therefore, the researchers compared the pre- and post-test results of both groups (i.e. intermediate learners in the experimental and control groups)

using the paired sample t-test. The experimental group post-test results showed a significant difference compared with the control group's, suggesting the effectiveness of the communicative framework (see Table 4).

Table 4. Paired Samples T-test, Comparing the Pre- and Post-test Results of the /i/ Vowel F1 Production in the Experimental and Control Groups (Intermediate)

Tests	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest Experiment Post-test Experiment	54.4	27.3	12.2	20.4	88.4	4.4474		.011
Pretest Control Post Control	4.2	67.9	30.3	-80.1	88.6	.140	4	.896

Moreover, in the advanced group the production of F1 formant of the /i/ vowel did not significantly differ from Ladefoged and Johnson's (2014) criteria in neither the control (M = 422, SD = 23.9), t(4) = 2.05, p = 0.109, nor the experimental group post-test results (M = 423, SD = 35.8), t(4) = 1.49, p = 0.209. The first sub-null hypothesis being rejected for these learners, the post-test results of the experimental and control groups were analyzed through a paired t-test but unlike the intermediate level, the difference between the pre and post-test scores was not significant in neither group; (p = 0.558 for experimental and p = 0.233 for the control group) However, it was noticed that the mean score of the experimental group (M = 422 Hz, SD = 23.9) was closer to the criteria (400 Hz) than the control group (M = 424, SD = 35.8) with a narrower standard deviation. This evidence can suggest the effectiveness of the communicative method and might be a promising subject for further research.

F2 frequency analysis

In the basic level group, the comparison of the participants' post-test

production of F2 frequencies (related to the frontness of a vowel) showed no significant difference with Ladefoged and Johnson's (2014) criteria of 1920Hz; therefore, the first sub-null hypothesis was rejected. The paired t-test which was conducted to measure the difference between the pre- and post-test results between the experimental (M = 2067, SD = 295.2) and control group (M = 2175, SD = 148.4) showed no significant difference, with t(4) = -0.389, p = 0.717 for the experimental and t(4) = 2.2, p = 0.90 for the control group.

In the intermediate level, the first sub-null hypothesis was rejected in both groups. However, there was a significant difference in the pretest (M = 2175.4, SD = 148.4) and post-test scores (M = 1777.5, SD = 126) of the control group, t(4) = 4.185 , p = 0.014,while the null hypothesis was not rejected in the experimental group.

The advanced participants' production of F2 in the post-test did not differ significantly from Ladefoged and Johnson's (2014) criteria and the first sub-null hypothesis was rejected. The results of the paired sample t-test showed that the experimental group's post-test scores (M = 1782.7, SD = 245.4) were significantly different than those of their pretest (M = 1971.8, SD = 246.2), pointing to the effectiveness of the communicative framework, while in the control group no significant difference was observed (see Table 5).

Table 5. Paired Samples T-test, Comparing the Pre- and Post-test Results of the /i/ Vowel F2 Production in the Experimental and Control Groups (Advanced)

Tests	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest Experiment Post-test Experiment	189.1	110.5	49.4	51.8	326.3	3.825	4	0.019
Pretest Control Post Control	104.5	338.6	151.4	-315.9	524.9	.690	4	0.528

Voiced and Voiceless Dental Fricatives (/ð/ & /θ/)

As the researchers were not able to find a conventional standard criterion for the pronunciation of the two dental fricatives, they used the recorded voices of four native English adult speakers (two Americans and two Canadians), reading the pre- and post-test texts. As a reliable benchmark to assess the participants' pronunciation of /ð/ and /θ/ phonemes, three main features of the dental fricatives, namely intensity, duration, and center of gravity (COG), were analyzed (Jongman & Wayland, 2000). The first and second null hypotheses were the same as those for the previous phoneme (/ɪ/).

Voiced dental fricative (/ð/)

In the basic group, the first sub-null hypothesis was not rejected regarding the duration in either the experimental (M = 0.149, SD = 0.337) or the control group (M = 0.186, SD = 0.51) when compared with the same feature in the native speakers' speech (M = 0.061, SD = 0.038), with $t(4) = 3.513$, $p = 0.025$ for the experimental and $t(4) = 3.254$, $p = 0.031$, for the control group. Using a paired sample t-test, results for the intensity and COG variables were tested in the pre- and post-test production and no significant difference was observed.

In the intermediate group the first sub-null hypothesis was rejected regarding most of the features except the control group's duration of pronunciation (M = 0.143, SD = 0.016) when compared with the same feature in the native speakers' speech (M = 0.061, SD = 0.038), $t(4) = 4.787$, $p = 0.009$. The null hypothesis was not rejected regarding the COG in the experimental group's post-test (M = 4278, SD = 1468) when compared with the same feature in the native speakers' speech (M = 2213, SD = 651), $t(4) = 3.449$, $p = 0.026$. The remaining variables were tested but the second sub-null hypothesis was not rejected as the results did not show any significant difference between the pre-and post-test scores in either group. The advanced learners' duration, intensity, and COG of the phoneme in their post-test were not significantly different from the native speakers'

production of the same features, therefore, the null hypothesis was rejected regarding the three variables in both experiment and control groups. The second sub-null hypothesis was not rejected in this group.

Voiceless dental fricative (/θ/)

In the basic level the null hypothesis was rejected regarding the COG in the experimental group's post-test (M = 3731.2, SD = 1055) which was significantly different from the COG of the native speakers (M = 2219, SD = 114.9), t(4) = 3.180, p = 0.034. The results for the duration of this phoneme did not confirm the second sub-null hypothesis either. It showed a significant difference in the pretest results (M = 0.080, SD = 0.034) compared with the post-test scores (M = 0.129, SD = 0.016), t(4), = -2.79, p = 0.049. Although no other significant difference between the pre- and post-test results was discovered, it is worth mentioning that the intensity of the /θ/ sound, the post-test results, though not significantly different, demonstrated a smaller p-value (p = 0.120) compared with that of the control group (p = 0.368). this finding might suggest a trend in favor of the effectiveness of the treatment in the experimental group. In the intermediate level, the first sub-null hypothesis was rejected concerning all features of /θ/ within the control group; this hypothesis was also rejected for the intensity and COG of the sound produced by the experimental group. Among those variables, the intensity of the pronunciation in the control group's post-test (M = 86, SD = 2.5) was significantly different from that produce on the pretest (M = 80.4, SD = 5.3), t(4) = 2.384, p = 0.047, suggesting the efficiency of the practice in the control group in developing the correct intensity of the /θ/ sound.

In the advanced level, the null hypothesis was rejected in both groups' post-test concerning all features which pertain to the accuracy of the participants' pronunciations compared with the native speakers'. The second hypothesis was tested using the t-test but the test did not yield any significant results to reject the second sub-null hypothesis.

Schwa (/ə/)

Due to the flexible and broad acoustic nature of schwa (Flemming, 2004; Wieseman & Downey, 1998), the largest amount of computation in this research was performed on this phoneme. The average F1 and F2 frequencies and average duration of the pronunciation of the schwa phoneme in initial and mid positions were measured and analyzed. A paired sample t-test was used to compare these three features in the initial and middle positions of words. The first sub-null hypothesis states that there is no significant difference between the performance of the participants and the native speakers on the post-test while the second sub-hypothesis states that there is not a significant difference between the participants' pre- and post-test scores.

Analysis of schwa in the initial position

At the basic level, no significant difference was found in the post-test results of experimental and control groups compared with the oral production of the native speakers, suggesting that all three features had been pronounced within an acceptable limit. The second t-test measured the pre- and post-test frequencies of F1, F2, and duration of this sound in both groups. The treatment in the experimental group and the traditional method of teaching in the control group did not lead to any significant changes in the performance of the participants.

Within the intermediate level, the control group showed significant difference in their production of F2 formant ($M = 1555.4$, $SD = 58$) compared with the native speakers' production of this feature ($M = 1686.6$, 211.2), $t(4) = -3.233$, $p = 0.032$, and also their duration of pronouncing the initial schwa ($M = 0.136$, $SD = 0.063$) compared with the natives speakers' production ($M = 0.055$, $SD = 0.013$), $t(4) = 3.79$, $p = 0.037$. Therefore, the first sub-null hypothesis was rejected regarding the experimental groups' production of F1, F2, and duration but only the production of F1 in the

control group. In order to find the possible effectiveness of the treatment, the pre and post-test results were analyzed in the experimental group (as well as the F1 production in the control group). The results, however, did not show any significant difference in the post-test scores and therefore the efficiency of the treatment could not be verified.

In the advanced level groups, the null hypothesis was rejected on all features, meaning that both experimental and control groups' pronunciation of initial schwa sound had been statistically close to that of the native speakers. Therefore, the second sub-null hypothesis was tested and the results showed a significant difference between the pretest (M = 0.089, SD = 0.227) and post-test (0.059, SD = 0.009) results in the experimental group regarding the duration of the schwa sound in initial position, t(4) = 3.39 , SD = 0.027. No other significant differences were found between the pretest and post-test results at the advanced level.

Analysis of schwa in the middle position

The procedure for analyzing the quality of the schwa sound in the middle of the word was similar to its analysis in the initial position. In the basic level the first sub-null hypothesis was not rejected in the control group in two instances: there was a significant difference in production of the F2 formant in control groups' post-test (M = 1145.8, SD = 54.5) compared with the native speakers' production of that feature (M = 1686, SD = 211.2), t(4) = -4.837, p = 0.008). The duration of the production of the schwa sound was also significantly different in the control group (M = 0.141, SD = 0.017) compared to that of the native speakers (M = 0.055, SD = 0.013), t(4) = 8.955, p = 0.001, suggesting that the traditional training in the control group was not effective enough regarding the two variables of F2 and duration. The second sub-null hypothesis was subsequently tested to measure the possible effectiveness of the treatment in the experimental group; the t-test results did not show any significant difference between the pretest and post-tests regarding the features. The difference was not observed in the F1

formant production of the control group either, suggesting that the subjects' performance was similar to that of the native speakers in both pre- and post-test, with no significant difference.

In the intermediate level, the first sub-null hypothesis was rejected regarding all features in both the control and experimental group. The second hypothesis was also tested through a paired samples t-test. The test showed no significant difference between the pre- and post-test results of the intermediate-level participant.

In the advanced group, the first sub-null hypothesis was rejected concerning all features of /ə/. The second sub-null hypothesis was confirmed rejected for this group as the learners' pre- and post-test scores were not significantly different. These results can be due to the learners' higher knowledge of pronunciation which can be attained through exposure (Jarosz, 2019).

DISCUSSION

The present study is one of the few studies of its kind (e.g., Elliot, 1997; Heikkinen, 2018; Nazari & Mirsaeeidi, 2017) to measure the efficacy of a communicative approach-based framework in improving the pronunciation of phonemes absent in adult EFL learners' L1. It also compares the effects of the framework with those of a traditional method of teaching pronunciation which mainly applies mechanical drills. The research was conducted with learners of three different proficiency levels and the analysis of the learners' pre- and post-test results revealed the beneficial effects of the communicative framework on helping the production of specific features of the six problematic sounds. These improvements included a general performance of the basic and intermediate groups, better production of the F1 and F2 formants of the near close unrounded vowel /i/ by the intermediate and advanced learners respectively, improvement in duration of the voiceless dental fricative /θ/ within the basic group, and the duration of the schwa /ə/ sound in the initial position within the advanced group. The

improvement of the abovementioned features led to the correct pronunciation of three problematic phonemes (/i/, /θ/, and initial /ə/) whose other features the learners already produced correctly, that is, to a standard or near native-like level. It is also worth noting that four other features showed a high probability of improvement after the treatment with the communicative method. These include epenthesis within the intermediate group concerning CCs, the F1 formant in /i/ vowel within the advanced group, the intensity of /θ/ and the F1 formant regarding schwa /ə/ in the initial position within the basic group.

The results pointed to an interesting finding that when the learners had difficulty in pronouncing a phoneme, they hardly produced all the features of that phoneme erroneously; in most cases, they had difficulty producing only one or two of those features (e.g., the formant or duration). This can be a good starting point for future research as finding techniques to facilitate the production of these features can help teachers and materials developers assist Persian-speaking EFL learners' pronunciation of the problematic sounds more effectively. By helping the learners fix their erroneous production of the features of specific phonemes, the communicative framework could help the participants correctly pronounce the following sounds:

1. Intermediate and advanced learners' production of /i/. It should be noted that although both groups showed improvement in F1 and F2 formant production of the /i/ sound, the participants trained with the communicative framework produced frequencies which were much closer to the North Americans';
2. Basic learners' production of the duration of /θ/; and,
3. And advanced learners' production of /ə/ in the initial position.

A note should be made here that the traditional method of teaching also succeeded in improving the production of the intensity feature of the /θ/ phoneme within the intermediate group, and helped the basic and intermediate learners in the control group with their production of the F1 formant of the /i/ vowel. This finding suggests that the traditional method

(or rather its focus on mechanical drills and motor receptive skills) can still be beneficial and should not be forgotten in the syllabus design or classroom exercises (Maya Sprima, 2017). The traditional method, however, proved unsatisfactory regarding the schwa sound in the initial and mid position; it did not succeed in improving the basic and intermediate learners' production of F2 formant and duration of the schwa sound.

The next interesting result came not from the significant improvements gained through the pieces of training, but from the participants' initial ability to pronounce the features of the absent phonemes correctly. It was reassuring to discover that many of the features of the absent phonemes were produced accordingly and with a quality that is near to the standard criteria or the native speakers' performance. This was the case with the advanced students who, for example, did not show any difficulty in pronouncing the voiced and voiceless dental fricatives on their pretest.

Another practical finding of the research is the indication of the most difficult features of each sound for the learners. The results showed that the center of gravity is a difficult feature to master in the pronunciation of dental fricatives (both voiced and voiceless) by the basic and intermediate learners as they were not able to significantly adjust their COG in either experimental or control group. Based on this finding, it is recommended that any program improve the pronunciation of these two consonants within beginning learners focuses more on the COG feature of those sounds.

Another advantage of the communicative framework, which is obvious regardless of the present research findings, calls for Bygate's (1987) famous suggestion that the notion of speaking skills is to be viewed in two basic aspects of motor-receptive skills and interaction skills. Unlike the traditional methods of teaching which focus mainly on the former (Li, 2019), the communicative framework presented a broader context for its participants by helping them improve in both of the mentioned skills.

CONCLUSION AND IMPLICATIONS

The results of the study supported the effectiveness of the communicative framework in improving Iranian adult EFL learners' production of specific features of six phonemes absent in their L1. The findings of the study also supported the previous findings on the positive effect of exposure to L2 in improving the pronunciation and phonetic coding ability of the EFL learners (Jarosz, 2019). The advanced participants in our study produced the target phonemes with acceptable accuracy on the pretest. The duration of the initial schwa sound and the F2 formant production in the /i/ vowel were the two instances of difficulty for this group which both improved in their post-test results. Based on this finding, the best candidate group to receive pieces of training to improve their pronunciation of absent phonemes in Persian appears to be the basic and intermediate level learners.

The present study has implications for teacher training programs, English pronunciation teaching in Iran, and future research. It can assist the syllabus writers and teachers active in adult EFL education by calling their attention to the problematic phonemes for the Iranian EFL learners and by furthermore pinpointing the most problematic features of each phoneme (formants, intensity, duration, etc.) and finally categorizing the problems according to the proficiency of the learners who suffer from them the most. Concerning the implications of this study for future pedagogy research, we suggest applying the communicative framework employed in this study in treating the suprasegmental features of L2 learners' speech. As affirmed by Thomson (2015, p. 222), "fluency and comprehensibility are both closely aligned with suprasegmental features of pronunciation". We also recommend that future research looks more closely at communicative techniques that can target specific features of problematic sounds for L2 learners; such a micro-level analysis and treatment might prove to be more effective with the production of problematic sounds in their L2. The addition of the communicative approach enables the learners to also improve their fluency.

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