An Acoustic Study of the Role of Consistency of Input in Acquisition of English Short Vowels in Pakistan

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Abstract

The study is aimed at observing the effect of consistency of input on the acquisition of English short vowels regarding jaw opening (correlated with F1), tongue fronting (correlated with F2) and Duration of vowels. The design of the study is quasi-experimental with a 'pre-test-post-test control-group' frame. The researcher took three intact class groups, at middle level from a public girls school, and assigned them to experimental groups and control group. Experimental Group A was consistently exposed to English RP based audios/videos for 60 consecutive days. Experimental Group B was inconsistently exposed to input in alternative days adding up to 30 days. Control group C was not given treatment of any kind. For data elicitation, the target short vowels were embedded into /ɦvd/ syllables in the carrier phrase 'say --- please' as a stimuli. Each phrase was recorded five times in pre-test and five times in post-test adding up to eighteen thousand tokens of English short vowels. For marking phonemic boundary of vowels in hvd syllable, the interval between vowel onset and offset was selected. FormantPro (Xu, 2013) software was run to obtain average values of F1, F2, and Duration of vowels of each participant on the basis of which average values of each group were calculated. The results of the data show that short vowels of group A are significantly affected by consistent exposure to RP vowels. No remarkable difference is found in the short vowels of group B and group C. This study gives a few recommendations related to administrative and pedagogical practices for ensuring consistency in teaching of L2 phonology.

1. Introduction

Second Language Acquisition is defined in various ways by researchers. However, they are unanimous that second language is a language other than the mother tongue of the speaker that used inside or outside of a classroom (Ellis, 1985; Gass & Selinker, 2008; Fazel, 2014). In this way, the area of foreign language learning also becomes a part of Second Language Acquisition (Moeller & Catalano, 2015). In addition, SLA is a subfield of linguistics that studies the procedures underlying the acquisition of second language among the learners of non-native language (Saville-Troike, 2006). The field of SLA is related with parent disciplines like linguistics, education, psychology, and even sociology and anthropology.

Second Language Acquisition cannot take place without some sort of "input" that is one of the two requirements of (Ellis, 1985). VanPatten (2003a) proposed that input does have communicative intent for the learners. However, Gass (2010) stated that input can be "written form, or from the spoken language, or, in the case of sign language, from the visual mode" (p. 195). Hence, input is any form of language to which the learner is exposed including communicative, textual, and semiotic (Zhang, 2009). The researchers (e.g Larson-Hall, 2008; Munoz, 2008) think that if the input is not adequate, there is no guarantee of the early start and natural exposure in SLA.

Input is distinguished from intake by Gass and Selinker (1994) as input is all information/exposure of language "that goes in one ear and out the other" (p. 305). But when this language input is internalized by the learner it becomes intake (Corder, 1967). Language is acquired successfully when a large amount of input is converted into intake that can be obtained by 'noticing' (Schmidt, 1994). Noticing makes the learners sensitized to the structure/form and consequently spot such structure/form in the language input. Counselman (2010) observed that when the learners' attention is drawn to specific structures of the input, they easily learn the target items in the input. For the acquisition of L2 phonology, Schmidt (2001) found that the learners must notice the sound differences and phonetic qualities of the L2. Among different strategies of noticing, input enhancement is very common. This technique makes the essential/difficult target forms noticeable for learners' attention (Leow, 2001). Input can be enhanced either by elaboration, textual enhancement or by giving explicit instructions. Frequency of occurrence of the target forms/structures/items in input also has facilitative effect on L2 acquisition (Schwartz & Causarano, 2007) because language learning is an unconscious "tallying" (Ellis, 2002a) of occurrence of the linguistic items. Frequency can be of the tokens and the types of the target structures. Frequency of target structures brings morphological, phonological, and syntactic productivity, automaticity of production, and strengthens the representational schema of the target structure for further application.

Among various factors related with enhancing the quality of input in SLA, the factor of "consistency" of input in SLA has been ignored to a great extent. The term 'consistency' has been defined in two ways in dictionaries: (1) The quality of achieving a level of performance which does not vary in quality over a period of time; (2) The way in which a substance holds together having thickness or stickiness. In the previous research studies (Childers & Tomasello, 2001; Kanno, 1998; Nakamura, 2015), the latter meaning of "consistency" was applied as the quality of the input where the target structures have been inducted thickly and densely for their enhancement. But in the present study, consistency of input is taken as the 'regular/steadfast adherence to the same course without gaps and intervals'. This regular and steadfast adherence is the exposure of Pakistani learners of English (as L2), at middle level, to English RP short vowels for the period of 60 days. This regular exposure of the learners to the RP short vowels for a long period of time makes consistency longitudinal instead of lateral (Kanno, 1998). Before advancing to the study, it is desired to discuss the status of English in Pakistan.

Pakistani children get exposure to English at the age of four in formal setting supervised by the government of Pakistan. English phonology, regardless of being a central area in SLA, has been overlooked since decades in Pakistan. In addition, the learners are exposed to English input for limited time such as a period comprising of 45 minutes. This input is provided by the non-native speakers of English. This situation is aggravated by non-provision of audio and visual aids for teaching that decreases the effectiveness of lessons (Ali, 2011). Therefore, an indigenized variety of English is developed that "deviated from the standards" of British RP (Kachru, 1983). The distinction of Pakistani English phonology is the deviant use of vowels rather the use of consonants (Ladefoged & Johnson, 2011). Rahman (2014) observed that Pakistani speakers of English replace the RP diphthongs /əʊ/ and /eɪ/ by monophthongs/ɔ:/and/e:/even by educated Pakistanis. The vowel sound /ə/ is often omitted or replaced by the phoneme/ɑ:/. RP vowel sounds /ɔ:/ and /ɒ/ are usually replaced by /ɑ:/ phoneme. Moreover, Pakistani speakers of English take

tense-lax vowels as contrastive phonological feature of short-long vowels contrary to English language where tense-lax phenomenon is a phonetic phenomenon.

1.1. Research Questions

The current study has the following research questions:

1. What is the effect of consistency of input on the acquisition of jaw opening (correlated with F1 values) of English RP short vowels at middle level in Pakistan?
2. What is the effect of consistency of input on the acquisition of tongue fronting (correlated with F2 values) of English RP short vowels at middle level in Pakistan?
3. What is the effect of consistency of input on the acquisition of duration of English RP short vowels at middle level in Pakistan?

2. Materials and Methods

2.1 Research Design

The current study is quantitative because it uses numbers to measure the acquisition of RP short vowels in terms of numbers. Additionally, it is quasi-experimental study because the sample was not selected and assigned to experimental and control groups randomly (Cook & Campbell, I979). In the current educational setting, genuine true-experimental design was not feasible due to practical constraints (Dornyei, 2007). The frame of the study is 'pre-test-post-test control-group' (O»X»O, O»-»O) to control different threats to internal validity of the experiment (Leedy, 1997). The researcher formed three groups from three intact class groups: two experimental groups which were exposed to the special condition of input as a treatment, and one control group to used as baseline for comparison of the performance of the groups to observe how the acquisition of RP vowels of experimental groups is distinguished from the participants of the control group.

The variable of consistency is the variable of influence whose conditions are manipulated by the experimenter (Best & Kahn, 2007). The 'acquisition of RP short vowels' is the dependent variable that has three values: duration of vowels, jaw opening (correlated with F1), and tongue fronting (correlated with F2). The variable of consistency of input was manipulated to observe its effect on the acquisition of RP vowels explainingcausal relationships between these variables. It is not possible and even desirable to control all the extraneous variables because this endeavor may reduce the generalizability (external validity) of the study (Clarke, 2004). However, the researcher tried to manipulate the variable of consistency of input keeping some extraneous variables constant i.e gender, age, and language proficiency level.

2.2 Sampling

Three genuine intact class groups of learners at middle level are selected from a typical public school for girls in District Sheikhupura, Pakistan. The researcher took the whole class as a group and dropped the students who were frequently absent during the procedure of treatment making the final number of participants in each group 30. The researcher assigned these classes to experimental group A, experimental group B, and control group C. To improve the quasi-experimental design of the study, the researcher applied two strategies, suggested by Heinsman and Shadish (I996): (a) avoiding any self-selection of the students to be in the treatment group; and (b) minimizing pre-test differences between the treatment group and the control groups as much as possible. Moreover, only female learners were selected as the participants of the study because there is 10 to 15% difference in formant frequencies in male and female speakers. The

average age of the participants of this study was 13 years; it means that the participants were exposed to English input for almost eight to nine years.

2.3 Stimuli

The researcher embedded the target short vowel /ɪ/, /e/, /æ/, /ɒ/, /ʊ/, /ə/, /ʌ/ into /ɦ-v-d̪/ syllable for the least coarticulatory effects of the neighboring consonants on the target vowels (Bohn & Ocke-Schwen, 2004; Cox, 2006; Hillenbrand et al., 2001). The enormous use of the /ɦvd̪/ syllable is due to its 'null environment' (Stevens & House, 1963). The voiceless glottal fricative [ɦ] has the quality of the vowel it precedes because the configuration of the vocal tract in producing [ɦ] is determined by adjacent sounds. That's why, for evaluating articulatory behavior of the sounds surrounding the [ɦ], the articulatory characteristics of [ɦ] are fully appreciable (Perry, 2008; Robb & Chen, 2009). Likewise, the voiced alveolar plosive [d̪] has least anticipatory coarticulatory effect on the vowel followed by [d̪] except the effect of the pre-boundary voicedness on the length of the preceding vowel (Pickett, 1999). Hence, the combination of the phonemes [ɦ] and [d̪] in /ɦvd̪ / syllable assures more standardization of the syllable shape as well as co-articulatory influences. The /ɦvd̪ / syllables used in the current study were hid, head, had, hod, hood, ha, hud. These /ɦvd̪/ syllables were inducted in the carrier phrase 'say hvd please' (Ali, 2013). The carrier phrase was used as stimuli to control the intonational influences of the speakers, provision of the required number of tokens of each vowel, and prominence of acoustic properties of vowel sounds (Al-Hamadi & Ali, 2012)

2.4 Procedure

The total period of treatment was 60 days for provision of input of RP short vowels. Both of the treatment groups (Group A and Group B) were manipulated by giving them audio and visual input of English vowels along with explicit instructions to make the vowels in the videos noticeable for the learners. The participants of the experimental groups were exposed to the RP short vowels in the first 28 days. In the remaining 32 days, mixed practice of listening and pronouncing the short vowels was done by the participants. The participants of the experimental group B were given the same exposure to RP short vowels as the group A received except that the group B was exposed to RP vowels in alternative days. Hence, the total period of treatment of group B was 30 days. The control group C was given no treatment at all. The researcher is a non-native speaker of English whose first language is Punjabi. That's why, the researcher tried to minimize her role and facilitate the participants only when they face some sort of problem in noticing the target sounds in the input.

2.5. Data Collection

Before giving treatment to the experimental groups, the pre-test was administered by giving the stimuli of the carrier phrases embedded with the /ɦvd̪/ syllables. The data were collected by recording the reading of the 'say hvd please' phrases of the participants of the experimental groups and control group. The recordings were made at a sound attenuated place in the school. All the participants were asked to read each phrase five times in pre-test and five times in post-test to get the average performance of acquisition of RP vowels of the participants adding up eighteen thousand tokens of English vowels (100 ×2 = 200×90=18,000). The data were organized in different folders for systematic analysis.

2.6. Analysis of Data

Segmentation is the first step of acoustic data analysis that "decomposes the speech signals into smaller acoustic units" (Kaur & Singh, 2010, p. 1). The researcher manually segmented the syllable and vowel phonemes. However, the researcher also benefitted from auditory and visual cues from waveform and spectrograms (Colantoni & Marinescu, 2010; Figueroa and Evans, 2015). The researcher transposed the vowel tokens to FormantPro software (Xu, 2013) for segmentation. For marking the boundary, the interval from the approximate onset and offset of the vowel was selected (Ali, 2013; Hillenbrand et al., 2001). The onset of the vowel was marked where the vocal folds began to vibrate along with the increase in wave amplitude and complexity. Fricative noise of [ɦ] in form of random pattern and aperiodicity in the waveform (DiCanio, 2015) was not included in the vowel domain. For setting the offset boundary of the vowels, the closure of [ɗ] phoneme was excluded from the domain of vowels by looking for a sudden decrease in amplitude and complexity in waveform; a loss of energy in higher formants in spectrogram; the onset of aperiodicity. The researcher focused on the two lowest frequency formants (F1 and F2) for phonemic segmentation because they present the most vital acoustic properties visible in spectrograms, a determiner of vowel quality (Delattre et al., 1955). Afterwards, FormantPro.praat (Xu, 2013) was run for extracting formant values and duration values of the vowels. The researcher imported the extracted average values to the excel file. The researcher calculated the average F1, F2, and Duration values of each group in pre-test and post-test.

2.6.1 Measurement Reliability

The researcher estimated the measurement reliability of the data by correlating two sets of scores (e.g. Robb & Chen, 2009). Ten percent of the total data set (1800 token of vowels) was re-analyzed. The computation of the mean values of the first and second data sets show that the Mean Absolute Deviation of the F1 and F2 of vowels ranges from 0 to 15.15 Hz from the mean values that is within the range of reliability of measurement i.e -+ 60 Hz (Monsen & Engebretson, 1983). MAD values of duration measurement range from 0 to 15.02 ms.

3.Results

The results of the data analysis are displayed in the tables followed by their graphical representation.

Table 3.1: **F1 and F2 of Short Vowels of Group A, Group B, and Group C in Pre-test**

Vowel	F1			F2		
	Group A	Group B	Group C	Group A	Group B	Group C
ɪ	508	494	483	1717	1678	1774
e	639	578	684	1717	1648	1704
æ	762	737	757	1707	1611	1635
ɒ	548	540	567	1230	1294	1187
ʊ	517	520	499	1258	1293	1271
ə	833	768	800	1392	1459	1328
ʌ	652	618	682	1473	1434	1450

Table 3.1 shows that there is no significant difference in the F1, F2, and Duration values of the short vowels of Experimental group A, Experimental group B, and control group C in pre-test. No

doubt, minute difference is observed in the performance of the groups but this difference is not significant as p > .05 in One-Way ANOVA and Fisher's LSD post-hoc test.

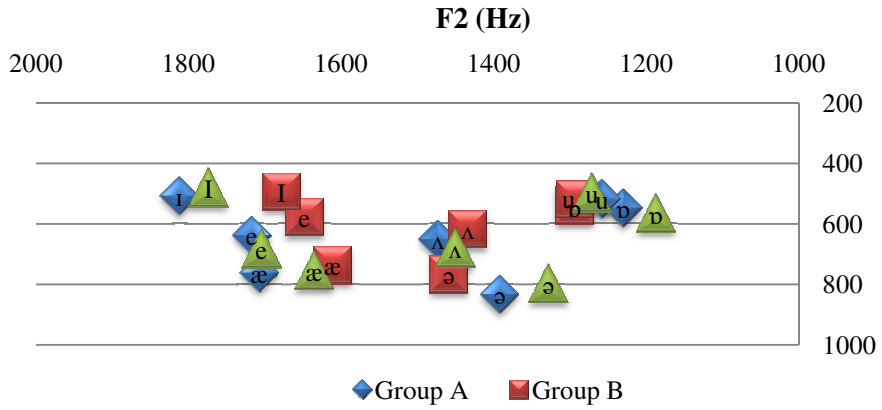

Figure 3.1.**Short Vowels of Group A, Group B and Group C in Pre-test**

Figure 3.1 shows that the short vowels of experimental group B are pronounced somewhat differently from the short vowels of group A and group C regarding the position of tongue fronting in pre-test. However, the short vowels /æ/ and /ʌ/ of group B are not found markedly different from these short vowels of other groups.

Table 3.2: **F1 and F2 of Short Vowels of Group A, Group B, and Group C in Post-test**

Vowel	F1			F2		
	Group A	Group B	Group C	Group A	Group B	Group C
ɪ	418	431	531	1875	1921	1860
e	731	672	710	1768	1677	1729
æ	792	739	750	1760	1590	1654
ɒ	615	587	546	1266	1185	1201
ʊ	463	484	479	1267	1212	1218
ə	817	752	797	1382	1301	1350
ʌ	791	676	704	1568	1372	1470

Table 3.2 shows that the short vowels of the experimental group A are pronounced significantly different from the short vowels of group B and group C in post-test. The F1 and F2 values of four short vowels of group A are found significantly different from the F1 and F2 values of the short vowels of group B and group C as p < .05.

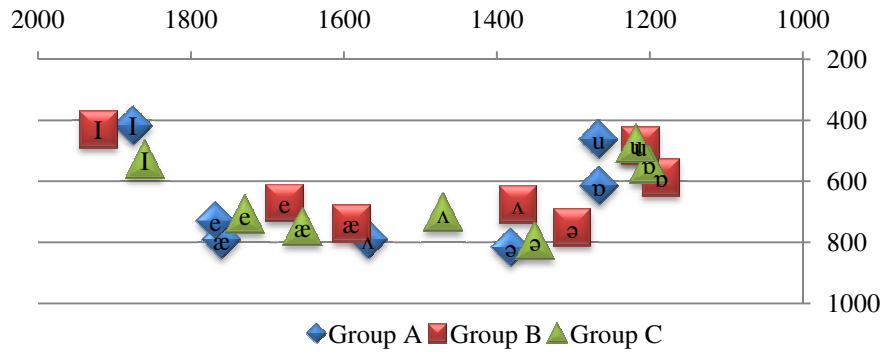

Figure 3.2.**Short Vowels of Group A, Group B, and Group C in Post-test**

Figure 3.2 shows that the short vowels experimental group A are most affected by the treatment. In the post-test data of vowels, the short vowels of group A are found pronounced differently from the short vowels of group B and group C. Marked difference is observed in the pronunciation of the vowels /æ/, /ʌ/, /ɒ/, and /ə/ after the treatment.

Table 3.3: **Duration of the Short Vowels of Group A, Group B, and Group C in Pre-test and Post-test**

Vowel	Pre-test Duration			Post-test Duration		
	Group A	Group B	Group C	Group A	Group B	Group C
ɪ	94	97	100	113	127	110
e	122	127	112	139	173	112
æ	151	139	209	213	199	204
ɒ	145	130	166	186	199	171
ʊ	127	121	115	133	133	124
ə	166	139	177	225	227	187
ʌ	106	117	111	153	136	122

Table 3.3 indicates that the duration of the short vowels of group C is longer than the duration of the short vowels of the group A and group B in pre-test. However, this difference in the duration of the short vowels of group A is decreased in post-test. Only one short vowel of group B is found different from the short vowels of group A and group C in duration values in post-test.

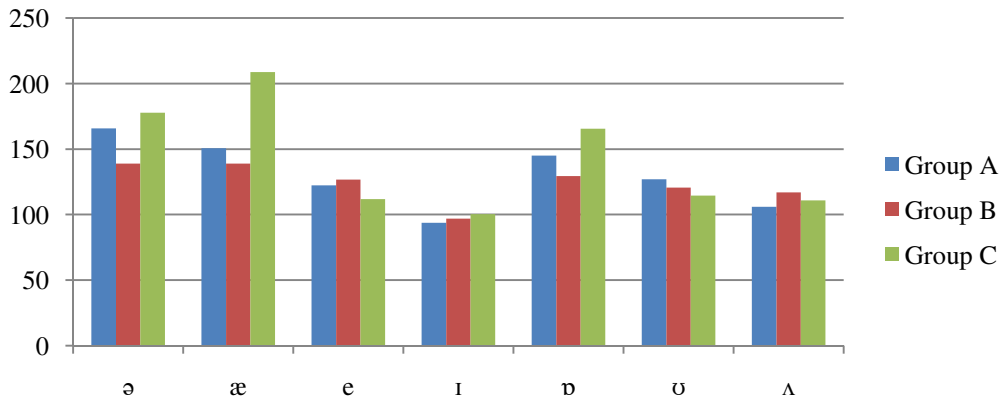

Figure 3.3: **Duration of Short Vowels of Group A, Group B, and Group C in Pre-test**

Figure 3.3 reflects that the duration values of short vowels /æ/ and /ɒ/ of group C are significantly higher from the duration values of these vowels of group A and group B. The duration values of vowel sound /ə/ of group A and group C are observed significantly different from the duration values of the vowel /ə/ of group B. No significant difference is observed in the duration of the vowel sounds /e/, /ɪ/, /ʊ/, and /ʌ/ among the groups.

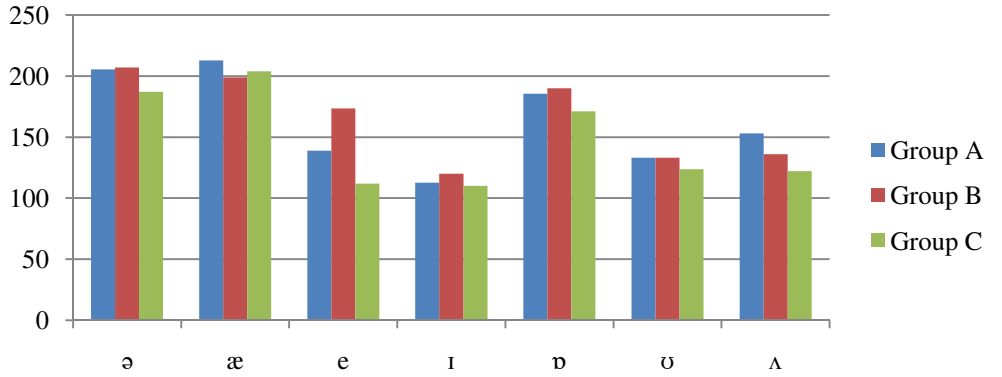

Figure 3.4:**Duration of Short Vowels of Groups in Post-test**

The Figure 3.4 indicates that there is no significant difference in the duration of the short vowels /ə/, /æ/, /ɪ/, /ɒ/, and /ʊ/ of control group and experimental groups. Significant difference is found in duration values of only two vowels. The duration values of the vowel sound /e/ of group A and group B are found significantly different from the duration values of the vowel sound /e/ of group C. Likewise, the duration values of the vowel sound /ʌ/ of group A are observed significantly different from the duration values of the vowel sound /ʌ/ of group B and group C.

4. Discussion

The study of the pre-test and post-test short vowels of experimental group A, experimental group B, and control group C shows that the acquisition of the RP short vowels of the experimental groups in post-test is different from their pre-test acquisition of vowels regarding their spectral and temporal features. Only 1 short vowel (/ə/) of group A is observed different in F1 values from the short vowels of other groups with 14% difference in pre-test. While, 4 short vowels (/ə/, /æ/, /ɒ/, /ʌ/) of group A are found different mounting to 57% difference level in post-test. F2 values of only 1 short vowel (/ɪ/) of group A with 14% difference level are found significantly different in pre-test; but, F2 values of 4 short vowels (/ə/, /ɒ/, /æ/, /ʌ/) of group A with 57% difference level are found significantly different from those of group B/ C in post-test short vowels. In case of Duration of short vowels, no significant difference is observed in any short vowel of group A in pre-test; but, in post-test, 29% short vowels (/e/, /ʌ/) of group A are located significantly different from the short vowels of other groups in duration. Hence, consistency of input played a significant role in acquisition of English vowels particularly spectral features of the vowels of the learners.

The short vowels of group B are not found significantly different in their spectral features in pre-test and post-test. Surprisingly, not a single short vowel of Group B is found significantly different in F1 in pre-test and post-test. F2 difference is located in 29% short vowels (/ə/, /ɒ/) of group B in pre-test. However, in post-test, this difference in F2 of short vowel is non-existent. No significant difference is located in duration of the short vowels of Group Bin pre-test. While, in post-test, one short vowel of group B (/e/) is found at variance with the short vowels of group A/C in duration. This pre-test and post-test performance of group B reflects that inconsistent input does not affect the acquisition of the spectral and temporal features of the vowels of the learners.

So far as the short vowels of group C are concerned, one short vowel is found significantly different in F1from the short vowels of group A/B in pre-test (/e/) and post-test (/ɪ/) with 14% difference. No significant difference is observed in F2 of short vowels in pre-test and post-test. However, difference found in duration of 43% short vowels of group C (/ə/, /æ/, /ɒ/) in pre-test is decreased to 0% in post-test. In this way, the results show that absence of input has no significant effect on the acquisition of English vowels.

5. Conclusion and Recommendations

The results of the study show that consistency of input does play a significant role in the acquisition of English RP short vowels. Group A that received input of English RP short vowels consistently has improved in the acquisition of short vowels in comparison to the vowels pronounced in its pre-test. This improvement is quite noticeable in the features of tongue height (F1) and tongue fronting (F2) of the vowels. However, the acquisition of the duration of the short vowels is not much affected by the consistency of input. Contrary to experimental group A, the short vowels of the groups that received input inconsistently i.e. experimental group B and control group C do not improve the short vowels in post-test in comparison to their pre-test short vowels. In the light of these results, the current study gives following recommendations.

1. the schedule of teaching English language classes on weekly bases should be rearranged for managing the classes on regular basis so that the acquisition of English phonology get greater gains. Moreover, consistency of input can be maintained by ensuring the regularity of teachers and learners in the process of acquiring target sound patterns.

2. In the field of pedagogy, consistency of input can also be achieved by focusing on the particular target sounds/items without introducing the new items until the first target sound pattern turned into intake.

Referances

Al-Hamadi, H. M., and Ali, F. F. (2012). Acoustic analysis of English pure vowels in clear and conversational speech: An experimental study at the University of Basra. *Journal of Al-Khaleejul Arabi*, *40*(3-4), 1-38.

Ali, T. (2011).Exploring students' learning difficulties in secondary mathematics classroom in Gilgit-Baltistan and teachers' effort to help students overcome these difficulties.*Bulletin of Education and Research*, *33*(1), 47-69.

Ali, T. (2013). Pronunciation problems: Acoustic analysis of the English vowels produced by Sudanese learners of English. *International Journal of English and Literature, 4* (10), 495-507.

Best, J.W., and Kahn, J. (2007).*Research in education*. New Delhi: Prentice Hall of India.

Bohn, and Ocke-Schwen. (2004). How to organize a fairly large vowel inventory: The vowels of Fering

(North Frisian).*Journal of the International Phonetic Association, 34*(2), 161–173.

Childers, J. B., and Tomasell, M. (2001). The role of pronouns in young children's acquisition of the English transitive construction. *Developmental Psychology, 37*(6), 739-748.

Cook, T.D., and Campbell, D. T. (1979). *Quasi-Experimentation: Design and analysis for field settings*. Chicago: Rand McNally.

Colantoni, L., and Marinescu, I. (2010).The scope of stop weakening in Argentine Spanish. In M. Ortega-Llebaria (Ed.), *Selected proceedings of the 4th conference on laboratory approaches to Spanish phonology* (pp.100-114). Available from www.lingref.com/cpp/lasp/4/paper2371.pdf

Corder S. P. (1967).The significance of learner's errors.*International Review of Applied Linguistics (IRAL), 4*, 161-170.

Cox, F. M. (2006).The acoustic characteristics of /hVd/ vowels in the speech of some Australian teenagers.*Australian Journal of Linguistics, 26* (2), 147-179.

Counselman, D. (2010). *Improving pronunciation instruction in the second language classroom* (Doctoral dissertation).Available from PenState electronic theses and dissertations for graduate school. Available from https://etda.libraries.psu.edu/catalog/11030

Delattre, P.C., Liberman, A.M., and Coper, F.S. (1955). Acoustic loci and transitional cues for consonants.*Journal of the Acoustical Society of America*, *27*(4), 769–773.

DiCanio, C. (2015, July 10). Introduction to acoustic phonetics (Lecture).University at Buffalo.

Retrieved from: www.buffalo.edu/~cdicanio/pdfs/Lect_10-8_acoustics.pdf

Dörnyei, Z. (2007). *Research methods in applied linguistics: Quantitative, qualitative and mixed methodologies*. Oxford: Oxford University Press.

Ellis, R. (1985). *Understanding second language acquisition.* Oxford: Oxford University Press.

Ellis, N. (2002). Frequency effects in language processing. *Studies in Second Language Acquisition, 24*(2): 143-188.

Fazel, I. (2014). Current issues and debates in SLA. *Journal of ELT and Applied Linguistics, 2*(2), 82-90.

Figueroa, M., andEvans, B. G. (2015). Evaluation of segmentation approaches and constriction degree correlates for spirant approximant consonants. *International Congress of Phonetic Sciences (ICPhS).* Retrieved from www.mauriciofigueroa.cl/02_academia /2015_ ICPhS_poster.pdf

Gass, S. M. (2010). The relationship between L2 input and L2 output. In E. Macaro (Ed.), *Continuum companion to second language acquisition* (pp. 194-219). London: Continuum International Publishing Group.

Gass, S., and Selinker, L. (1994). *Second language acquisition: An introductory course*.Hillsdale: Lawrence Erlbaum Associates.

Gass, S.M., and Selinker, L. (2008). *Second language acquisition*: An introductory course. New York: Routledge.

Heinsman, D.T., and Shadish, W.R. (1996). Assignment methods in experimentation:When do non-randomized experiments approximate the answers from randomizedexperiments? *Psychological Methods,* 1, 154-169.

Hillenbrand, J.M., Clark, M. J., and Nearey, T. M. (2001). Effects of consonant environment on vowel formant patterns. *Journal of the Acoustical Society of America,109*(2), 748-763.

Kanno, K. (1998). Consistency and variation in second language acquisition.*Second Language Research, 14*(4), 376-388.

Ladefoged, P., and Johnson, K. (2011).*A course in phonetics.*Boston: Wadsworth Cengage Learning.

Larson-Hall, J. (2008). Weighing the benefits of studying a foreign language at a younger starting age in a minimal input situation.*Second Language Research, 24* (1), 35-63. Retrieved from http://peer.ccsd.cnrs.fr/docs/00/57/07/38/PDF/PEER_stage2_10.1177%252F0267658307 082981.pdf

Leedy, P.D. (1997). *Practical research: Planning and design*. Merrill: Prentice Hall.

Leow, R. P. (2001). Do learners notice enhanced forms while interacting with the L2? An online and offline study of the role of written input enhancement in L2 reading.*Hispania, 84*(3), 496-509.

Moeller, A.K., and Catalano, T. (2015). Foreign language teaching and learning.In J.D. Wright (Ed.), *International Encyclopedia for Social and Behavioral Sciences* (pp. 327-332). Oxford: Pergamon Press.

Monsen, R.B.,and Engebretson, A.M. (1983). The accuracy of formant frequency measurement: A comparison of spectrographic analysis and linear prediction. *Journal of Speech, Language and Hearing Research, 26*, 89-97.

Munoz, C. (2008). Age-related differences in foreign language learning: Revisiting the empirical evidence. *International Review of Applied Linguistics, 46*(3), 196–220.

Munoz, C. (2010). On how age affects foreign language learning.*Advances in Research on Language Acquisition and Teaching: Selected Papers* (pp. 39-49). Retrieved from http://www.enl.auth.gr/gala/14th/Papers/Invited%20Speakers/Munoz.pdf

Nakamura, D. (2012). Input skewedness, consistency, and order of frequent verbs in frequency-driven second language construction learning: A replication and extension of Casenhiser and Goldberg (2005) to adult second language acquisition. *International Review of Applied Linguistics in Language Teaching, 50*(1), 1-37.

Perry, W. E. (2008). *Effective methods for software testing: Includes complete guidelines, checklists,and templates(3rd ed.)*. New Jersey: Wiley Publishing.

Pickett, J. M. (1999). *The acoustics of speech communication: fundamentals, speech perception, theory and technology.* Boston: Allyn and Bacon.

Rahman, T. (2014).*Pakistani English*. (3rd ed.). Islamabad: National Institute of Pakistan Studies, Quaid-e-Azam University.

Robb, M., and Chen, Y. (2009). Is /h/ phonetically neutral? *Clinical Linguistics & Phonetics, 23*(11), 842–855

Saville-Troike, M. (2006).*Introducing second language acquisition*. Cambridge: Cambridge University Press.

Schmidt, R. (1994). Deconstructing consciousness: In search of useful definitions for Applied Linguistics.*AILA Review, 11*(1), 11-26.

Schmidt, R. (2001). Attention. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 3-32). Cambridge: Cambridge University Press.

Schwartz , M., and Causarano, P. (2007). The role of frequency in SLA: An analysis of gerunds and infinitives in ESL written discourse. *Arizona Working Papers in SLA & Teaching*, 14, 43-57.

Stevens, K. N., and House, A. S. (1963). Perturbation of vowel articulations by consonantal context:

An acoustical study.*Journal of Speech, Language and Hearing Research, 6* (1), 111–128.

VanPatten, B. (2003). *Processing instruction: Theory, research, and commentary*. New Jersey: Lawrence Erlbaum Associates.

Xu, Y. (2007-2015). *FormantPro.praat*. Available from: http://www.phon.ucl.ac.uk/ home/ yi/FormantPro/.