Foreign speech accent and comprehensibility: Technology integration to bolster EFL learners' pronunciation for effective communication

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Abstract

This quasi-experimental research study examines in depth the issues of accent and comprehensibility but also the effects of technology on the accent reduction of Saudi EFL (English as Foreign Language) students at an English Language Institute in a Saudi university. In this study, recorded speeches of students of two classes were first rated for foreign speech accent and comprehensibility by two native, two non-native English listeners and an IELTS speaking examiner at pre- and post-accent reduction program stages. While one class (controlled group) was treated through conventional instruction, the second class (experimental group) got treatment through technology- based accent reduction instruction. It was found that the foreign speech accent interfered with comprehensibility and the phonological factors which accounted for foreign speech accent were both segmental and supra-segmental features. Most, importantly, the study discovered that ubiquitous nature of mobile applications served the EFL students with pronunciation training in the target language anywhere anytime. Lastly, this study recommends a Lingua Franca Core standard of comprehensibility while designing technology-based accent reduction programs specifically for EFL settings.

Keywords: CAPT, accent, comprehensibility, pronunciation, technology integration, pre-test and post-test

1. Introduction

Achieving native-like fluency has been a keen desire and goal of English learners and non-native English teachers not only to be comprehensible but also to be presentable (Lippi-Green, 1997). Besides grammar and vocabulary, pronunciation has been one of the important factors of a language for foreign/second language learners to sound like native speakers and consequently to be more intelligible and comprehensible to the native English speakers. Therefore, both the non-native English teachers and the learners have been trying to follow either Received Pronunciation (RP) standard or the General American standard (GA) accent.

However, various empirical studies affirm that achieving the standard pronunciation competence is nearly impossible for adult learners. Therefore, they have

suggested near native like pronunciation competency for such learners so that they are intelligible and comprehensible in English as an international (EIL) and second language (ESL) contexts (Jenkins, 2000; 2002; 2004; 2005; 2006; Munro and Derwing, 1995a; 1995b; 1997). In ESL context, non-native English speakers (NNES) learning language for communicating with native English speakers (NES) (Anderson-Hsieh, Johnson and Koahler, 1992; Derwing and Munro, 1997) and in EIL context, NNES of various L1 backgrounds learn the language solely for communicating with others (Jenkins, 2002; 2004; Gargile, 1997). To meet this end, several technology based accent reduction programs have been recommended (Saz, Rodríguez, Lleida, Rodríguez, and Vaquero, 2011; Murray, 1999; and Neri, Cucchiarini, Strik, and Boves,2002). Following the same streamline, first the researchers intend to investigate the effects of foreign speech accent on comprehensibility in both ESL (Anderson-Hsieh, and Koahler, 1988, Derwing and Munro, 1997; 2001; 2005; Derwing, 2003) and in EIL contexts (Jenkins, 2004). Secondly, the goal is to explore the phonological factors accountable for foreign speech accent in these two contexts (Jenkins, 2000; 2002; Munro and Derwing, 1995a; 1995b). Lastly, the objective is to investigate the effects of technology integration on improving EFL learners' pronunciation for effective oral/aural communication (Neri *et al.,* 2002).

2. Literature review

In order to meet the multiple objectives of the study, the literature review is divided into three sections. The first two sections address the issues of foreign speech accent and its effects on communication in ESL and EIL contexts. The third section addresses Computer Assisted Pronunciation Teaching (CAPT) and its effects on EFL learners' pronunciation.

2.1 Second Language Context

A number of studies have been carried out in second language context to discover the effects of foreign accent on the intelligibility and comprehensibility of NES listeners (Munro and Derwing 1995a; 1997; Munro and Derwing and Morton, 2006). Munro and Derwing (1995a) have compared transcription scores for intelligibility, accent and perceived comprehensibility ratings with phonetic, phonemic, grammatical errors, and goodness of intonation ratings in Mandarin speakers' English productions. They have found that a strong foreign accent does not necessarily interfere with intelligibility, although NES listeners may require extra processing time to understand NNES speech, which may lead to lower perceived comprehensibility ratings mainly because of supra-segmental features (tone, pitch, rhythm, and stress).

Unlike Munro and Derwing (1995a), Derwing and Munro (1997) extend their research by examining NES listeners' reaction to speech from four different first language (L1) backgrounds: Cantonese, Japanese, Polish and Spanish. Moreover, familiarity with speakers from a particular language background is also

investigated to see, to what extent familiarity with accented speech of an L1 speaker affects the comprehensibility of the NES listeners. They also changed the population from that of advanced level ESL speakers to intermediate level to identify any change in comprehensibility. They have found that the accent ratings are harsher than perceived comprehensibility ratings which in turn are harsher than actual intelligibility scores. On the basis of their findings, they have claimed that though some phonemic features of NNES speakers' accent might be highly important, they do not necessarily interfere with the intelligibility of NES listeners. They have further inferred from the findings that the accent ratings and intelligibility should be disassociated from each other in language assessment instruments which often perplex the two measurements. Moreover, the difference between comprehensibility and intelligibility scores, according to Derwing and Munro (1997), suggested that some accented but fully intelligible utterances might require additional processing time, which led the listeners in their study to rate the fully intelligible utterances difficult to understand, in other words, less comprehensible.

The frequency of individual contributions of four accent features – grammatical errors, phonemic errors, prosody, and speaking rate- are different for intermediate level ESL learners compared with the advanced level students. In Derwing and Munro (1997) the accentedness is mostly caused by phonemic errors; and difficulty in comprehensibility is caused by grammatical errors, while in Munro and Derwing (1995a) in which the speakers are of advanced level ESL learners, the biggest cause of both the accentedness and comprehensibility are prosodic errors. In the end, the researchers have claimed on the basis of the results that "[i]mprovement in NNES comprehensibility, at least at intermediate and high -proficiency learners, is more likely to occur with improvement in grammatical and prosodic proficiency not with the sole focus on correction of phonemic errors"(Derwing and Munro, 1997, p.)

In order to compare the comprehensibility ratings of NES listeners to those of NNES listeners and to generalize the findings to an even larger population, Munro, Derwing and Morton (2006) have replicated and extended Derwing and Munro's (1997) study. They intend to see whether both NNES listeners who share L1 background of the speakers and those who do not, would respond to the utterances in the same manner as the NES listeners did in the original study. They have found that the effects of L1 background and experience with a particular type of accent were relatively minor factors in the ability to understand the NNES speech. Based on their findings, all four groups of listeners have agreed a majority of the times about which of the 48 speakers are most or least intelligible. Additionally, they have found that the NES listeners' responses have correlated well with those of the other NNES listener groups. Thus, they

have concluded that the properties of the speech themselves are strong determinants of the listeners' responses.

2.2 English as an International Language Context (EIL)

According to Jenkins (2000), English as an International Language Context (EIL) encompasses the interaction among NNES speakers. She has carried out empirical studies which attempted to investigate the effects of accented speech in NNES-NNES interaction. The reasons for this shift from NES-NNES to NNES-NNES context are the facts that the number of NNES speakers outnumbered the NES speakers and that a small minority of NNES speakers need to interact with NES speakers. Therefore, she has recommended in her empirical research that the NNES speakers need to be more comprehensible in EIL context.

Unlike what Munro and Derwing (1995a; 1995b; 2006) propounded, Jenkins (2000; 2002) has provided empirical evidence in support of segmental features of phonology which mostly affect the intelligibility and comprehensibility of NNES listeners of different L1 backgrounds. Jenkins (2000) has claimed that "[f]or EIL, and especially for NBESs [non-bilingual English speakers], the greatest phonological obstacles to mutual intelligibility appears to (SV error) be deviant core sounds in combination with misplaced and/or miss-produced nuclear stress" (p.155). She has rightly noted that the research showing the importance of supra-segmental features in intelligibility has been entirely based on NES listeners who might process speech differently from NNES listeners. She has found that the majority of communication breakdowns are due to segmental and nuclear stress errors. She has found that these are the most difficult problems to resolve because NNES listeners primarily use bottom-up processing strategies and seem unable to compensate for pronunciation errors by using contextual or syntactic information, especially in a situation of processing overload. Therefore, Jenkins (2000) has recommended that teaching weak forms, word stress, stress-timing, pitch movement, reductions, assimilation and other features of connected speech may not be significantly helpful in daily communication because they may not hinder intelligibility in EIL context. In addition, they are unteachable.

In another study, Jenkins (2002) has provided three sets of data drawn from NNES-NNES interaction. The first set of data- five communication breakdowns- indicated that certain segmental deviation particularly in 'consonant sounds and vowel length and the placing of tonic stress' made the accent of NNES speakers unintelligible to NNES listeners.

The second set of data- indicates that co-text and context did not provide much help to understand the accented speech in EIL set up.

The third set of data indicates that NNES speakers of the same L1 background attempt to replace the L1-transfer with a more target like sound to

make it understandable to the listeners of different L1 backgrounds. In these exchanges, the adjustment has occurred chiefly on consonant sounds; corroborating the evidence of the Jenkins's (2000) field data where consonant sounds proved to be the greatest barrier to phonological intelligibility in EIL context.

From the above findings, Jenkins (2002) concluded that the NNES speakers need training in the areas of phonology which are crucial for intelligible interaction in EIL context. Additionally, Jenkins suggests pedagogic help in order to improve the accommodation skills of the NNES speakers. On the basis of these conclusions, Jenkins suggests two proposals-one for EIL pronunciation teaching-a lingua franca core based mainly on training of segmental features such as consonant sounds, vowel length and the placing of tonic stress to improve the pronunciation of NNES speakers. The second proposal is for the development of accommodation skills through exposure to a range of NNES accents which could be made possible through recorded material as it has been done for RP- and GA-accents. She also suggests video-conferencing activities among the institutions around the globe with different L1 backgrounds which would give real life exposure to the learners around the world.

From the studies reviewed, it can be inferred that in both ESL and EIL contexts, the accented speech of NNES speakers seem to decrease the level of comprehensibility of the NES/NNES listeners.

Having identified the fact that foreign accent is an issue in intelligibility and comprehensibility, a lot of research is carried out to test the efficacy of various technology- based accent reduction programs (Hunt, 1997; Levis, 2007; Murray, 1999). The next section presents a review of the literature on Computer Assisted Pronunciation Teaching CAPT.

2.3 Computer Assisted Teaching Pronunciation

Numerous studies have proven that technology can assist learners in various ways. Studies in the field of educational technology (Hunt, 1997; Levis, 2007; Pegrum, 2014) assert that technology provides learning opportunities that facilitate learning and teaching processes. To further support these claims Levis (2007) states that technology can provide customized instructions, constant practice through drill and practice exercises along with automatic visual support that exhibits learners how similar their own pronunciation has become compared to the modeled ones.

In the area of pronunciation teaching, Computer Assisted Language Learning (CALL) has had a vital role in EFL teaching. Most CAPT based programs fulfill the requirements of pronunciation learning ranging from segmental to supra-segmental features. Individual learners get the opportunity to identify the distinctiveness of all discrete phonemes. Besides, they can develop a better understanding of prosodic features like stress, intonation and rhythm by

practicing them on computers and other mobile devices.

CAPT enhances more confidence than that of practicing it in front of the class which has been observed in various research studies. Similarly, today's digital natives can perform better as compared to earlier generations (Saz, Rodríguez, Lleida, Rodríguez, and Vaquero, 2011). Currently, learners' dependence on technology has forced teachers, curriculum developers, and researchers to initiate such programs which not only engage learners but also give them sufficient provision of practicing at their own pace that could also augment self-reliance and foster confidence.

As suggested by Murray (1999) CAPT delivers an appropriate frame of learning which a learner can easily acquire in catering his particular needs. Likewise, learners can prioritize their preferences on any particular area of learning pronunciation on CAPT; it supports autonomy to learners on learning pace and volume of knowledge (Murray, 1999). Above all, privacy and self-paved nature of CAPT revelas positive effects on learning by removing the element of foreign language anxiety which is highly related to the phenomenon of social-judgment factors (Young, 1990 as cited in Neri *et al*, 2002). Contemplating the above stated views, one can infer the importance of CAPT as it can benefit learners in numerous ways: it can be self-paced, need based, and personalized. Above all, it can minimize the component of anxiety significantly.

Moreover, the element of synchronous and asynchronous learning can be exploited positively as CAPT gives a real time feedback to students and helps teachers identify the performance of their pupils. According to Neri *et al.,* (2002) students can develop their digital records which can be reexamined by the students themselves to assess problem areas and progress as well. Furthermore, teachers can also supplement the process by giving feedback. Technological programs provide many opportunities for learners to invigilate their own efforts and evaluate their own progress. Presumably, the entire process of technology incorporation can have positive effects on the entire process of learning.

In a nutshell, CAPT seems to provide a nearly ideal platform for the learners to focus on their learning needs in a non-threatening environment which minimizes the issues of losing face, language anxiety, demotivation and disengagement. Likewise, CAPT offers opportunities of pronunciation learning ranging from segmental to supra-segmental features. Above all, CAPT provides opportunities to the learners for personalized, situated and ubiquitous learning (u-learning).

Having recognized the importance of CAPT and the fact that the accent affects comprehensibility, the researchers venture to examine the integration of CAPT for pronunciation training of EFL learners at the English Language Institute in a Saudi university to investigate its effects on comprehensibility. For this purpose, the researchers use two well-grounded and research-proven accent

reduction applications i.e., *Pronunciation Power* and *English Pronunciation* which provided training at both segmental and supra-segmental levels. Last but not the least, technology is also utilized to record learners' speeches and rate of comprehensibility at both pre- and post-pronunciation training programs to recognize any change in accent and its effect on comprehensibility. Therefore, in this paper we attempt to address the following research questions:

3. Research Questions

1. To what extent does the non-native English speakers' accented speech affect the native and non-native English listeners' comprehensibility?
2. What are the perceptions of the listeners (i) what made some speakers more difficult than the others and, (ii) which aspects of their accent were most noticeable?
3. How far can technology-based accent reduction program help improve EFL learners' pronunciation for effective oral/aural communication?

4. Methodology

The study was conducted on empirical design with semi controlled research model for data collection analysis. Moreover, brief demographical interviews and reflections of the participants were exploited to triangulate the achieved results. The study was undertaken in a quasi-experimental model. The study was undertaken to analyze and determine the effects of foreign speech accent on the comprehension level of participants. Hence, the participants were selected who had an exposure to listen the accents through technology-based methods or applications for at least three weeks. In order to determine the comprehension level, segmental and supra segmental features were focused and their contribution towards the creation of foreign accent were observed. In order to retain a focus on phonological errors and avoid the expected grammatical errors, the researchers avoided extempore speeches instead, supplied the participants with a short dialogue. The dialogues of all thirty-six NNES participants were recorded (20 in a controlled group and 16 in an experimental group) of the same L1 background randomly selected from the pool of preparatory year graduate students. The recordings were played randomly to all the participants and their comprehension was recorded on the Likert scale of 1-5. However, in order to distinguish the participants as sative speakers and non-native speakers a questionnaire was administered which focused on the participants' daily use of English and their natural exposure to English. The questionnaire was exploited to determine the extraneous variable of familiarity with speech accent. Moreover, through open-ended questions, the participants view very recorded on what makes some speakers easy to comprehend and vice versa; and how an accent becomes more noticeable. In the end, all collected data was processed through rigorous statistical process to obtain the results.

4.1 Method

To conduct this study, two classes of the intermediate level Common European Framework of Reference (CEFR B2) students of preparatory year program at the ELI were selected for the data collection through an accent reduction program. The program was set to run five day a week, and it was incorporated for one hour in a four-hour program. The objective was to observe the changes in two different groups: one treated through technology and the other was treated using the traditional methodology. The group treated through technology was provided with pronunciation learning application in their mobile phones.

The method was validated through pre and post test method. Later, all the participants were invited to record their responses. Their responses were recorded in an audio recording format. The researchers ensured that all the data is recoded with minimum audio dissertation. Later, the responses were analyzed on the Likert rating scale of 1-5: 1 stands for least comprehensible and so the 5 stands for the most comprehensible.

The researchers used two different dialogues extracted from a real-life situation to maintain the earlier cited extraneous variable. The dialogues were adopted form the Headway Plus Book (Special Edition) of Intermediate level (CEFR B2). Since this book and its contents is designed for level of learners which is same for this study hence, it was assumed that it would reduce all other distracting factors. Similarly, extempore speech was ruled out as it would manipulate the extraneous variable with other irrelevant factors such as grammatical errors, speech rate, collection of errors or error association, associative probability of language transfer and meaning making.

A part form this, a couple of questionnaires were also administered to conduct a demographic survey of the participants. The survey helped the researchers to maintain a balance of all the participants and kept them separate from any extraordinary elements.

The whole data collected from the participants was processed through a rigorous statistical process and the results were recorded accordingly.

4.2 Participant Speakers

The researchers randomly selected two groups of the students: controlled and experimental) (see Table 1 below).

Table 1: *Participants: from non-native demographic view*

Participants	Native Lang-uage	Country	Gender	Average Age	The average of years studied	The average of years spoken	The average spoken hour: day	The average spoken native hour: day
Controlled group (22 speakers)	Arabic	Saudi Arabia	Male	19	7.6	4	4.3	8
Experimental Group (14 speakers)	Arabic	Saudi Arabia	Male	19	7.9	4.6	2.6	9

Each group comprises the actual number of enrolled students; researchers have avoided artificial equation. Therefore, to be fair and nullify the idea of exclusion, we have decided to treat each individual student equally. However, it should be noted that there is a significant difference between the groups in the number of hours they speak English daily, which might affect their speaking comprehensibility ratings.

4.3 Raters

Five raters are designated to evaluate the accent and comprehensibility of the students' speeches. The composition of raters and their corresponding demographic details are given in Table 2 below:

Table 2: *Demographics of listeners/raters*

Listeners/ raters Participants	Native Lang-uage	Country	Gender	Age	Speak Other Lang-uages	Educa-tion Level	Current Job	Stay in non-English speaking country	ESL teaching Experie-nce
Rater 1	Arabic	Yemen	Male	34	English	MA	EFL teacher	4 years	7 years
Rater 2	English	UK	Male	60	German	MA	EFL teacher	5 years	16 years
Rater 3	English	UK	Male	33	Urdu	MA	IELTS Examiner	7 years	7 years
Rater 4	English	UK	Male	30	Arabic	MA	EFL teacher	7 years	10 years
Rater 5	Arabic	Algeria	Male	30	Eng/ French	MA	EFL teacher	6 years	6 years

The reason behind involving rates on such diversity is to maintain the main objective of this study. All these raters stand different from one another in their language background and proficiency. Native speakers have a natural advantage of language acquisition and comprehension hence, they are not quite very familiar with the difficulties that the nonnative speakers face. That is why, the nonnative speakers especially Arabs are fully aware of the challenges that the learners face. Moreover, in order to authenticate the assessment of these raters, an IELTS examiner's assistant was sought to ensure that the whole process was conducted as per the assessment protocols used for EFL learners.

4.4 Teachers

The accent reduction program was administered by native English language teachers. It was ensured that the teachers possessed required teaching experience in teaching/learning settings like ESL and EFL. Before executing the whole process, researchers explained it to the teachers. In controlled group, the teacher was asked to teach pronunciation to the students in conventional way using the provided material. On the other hand, in the experimental group, the teacher was asked to teach pronunciation using mobile applications designed for pronunciation teaching. The latter group instructor was continuously reinforced with required training to use the applications, learning content and its pedagogy. (*Pronunciation Power* and *English Pronunciation*).

4.5 Pronunciation Training Applications

While using the technology, researchers exploited both segmental and supra segmental components. In this regard, the researchers selected *Pronunciation Power* and *English Pronunciation* applications (Android, Windows and IOS supported) to train learners. The app *Pronunciation Power* is designed with 52 phonemes training and also supplements practice on word and phrase levels. Furthermore, it incorporates an observation of the standard articulation of language. In addition, the app *English Pronunciation* offers training on articulation of connected speech focusing on tone, stress, pitch, and rhythm. Above all, these applications significantly facilitate to record and assess the language performance on a set standard of language. In particular, the teacher encourages students to exploit the ubiquitous nature of these pervasive devices and apps.

5. Results and Discussion

5.1 Comprehensibility Scores

Both groups are later assessed by rating their recordings on the rating scale of 1-5 under following assessment rubrics: On a scale1-5, 1 shows that the listener cannot understand speaker without extreme difficulty, 2 indicates that listener can

understand with some difficulty; accent interferes with intelligibility, 3 indicates that listener can understand with some effort; accent is distracting, 4 means that listeners can understand without effort, accent is a minor distraction and 5 is that the listener can understand without effort, accent may be present but is not distracting. The average comprehensibility scores in pre- and post-tests of both the groups are given below in Table 3.

Table 3: *Results of comprehensibility ratings (Pre- and Post-Tests)*

Listeners/raters Participants	**Average comprehensibility score of Controlled group (22 speakers)**		**Average comprehensibility score of Experimental group (14 speakers)**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Rater 1 (non-native)	3.9	4	2.3	2.9
Rater 2 (native)	2.7	3.7	2.4	2.9
Rater 3 (IELTS Exam)	4	4	2.4	2.7
Rater 4 (native)	3.9	4.5	3.4	4
Rater 5 (non-native)	4.4	4.5	2.9	4
Means score	3.78	4.14	2.68	3.3

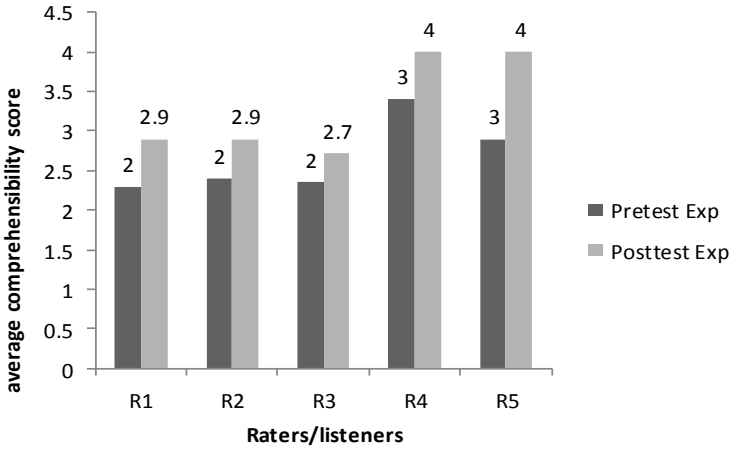
From table 3, the average comprehensibility score of all the speakers in the experimental group is below 3 in the pre-test which shows that the comprehensibility of both NES and NNES listeners is affected by the foreign speech accent of the NNES speakers. By controlling the syntactic and semantic errors by recording a reading of the written text (see Appendix B), it was observed that the segmental and supra-segmental features alone affected comprehensibility. The observation is recorded and discussed below in the section of accent and intelligibility.

The next important finding of the data given in Table 3 is that all the listeners rated the speakers more comprehensible in post-test which indicates that the intervention of an accent reduction program helped speakers to improve their pronunciation.

To authenticate the results further and to inspect whether these results are statistically significant enough that they could be generalized to the larger population, we ran sophisticated statistical analysis *namely Paired T-test*. Reason behind selecting this particular test was the nature of the data itself which we collected in pre- and post-tests. It was intended to see whether there was a significant difference in the comprehensibility score within the two groups before and after the accent reduction program.

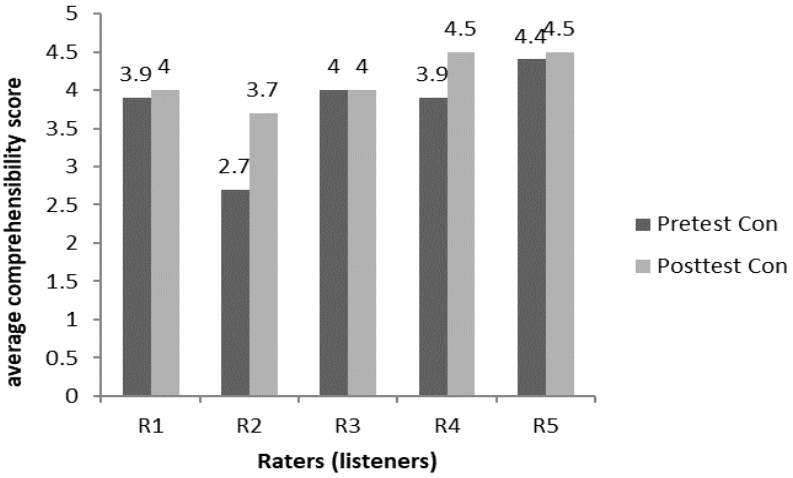
As the Figure 1 below shows, the experimental group has constantly achieved a significantly higher comprehensibility score from the five raters.

Figure 1: *Average Comprehensibility Score of Experimental Group*



On the other hand, though the controlled group has demonstrated some level of improvement in comprehensibility score (Figure 2 below), statistical analysis does not measure this improvement as significant as in the experimental group. What is more, it can be noticed in Figure 2 that rater 1, 2 (Arab NNES) and specially rater 3, an IELTS examiner (NES) gave the controlled group 4 on average on comprehensibility scale at both pre and post-test stages which reflects two important findings; first, it shows that controlled group scored high at both stages which means that IELTS examiner could understand their speeches without effort and accent was minor distraction. And secondly, it indicates that on average there was no difference in their scores according to IELTS standards which means that accent reduction program ran through conventional way might not be effective.

Figure 2: *Average Comprehensibility Score of Controlled Group*



Additionally, as reflected in Table 4, the *p*-value is statistically significant in the experimental group i.e., *p*-value = 0.009, whereas, in controlled group the *p* -value = 0.133 which indicates that there is no significant difference in the comprehensibility score.

Table 4: *Paired Samples T-Test*

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-test controlled group – Post-test controlled group	-0.36000	0.42778	0.19131	-0.89117	0.17117	-1.882	4	0.133
Pair 2	Pre-test experimental group – Post-test experimental group	-0.62000	0.29496	0.13191	-0.98624	-0.25376	-4.700	4	0.009

Therefore, it can be concluded that the intervention of technology-based accent reduction program has a positive impact on the pronunciation of the speakers of experimental group.

However, the average comprehensibility scores of the controlled group in the pre-test (3.78) is higher than that of the experimental group (2.68) which seems to be counterintuitive because both the groups are randomly selected from the same population. In order to understand this difference in comprehensibility rating for the speakers, we collected some important background information of the speakers: first, to find out the proficiency level of each group and second, to explore their exposure to speaking and listening English. As far as their proficiency level is concerned, we found that recently both groups qualified for the intermediate level according to CEFR B2 placement test; hence it is assumed that both have the same proficiency level. The only refuge left to us was to ascertain their exposure to English speaking and listening and see whether their past English learning experiences have affected their comprehensibility scores at the pre-test stage.

5.2 Speaking and listening opportunities

To inquire about their speaking and listening opportunities we administered a follow up questionnaire (see Appendix A). The findings of the questionnaire are

summarized in Table 5 and 6. The responses on the speaking and listening situations were elicited by two questions which were:

1. State how frequently you participate in activity' by using scale:
   1 = never, 2 = rarely, 3 = sometimes, 4 = every day
2. State the difficulty each situation gives you by using these numbers:
   0 = not applicable, 1 = no difficulty, 2 = some difficulty, 3 = great difficulty.

5.2.1 Speaking opportunities

Table 5: *Speaking Opportunities (in English) of Controlled and Experimental groups*

Situation	Frequency		Difficulty	
	Con-Group	Exp Group	Con-Group	Exp Group
Conversation with friends	2.88	2.57	1.55	1.71
Asking Questions	3	2.85	1.88	1.78
Responding to Questions	2.83	3	1.77	1.64
Small Group Discussion	3.5	3	2.7	2.64
Talking on the Phone	2.16	2	1.11	0.93
Speaking in Classroom	3.66	2	2.5	3
Presenting in Classroom	3.7	2.78	2.27	2.57
Mean score of overall listening opportunities	3.1	2.6	1.97	2.03

The average speaking opportunities of experimental group is 2.6, whereas, that of controlled group is 3.01, which indicates that they have been communicating orally in English more frequently. However, the score on the level of difficulty in speaking indicates that despite having more speaking opportunities, the controlled group faced the same level of difficulty in speaking as that of experimental group. The score on the level of difficulty in speaking does not corroborate with the score on the frequency of the speaking opportunity, which appears to be counterintuitive. It means that the perception of difficulty in different speaking situations of both the groups is higher and does not change despite having differences in speaking opportunities.

5.2.2 Listening opportunities

Similarly, in listening opportunities the controlled group has an average score (2.94) which is higher than that of experimental group (2.5) as shown in Table 6. Unlike average speaking opportunities, the scores on difficulty level in listening corroborates with the frequency of listening opportunities. In other words, more frequent exposure to listening seems to minimize its difficulty level and resultantly makes the speakers of the controlled group better listeners than those of the experimental group.

Table 6: *Listening Opportunities (in English) of Controlled and Experimental groups*

Situation	Frequency		Difficulty	
	Con-Group	Exp Group	Con-Group	Exp Group
Radio, television	2.83	1.78	1.44	0.92
Lectures	3.5	2.57	1.05	2.42
Telephone talk	2.22	2	1.2	1.07
Conversation	2.88	3	1.44	1.92
Understanding questions	3.28	3.35	1.5	1.78
Mean score of overall listening opportunities	2.942	2.54	1.326	1.622

In view of the background information of speakers, it is apt to investigate whether the scores on listening and speaking opportunities correlate with the comprehensibility scores specifically on the pre-test stage or not. The average scores of the controlled group on speaking and listening opportunities are 3.1 and 2.94 respectively and their average comprehensibility score on pre-test is 3.78, whereas the average scores on speaking and listening of the experimental group are 2.6 and 2.5 and their average comprehensibility score on pre-test is 2.68. As we can see there is a difference between the two groups in listening and speaking opportunities, therefore, the average comprehensibility score for the controlled group on pre-test is higher than that of the experimental group.

Hypothetically, it was expected that there wouldn't (informal expression) be any significant improvement in the comprehensibility score in the post-test of the controlled group as it was trained in pronunciation through conventional way without using the technology. However, we noticed that there is a difference in their average comprehensibility scores of their pre-test (3.78) and post-test (4.14). On other hand, it was expected that we would notice significant difference in the comprehensibility score of the experimental group in post-test because it was trained in pronunciation using technology. Nevertheless, we found a statistically significant difference in the comprehensibility scores of experimental group (p-value = 0.009), whereas that of controlled group (p-value = 0.133) which is not statistically significant. We could understand the improvement in the comprehensibility scores of the experimental group because they were treated through technology and this was also our hypothesis. However, the improvement in the comprehensibility scores of the controlled group though not statistically significant, needed more explanation. One reason for their improvement could be attributed to the conventional pronunciation training. In order to justify the difference in comprehensibility scores on more concrete grounds, we conducted a

follow up informal discussion with the controlled group after the post-test. It was revealed during the informal discussion that most of the students in the controlled group, having exposure to the language in English speaking countries, had already developed a comfortable level with the challenges of spoken English. The same exposure eventually made their learning experience in the classroom comparatively less stressful with more enhanced intrinsic motivation than that of the experimental group. Therefore, they willingly participated in the three weeks pronunciation training program though through conventional ways.

On the other hand, the participants in the experimental group had no previous experience of interacting with native English speakers and they didn't have the experience of interaction in English except in the EFL classroom. Based on our five years of experience as EFL teachers in the same context, our interaction with the experimental group, and their low comprehensibility score at pre-training stage and their demographic details, we found that usually Saudi EFL students, specially of low proficiency levels, are not intrinsically motivated and consequently they hardly speak English in a four hours long classroom. Most of the time, they use Arabic language when they interact among themselves/with one another inside or outside the class. Above all, they were not quite willing to improve their pronunciation and did not realize the importance of correct pronunciation because they never have had experienced any communication breakdown in their conversation with a native speaker. However, it is interesting to note that the experimental group was observed to be engaged in class tasks using a mobile application which apparently supported one of our hypotheses that technology is likely to help students engage in the learning process.

At the end of the program we visited their class and sought their reflections on the program in an open whole class discussion.

The data gained through field notes and open discussion also reflected that their perception about the importance of correct pronunciation was substantially changed and they asked for the continuation of the program until the end of the module which could be positively viewed as a significant improvement in their pronunciation as reflected in their comprehensibility scores due to technology integration.

5.3 Foreign Speech Accent

Our next critical research attempt was to investigate the perceptions of the listeners (a) what made some speakers more difficult than the others? (b) which aspects of an accent were the most noticeable focusing specifically on accent features of the Saudi speakers? To meet this end, the researchers supplemented an accent scale for the raters (see Appendix B), besides, a comprehensibility scale, in

order to assist the grading process by making it substantial (Major, 2002). The accent scale's both segmental and supra-segmental fragments were further split into vowels, consonants, intonation, stress, pitch, tone, and rhythm for the handiness of the raters to focus on the vocalization of individual phonemes as well as to differentiate among the supra-segmental features. It is worth mentioning here that at the end of grading, all raters have reflected on the validity and authenticity of the scale. They have estimated the scale as reliable, practical, useable, and clear with distinct categorizations which gives visual and qualitative background to the process of grading.

The raters have noticed that a considerable number of participants have the tendency to switch over to a different vowel sound. For instance, /e/, /ɒ/, and /ɔ:/ are swapped by /i/, /ə/ and /ɜ:/ respectively. Likewise, some participants have consumed certain phonemes: the diphthong /aʊ/ has been left out and substituted with /ʊ/ in the word "now". Also, some of them have the propensity to replace a diphthong with a long vowel. The word "try" was pronounced as /'tri:/ here the diphthong /aɪ/ is replaced with long vowel /i:/. It is noteworthy to consider that the reasons behind such errors do not come under the preview of this paper. However, further study can be recommended to explore the reasons for the difference in the articulation of these phonemes.

Similarly, raters have also reckoned that there are some inaccuracies in the production of consonants. Many participants have mispronounced the variance of -ed form of regular verbs. For instance, instead of /t/ they have used /id/ in the verbs "worked and liked". Equally, /g/, /p/, /ð/, /tʃ/, are substituted with /k/, /b/, /θ/, /ʃ/ respectively. Noticeably, it is the mispronunciation of consonants that really obstructs comprehensibility, whereas, imprecisions in vowel sounds may not be too critical in understanding the speech which confirms the findings of Field (2005) and Jennifer (2002).

Intonation, stress and tone are the most prominent supra-segmental features that are marked as erroneous. A quite substantial number of participants have shown incompetence to differentiate between peculiar trajectories of questions and affirmatives. Quite similarly, monotonic and inaccurately stressed sentences are also recorded. For example, wrong syllables are stressed and at times a word is mistakenly stressed, but actually they do not need to be. Occasionally, weak forms were stressed that made the speech unnatural and artificial. For example, the sentence "I see! How long have you worked for them?" is uttered as /ˈaɪ siː ˈwhuː ˈlɒŋ həf juː wɜːkid fɔːr ˈðem/ instead of pronouncing it like /ˈaɪ ˈsiː// ˈhaʊ ˈlɒŋ həv ju wɜːkt fə ðəm/.

In short, it is further validated from the above findings that the listeners' evaluation of the factors which made the speeches of the speakers accented, were segmental and supra-segmental errors which affected their comprehensibility. And these factors were aptly considered while selecting the pronunciation applications, which provided ample opportunities to the speakers to work on their

weak areas during a three weeks pronunciation program. The significant values on comprehensibility scores of the experimental group authenticated the validity of the pronunciation applications we selected for accent reduction. However, the speakers expressed their need for longer time of intervention and pronunciation training. This request was willingly accepted by the teacher who provided training on pronunciation using the applications. Later on, these applications were also introduced to the controlled group who showed greater enthusiasm to use them to further improve their pronunciation. Based on these findings, it is highly recommended to run such technological oriented accent reduction programs on a regular basis at the ELI and other such institutions specifically in EFL settings.

6. Conclusion

After reviewing and analyzing the landmark (too bi word substantial or significant) empirical studies, and conducting a quasi-experimental study, it can be concluded that: first, in both the contexts-second language context and international language context- the (ambiguous sentence) accented speech of non-native speakers affected the comprehensibility of all the listeners whether native or non-native. Secondly, the technology-based accent reduction program helped improved (omit d) the pronunciation of the students significantly. However, it was revealed through the findings inducted from the speaking and listening opportunity questionnaire that the improvement in the controlled group's pronunciation was mainly because of their academic and social background. However, the impact of a conventional pronunciation training program could not be overlooked. Thirdly, both the segmental and supra-segmental factors of phonology contributed to the foreign speech accent and consequently the speeches were less comprehensible to both native and non-native listeners. Therefore, the selected accent reduction program has provided training on both segmental and supra-segmental features. It can be inferred that a technology-based accent reduction program has augmented pronunciation training and consequently has bolstered effective oral/aural communication. Therefore, the researchers foresee a fruitful and promising future of such a program in schools of English in the identical EFL contexts.

7. Limitations

The study has a number of limitations. First, the judgments made about the comprehensibility of non-native accented speech are not based on extempore speech which might have added dependability to this study. However, in that case we could not control the effect of extraneous variables such as grammatical errors, speaking rate, collocation errors and language transfer in terms of meanings which might also affect comprehensibility. Second, the controlled group might not fall within the normal distribution of the larger population because of their better English proficiency. Therefore, it might not be the true representative sample to generalize the findings based on their responses. However, after further investigation, it was disclosed to the researchers that such mixed ability English language learners in the same level according

to (CEFR, B2) is a norm at the school in focus. Thirdly, the length of the pronunciation training program was three weeks which might not be sufficient for significant improvement. Fourth, numbers of the speakers in the two groups were not equal which might have affected the measurement applied for analysis. There was no set intention for the difference in the number of the participants in both groups except that these were the actual number of the students enrolled in the classes. To maintain fairness in the treatment of the participants, we could not adopt the idea of exclusion to make the number equal in both groups. Fifth, the pronunciation apps selected for the program had some compatibility issues with mobile devices possessed by speakers. For example, there was a difference in the interface of Android and IOS which challenged the comfort zone of the learners. Timely interventions of researchers supported the learners and the teacher in resolving the issue of compatibility. However, two of the participants were using mobile devices which were not supporting the apps. This issue was resolved pedagogically by putting these participants in pairs with those who had compatible devices. Last but not the least, although it was beyond the scope of this paper to investigate the most common segmental and supra-segmental errors found in NNES of Saudi origin, they could have been guided to provide focused trainings in those particular areas. Future research is highly recommended to investigate these pronunciation errors in depth so that a more focused and needs-based pronunciation training program could be designed.

8. Pedagogical implications

Pronunciation teaching seems to be revived in recent years and creating its place in second language pedagogy. Pedagogically speaking, studies reviewed, and the study conducted imply the importance of pronunciation teaching and learning specifically through technology integration which according to the researchers foster effective oral/ aural communication.

It can also be inferred from the study conducted that if one desires to be understood in both the contexts-NES-NNES or NNES-NNES interactions- one has to learn both segmental and supra segmental features of English Phonology. Most importantly, the study suggests that it should no longer be a compulsion for English teachers and learners to strive to sound like native and to follow Received Pronunciation (RP) or General American standard (GA) as long as comprehensibility is achieved which is the goal of pronunciation teaching. Such standard where comprehensibility is the major goal of communication is called "Lingua Franca Core" (Dauer, 2005; Jenkins, 2005; 2006; Kuo, 2006). Therefore, it is strongly recommended that Lingua Franca Core standards of comprehensibility should be the norm when implementing technology-based accent reduction programs in both ESL and EIL contexts.

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