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영어 약모음 /ə/ 교수에 있어서 명시적 Form-Focused Instruction의 효과 연구

The Effectiveness of Explicit Form-Focused Instruction in Teaching the Schwa /ə/

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요약

본 연구는 명시적 형태 중심 교수법(FFI)이 영어 약모음 /ə/을 교실 상황에서 EFL 학생에게 교수하는 데 있어 얼마나 효과적인지 조사하였다. 25명의 고등학교 여학생이 13명은 실험집단에 12명은 통제집단으로 나뉘어 참여하였다. 또한, 미국인 여성 한 명도 비교 기준점을 위한 음성자료를 제공하였다. 실험집단 참여자는 한 달 반 동안 연구자의 발음과 텍스트를 음성으로 변환해주는 인터넷 프로그램의 발음을 따라 하고, 개인별로 피드백을 받았다. 처치 전, 후 참여자들은 14개의 2음절 이상 다음절 실험단어와 그 단어가 포함된 문장을 읽었으며 읽은 문장은 음성자료로 녹음되었다. 자료 분석을 위해 대응 표본 t 검증과 비모수 Wilcoxon signed-rank 검증이 사용되었다. 연구 결과에 따르면 실험군 참여자들은 사전 실험보다 사후 실험에서 영어 약모음을 약 40% 짧게 조음하였다. 하지만 모음 조음 공간에서 혀의 위치를 나타내는 F1/F2 formant에서 실험 참여자의 F1/F2 formant 분포형태는 이 연구의 기준점인 539 Hz (F1) × 1797 Hz (F2)와 상이했다. 이 연구의 결과는 반복적인 따라 하기와 적절한 피드백을 제공하는 명시적인 형태 중심 교수법(FFI)이 영어 발음 교수에 일부 효과가 있다는 것을 보여 주었다.

■ 중심어 : | 형태중심교수 | 영어약모음 | 인지 | 발음교육 | F1/F2 formant |

Abstract

This study aimed to explore how effective explicit form-focused instruction (FFI) is in teaching the schwa vowel /ə/ to EFL students in a classroom setting. The participants were 25 female high school students, who were divided into the experimental group (n=13) and the control group (n=12). One female American also participated in the study for a speech sample as a reference. The treatment, which involves shadowing model pronunciation by the researcher and a free text-to-speech software and the researcher's feedback in a private session, was given to the control group over a month and a half. The speech samples, for which the participants read the 14 polysyllabic stimulus words followed by the sentences containing the words, were collected before and after the treatment. The paired-samples t test and non-parametric Wilcoxon signed-rank test were used for analysis. The results showed that the participants of the experimental group in the post-test reduced the duration of the schwa by around 40 percent compared to the pre-test. However, little effect was found in approximating the participants' distribution patterns of /ə/ measured by the F1/F2 formant frequencies to the reference point, which was 539 Hz (F1) by 1797 Hz (F2). The findings of this study suggest that explicit FFI with multiple repetitions and corrective feedback is partly effective in teaching pronunciation.

■ keyword : | Form Focused Instruction | Schwa | Noticing | Pronunciation Teaching | F1/F2 Formants |

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I. Introduction

Pronunciation teaching has again gathered increased interests from researchers in the second language teaching after it was sidelined when communicative language teaching (CLT) emerged as a mainstream discipline in language teaching in the 70s and 80s[1]. As the primary focus of language instruction shifted to effectively enhancing learners' communicative competence, much attention has been paid to intelligibility or comprehensibility, lack of which might result in the breakdown of communication between interlocutors[2]. For pronunciation, accuracy like that of a native speaker is not required; yet, there is a threshold level, below which effective communication cannot be expected[2]. This demand for teaching English pronunciation with a focus on comprehensibility renewed research interests ranging from what to teach to how to teach.

The growing interest in pronunciation teaching is evidenced by the surging volume of research in this area. One meta-analytic study on the recent research of pronunciation instruction (PI) suggests that it is effective to teach specific pronunciation features explicitly [3]. Another recently published study with the meta-analysis approach indicates that more extended intervention and providing feedback bring out more effective results in PI[4].

Recently, form-focused instruction (FFI), a teaching method emphasizing language forms, has been garnering popularity from the researchers of language teaching. The researchers in PI have also turned out quite a few studies showing its effectiveness in teaching specific pronunciation features. The popularity of FFI can be attributed to the fact that pronunciation involves language knowledge as well as motor skills, which control various muscles associated with producing sounds[5]. FFI prefers explicitly focusing on specific phonetic features and repeating them multiple times, which exercises oral motor skills related to articulating sounds.

Essential to the success of FFI is its overarching principle: noticing. As Schmidt indicates[6], learners need to pay attention to the target language feature first in order for learning to occur. Otherwise, however much input they are exposed to, they will not be motivated to change input into intake. Thus, language teachers are encouraged to guide the learners' attention to the language forms they premeditated through providing appropriate feedback. Directing language learners' focus into intended language forms or giving feedback can be done implicitly or explicitly. However, in terms of effectiveness, a large portion of the research supported explicit instruction, particularly in PI.

Out of many suprasegmental features, English lexical stress is known to play a crucial role in speech intelligibility[7-9]. Lexical stress is relative prominence on the stressed syllable compared to the unstressed syllable. This salience is acoustically realized by longer duration, larger intensity, higher F0, and vowel quality. Vowel quality is the alternation of a full vowel followed by a reduced vowel/schwa or vice versa. According to Cutler[10], vowel quality is crucial to identifying incoming speech sounds by providing cues for segmentation[11].

Connected speech signals should be divided into recognizable chunks so that humans can map sound signals into the candidate words in the lexicon and finally identify the word they

hear. In that process, the alteration of a full vowel and a schwa signals a starting point of segmentation. Therefore, it is regarded important to train ESL learners to produce the schwa /ə/ correctly. Besides, the reduced vowel is not often found in the vowel inventories of other languages, particularly in Korean. This discrepancy might lead Korean learners of English to pronounce this reduced vowel as a full vowel.

Notwithstanding the schwa's important role in comprehending English speech, there has been a paucity of studies that investigated effective teaching techniques of this important feature in an actual classroom setting. This study intends to examine whether FFI, teaching a specific language form explicitly facilitating learners' noticing, works for teaching the schwa /ə/.

II. Literature Review

1. Form-focused instruction

In 1991, Long suggested returning to focus on forms from focus on meaning, saying the latter is insufficient to help language learners reach ultimate attainment in terms of rate[12]. Since then, many researchers, curriculum designers, and materials developers have attempted to incorporate this idea into their works[13]. Spada defined FFI as any efforts by educators to guide learners' attention to language form implicitly or explicitly[14]. That is, when teaching language forms, instructors can present a focus on language either spontaneously or in a predetermined way. Ellis refers to FFI as "any incidental or planned instructional attention that is intended to induce language learners to pay attention to language form"[15]. Three common threads weaving through all the above definitions are focus on language form, noticing, explicit instruction.

Based on the explicitness of instruction, Ellis [16] divided FFI into two types: Implicit and explicit FFI. The former underscores no use of metalanguage, spontaneous delivery, presenting target forms in context. On the other hand, the latter focuses on directing student's attention to target form, presenting them in isolation, and using metalanguage. Explicit FFI is focused on "perception and production on multiple repetitions"[13]. It also encourages instructors to provide corrective feedback at the post-input stage to enable learners to notice the gap between their current performance and the target language form. This study used explicit FFI considering the setting of this study, actual high school classes where time is very limited for teaching target language forms and presenting them in meaningful contexts. Besides, this study also employed multiple repetitions and corrective feedback.

2. Schwa /ə/

The schwa is a mid-central vowel with the tongue positioned at the center of the vowel space. The organs for producing this sound are relaxed with the tongue neutral and the mouth half-open[17]. In American English, /ə/ might take an r-colored form, /ɚ/, when it is followed by the rhotic /ɹ/ as in *prefer*. Another r-colored vowel in a stressed syllable, /ɝ/, as in *bird* is not a schwa. The schwa sound has distinctive features that differentiate it from other vowels [18]. It only comes at unstressed syllables. It is the most common vowel in connected speech. Therefore, using full vowels instead of his

reduced vowel might “strike the native speaker’s ear as unnatural”[19]. It is also short compared to other full vowels. In Yavas[19], the duration of /ə/ was almost three times shorter than the stressed full vowel with the longest duration /æ/.

The locations of vowels in the vowel space can be visually marked using the first and second formants. The first formant (F1) indicates the height of the tongue with the second formant (F2) representing the tongue’s frontness. The larger F1 indicates the lower tongue position. The smaller F2 means its more backward position in the vowel space. The acoustic measurements of schwa vary so much because it is easily assimilated to adjacent sounds when articulated. Therefore, the F1 and F2 measurements of schwa are different by studies. However, it is expected to be produced around the mid central position, which is approximately 500 Hz in F1 and 1500 Hz in F2, because its tongue position is neutral. This study examines whether FFI improves students’ production of the schwa /ə/ in terms of duration and the tongue position measured by F1 and F2.

3. Previous studies

Among the many studies showing the effectiveness of FFI, Spada and Lightbown [20] is noteworthy in that it explored the fundamental issue of FFI: Does it work best when the language form is isolated from or integrated into the context? Some practitioners of FFI argue that teachers need to design activities where target forms are included in a meaningful context. That way, they think learners can make use of the acquired form outside the classroom spontaneously. The study by Spada and Lightbown revealed that FFI can be beneficial in both isolated and integrated contexts depending on what language forms learners learn, what characteristics they have, and under what conditions they learn. They suggested that FFI with isolated language forms might help the learners sharing the same L1 overcome their L1 interference on their interlanguage. On the other hand, FFI in an integrated context might be best used for improving learners’ fluency or automaticity.

Trofimovich and Gatbonton[21] explored FFI in terms of the effectiveness of repetition. They showed that repetition and FFI were beneficial to improving students’ auditory process of L2 speech. The results underscored the main feature of explicit FFI. In other words, guiding learners’ attention to perception or production of language form is crucial to learning, which can be efficiently achieved through multiple repetitions. This present study incorporated repetition (specifically shadowing) as the primary technique to bring students’ attention to target forms under the frame of explicit FFI.

Another important study with respect to FFI is the one by Saito and Lyster [5]. They examined the role of corrective feedback in FFI. They taught Japanese students of English the non-lateral /ɹ/ recasting students’ mispronunciation and unclear pronunciation. The results showed that compared to the control group, the participants treated with FFI and corrective feedback made the improved production of /ɹ/. Their study supported the usefulness of corrective feedback in promoting students’ attention to target form and noticing the gap between their performance and their target.

There were studies that looked into whether Korean learners of English could produce the

schwa vowel with its two distinctive features: short duration and a mid-central tongue position. Korean is not known to have any corresponding vowel to the schwa, /ə/. Therefore, Koreans are likely to pronounce it as /ʌ/, a full vowel, which exists in the Korean vowel inventory. Han, Hwang, and Choi[22] revealed Korean learners of English without the experience of residence in Canada were not able to produce reduced vowels such as /ə/ or barred-*i*; instead, they produced them all as full vowels. On the contrary, the learners with some experience of residence produced the reduced vowels in similar patterns as those of native speakers. The findings, they argued, showed the reduced vowels of English including /ə/ could be acquired by learners of English whose native language does not have a corresponding vowel.

Another study involving Korean learners of English compared speech samples by two Americans and two Korean learners of English to see whether /ə/ produced by both groups was phonemically different[23]. Ahn discovered that the schwa produced by Koreans had as long duration as full vowels whereas Americans' schwa was much shorter than full vowels.

As seen in the previous studies, despite a substantial amount of research revealing Korean ESL/EFL learners' mispronunciation of /ə/ as a full vowel, there seem to be few studies investigating how to teach this language form, particularly in a classroom setting. This current study aims to probe whether explicit FFI is effective in teaching the schwa vowel to Korean high school students in the English class. To determine its effectiveness, this study would measure its duration and examine the distributional patterns of /ə/ produced by the participants.

III. Method

1. Participants

For this study, 25 female second-grade high school students from a metropolitan city in Korea participated in the experiment. They are from two pre-existing classes: The experimental group consisted of 13 students from one class while the control group was comprised of 12 students from the other class. The average age is 17.2, and all of them did not have an experience of living in the countries whose first language is English. Their reading competence is on average moderate to good, whereas speaking proficiency is considered to be lower than the reading competence. Typically, Korean high school students do not show as good performance in speaking as in reading because the focus of English classes in high school is centered on improving reading comprehension for college entrance. This study also recruited one female American for the speech samples of a native speaker, which were compared to those of the Korean participants. She was in her mid-20s, from the northern United States, and had resided in Korea for four months.

2. Materials

The stimulus words were selected from the list of 3,000 essential words in the English Curriculum released by the National Curriculum Information Center in Korea[24]. Publishers of the school English textbooks in Korea are recommended to integrate the essential words in the list to their textbooks for approval. First, 107 words were chosen taking into account the number and structure of syllables. After rigorous screening, 14 stimuli were finally

selected for recording. [Table 1] shows the final list of the stimuli used for collecting speech data.

Table 1. The list of stimuli

word	N of syllables	word	N of syllables
adapt	2	customer	3
appeal	2	develop	3
connect	2	penalty	3
husband	2	democratic	4
special	2	economy	4
weapon	2	independent	4
accomplish	3	technology	4
Total		14	

*The shades indicate the succeeding full/schwa vowels or vice versa.

The list includes six disyllabic, four trisyllabic, and four tetrasyllabic words. All of them are polysyllabic, and monosyllabic words were excluded because they do not have the contrast of full/schwa vowels. Besides, only the words with the full vowels preceded or followed by the schwa were selected because English vowel quality is realized by the contrast of the successive full/reduced vowels or the other way round. This study did not extend its focus to another reduced vowel, a barred-i, and the colored schwa /ɚ/. Thus, even though these were included in the stimuli, they were not investigated.

After all, 26 speech samples were collected from 13 experimental group participants, 12 control group participants, and one American participant. Then, these samples were segmented for analysis by the researcher. The stimulus words were extracted from the segmented words of the sentences read by the participants. In total, 182 words from the experimental group, 168 words from the control group, and 14 words from the American participant were analyzed. All of the words were segmented and annotated for the analysis.

3. Procedures

At the beginning of the experiment, speech samples were collected from the 25 students from both the experimental and control group as a pre-test. They read the stimulus words and the sentences containing the words to a microphone connected to the computer in a silent room. Their speech samples were digitized at a sampling rate of 48,000 Hz.

After the pre-test, the treatment began and continued for around two months in the class with the experiment group. At the beginning of the treatment, the researcher explained what characteristics English vowel quality has, how it is pronounced, and why it is important. The treatment was an integral part of a typical high school English class, which is 50 minutes long.

When each class started, the researcher presented on the monitor ten words followed by sentences including the words from the first list of 107 candidate words. Then, the researcher, who is a trained phonetician and had an experience of residing in the United States for six years, read the word with sentences, and the students shadowed him. It took five to seven minutes for one session and went on for six weeks. Additionally, a free text to speech software was used to give input as in [Figure 1]. As for pronunciation, it is recommended to provide as various input as possible[13]. Then, the researcher had an around ten-minute private session with each of the experiment group participants, in which the participants heard their own speech and got feedback from the researcher.

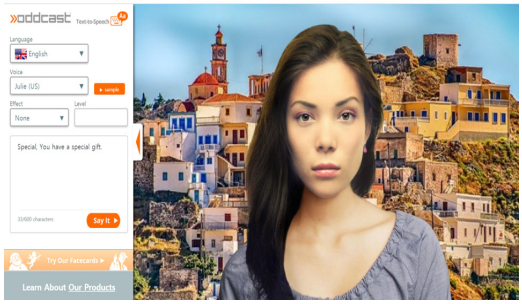

Figure 1. Free text speech software

After the treatment, speech samples from all the participants of the three groups were collected again in the same way as in the post-test. The researcher segmented and annotated the samples seeing the spectrograms of the Praat software (Ver. 6.0.23) for analysis (see [Figure 2]). Using Praat scripts, duration and F1 and F2 formants of each segmented word were measured. The F1 and F2 formants were picked up at the midpoints. For analysis, all the data was loaded to SPSS (Ver. 27).

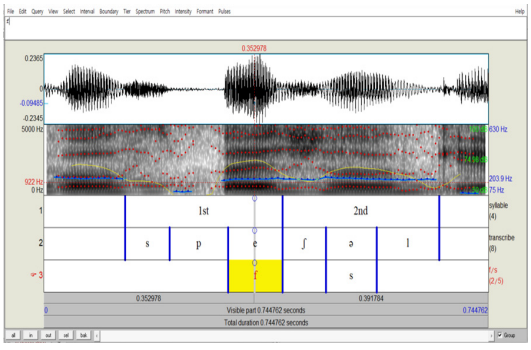

Figure 2. Sample of Praat annotation

IV. Results & Discussion

1. Intra-rater reliability

The researcher randomly picked 40 words and repeatedly segmented them with an interval of one week. The durations of each set were measured and compared in order to check the intra-rater reliability. Cronbach's alpha showed that the segmentation was reliable with α = 0.82, which is fairly good according to George and Mallery's rules of thumb[25].

2. Duration

For analysis, the duration ratios of full vowels to schwas were used. So, the duration of the full vowel was divided by that of the schwa for each word. [Table 2] and [Figure 2] show the descriptive statistics of the duration ratios of all groups. As expected, there was little difference in the duration ratios between the pre- and post-tests in the control group. By contrast, the experimental group showed much more discrepancy between the pre- and post-tests than the control group. For the native speaker, the data reveals the full vowels were produced much longer than the reduced vowels compared to the Korean participants. The results imply that explicit FFI seems to work in teaching the schwa vowel, at least in terms of duration.

Table 2. Duration ratios

	Experimental group		Control group		Native speaker
	Pre	Post	Pre	Post	
N	182	182	168	168	14
Mean	1.05	1.45	1.16	1.18	1.83
SD	.34	.38	.31	.33	.77

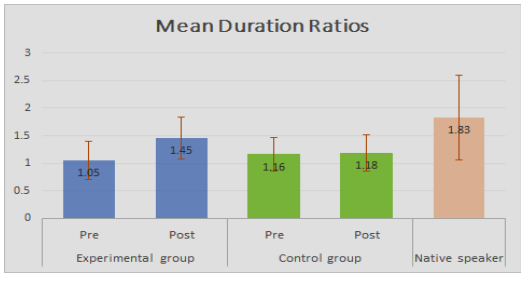

Figure 3. Duration ratio mean and SD

Then, the statistical analysis was run to check whether the differences of the duration ratios between the pre- and post-tests in the control and experimental groups are statistically significant. For the control group, the data was normally distributed with no outstanding outliers, and the sample sizes of the groups were the same. Thus, since any assumptions were not violated, the paired sample T-test was performed to check any meaningful differences in the duration ratios between the pre- and post-tests. The results showed that the duration ratios of the pre-test (M = 1.16, SD = .31) are no different from that of the post-test (M = 1.18, SD = .33), $t(167)$ = .177, p = .862. In other words, the test outcome indicates that the participants pronounced the words with the same duration ratios both in the pre- and post-tests.

Before running a paired sample t-test on the experimental group, its normality was checked. A Shapiro-Wilk showed a significant departure from normality in both pre- and post-tests, $W(182)$ = .963 , p = .00 for the pre-test, $W(182)$ = .898, p = .00 for the post-test. Furthermore, the data had noticeable outliers, as seen in Figure 4. Therefore, a non-parametric Wilcoxon signed-rank test was used.

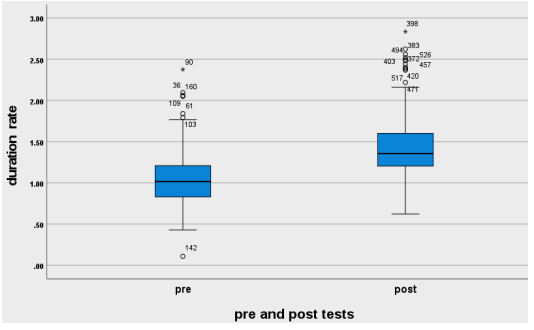

Figure 4. Outliers of the experimental group

The test results showed that the explicit FFI treatment elicited a statistically significant change in the duration ratios (Z = -9.195, p = .000). After the treatment, the participants produced schwa almost 40 percent shorter than the full vowel. This is significant progress from the pre-test, in which the participants uttered the full and schwa vowels with the roughly same durations.

3. The F1/F2 values

Schwa has a highly large variance in the values of F1/F2 because their values are strongly influenced by the surrounding contexts. They are easily assimilated to the adjacent sounds to a large extent[26]. Ideally, schwa has a tendency to converge on a mid-central position in the English vowel space, which is 500 Hz (F1) and 1500 Hz (F2) for males[27]. In an attempt to see whether there was an improvement in producing schwa in terms of the tongue position, this study examined how far away the participant's F1/F2 plot in the formant chart is from the reference point.

This study used Flemming and Johnson's study [28] as a reference because it provided rare reference frequency values of F1/F2 produced by nine females. Generally, the F1/F2 mean values by other previous studies were mostly taken from the male participants. Thus, Flemming and Johnson's study would be a suitable reference point for this current study using the data from female participants. To calculate the perceptual distance from the reference point to each participant's F1/F2 plot, this study used Lindblom's perceptual distance [29], which is defined as:

$$D_{ij} = \sqrt{(F1_i - F1_j)^2 - (F2_i - F2_j)^2}$$

where i is the mean values of the reference point and j is the participants' F1/F2 mean

values. Following is the table displaying the means of the perceptual distances in the vowel space and the mean values of the reference point F1/F2.

Table 3. Mean distance from the reference point

Experimental group		Control group		Native speaker	Reference point	
Pre	Post	Pre	Post		F1	F2
415.4	412.6	417.5	418.6	245.7	539 Hz	1797 Hz

[Table 3] shows little difference in the mean distance from the reference point between the pre- and post-tests for the control group. However, for the experimental group, though being meager, the mean distance of the post-test from the reference point looks to be larger than that of the pre-test. By comparison, the mean distance of the native speaker from the reference point seems to be distinctively shorter than that of the pre- and post-test in any group. The shorter distance of the post-test for the experimental group than that of the pre-test might indicate the treatment helped the participants produce schwa close to the mid central point in the vowel space, which is 539 Hz (F1) and 1797 Hz (F2) for this study. Thus, statistical tests were conducted to determine whether the mean difference between the pre- and post-tests for the experimental group was really meaningful.

Before performing any statistical analysis, the normality of the data from the experimental group was tested. The test results indicated that the data was not normally distributed (W = .97, p < .05 for both pre-/post-tests). Thus, instead of the paired sample t-test, a non-parametric Wilcoxon Signed-Ranks test was used. The test results showed that the median post-test ranks were not statistically significantly different from the median pre-test ranks, Z = - .356, p = .722.

Additionally, the F1/F2 plots on the formant charts were visually checked to find any changes between the pre- and post tests. As seen in [Figures 5] and [Figures 6], there seems to be little difference in the plots between the two groups. However, the plots of the post-test group appear to be less dispersed than those of the pre-test. When both groups were compared to the native speaker, as in [Figure 7], the discrepancy is outstanding. The F1/F2 plots of the native speaker were mostly found near the target reference point. Overall, the results of the statistical analysis showed that the treatment did not bring out any meaningful changes concerning the F1/F2 plots in the vowel formant charts.

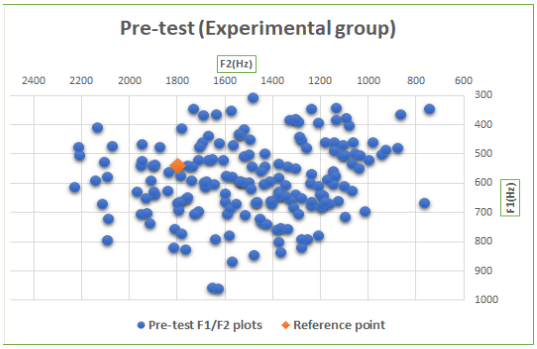

Figure 5. F1/F2 plots of the pre-test values

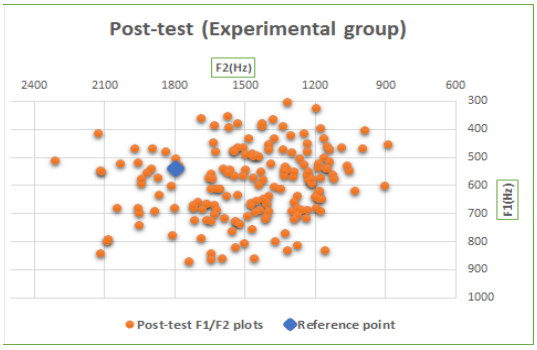

Figure 6. F1/F2 plots of the post-test values

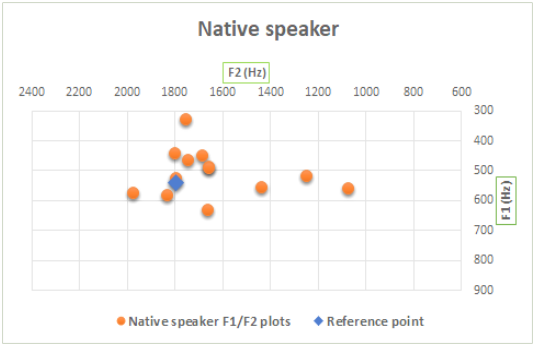

Figure 7. F1/F2 plots of the native speaker

4. Discussion

As for duration, the native speaker's performance was commensurate with the results of other previous studies [3][19][24][26]. The schwa vowels of those studies were 60 percent shorter than the full vowels. Though small compared to that of the native speaker, the duration ratios of the post-test for the experimental group increased from those of the pre-test. These results imply that the Korean participants of the experimental group pronounced the schwa vowels 40 percent shorter than the full vowels after the treatment. This seems a significant improvement, given that the same participants pronounced the full and schwa vowels with similar lengths before the intervention began.

Regarding the F1/F2 formant plotting, the results did not reveal that the treatment brought out any improvement in the students' tongue position when they articulated schwa. The numerical comparison of the perceptual distance from the reference point to the participants' F1/F2 formant plots between the pre- and post-tests did not produce any meaningful changes. The results revealed that the treatment barely contributed to making their F1/F2 plots converge on the mid-central position in the vowel space. The only silver lining is the formant plotting showed that there was a tendency for the experimental group students' plots in the post-test to converge though they were not clustered around the target reference point. This result might indicate that there could be progress toward the target point should the intervention continue.

The finding of this study is consistent with that of Kim, Flynn, and Oh[30], which found that the Korean learners of English showed improvements in producing the English reduced vowel after instruction. After the treatment, the Korean learners produced the reduced vowels much shorter than before; yet, their reduction fell short of their American counterparts' production. Besides, while the native speakers' first and second formant plots were centralized on the mid-central position, the Korean participants' F1/F2 formant values did not cluster around the schwa position. The finding of this current study reconfirms that schwa is teachable, but the effect of instruction is limited. Explicit FFI was effective in reducing the duration of schwa, but its effect on positioning the tongue at the mid-center of the vowel space is found to be scanty.

V. Conclusion

For the purpose of examining the effectiveness of explicit FFI, the present study incorporated three essential structural elements of explicit FFI into the treatment. First, this study directed the learners' attention to a specific language form. Second, the English schwa vowel was explicitly taught using the

metalanguage and multiple repetitions. Lastly, oral feedback was used to get the learners to notice their gaps. The explicit FFI treatment of this study brought forth some mixed results. It effectively reduced the duration of schwa; yet, it hardly made the learners' F1/F2 formant values converge on the mid-central position.

Duration might be relatively easy to raise learners' awareness because acoustic analysis of learners' samples enables learners to perceive their own performance through visual or auditory feedback. For example, students might listen to their recordings repeatedly and visually check their performance, looking at the segmented speech parts, as in [Figure 2]. On the contrary, regarding the F1/F2 plotting, it is hard for learners to mentally map their performance when they receive feedback unless they have some training in phonetics. Probably, that is why studies have produced relatively poor results in F1/F2 formant plotting compared to duration.

The findings of this study are significant in that it added further empirical evidence to the literature that explicit FFI is effective in instructing specific language form. It also provided some insight into the English pronunciation teaching in a real EFL classroom. Furthermore, this study might bring some attention of researchers and classroom practitioners to a language form that was rarely researched: the English schwa vowel. Schwa plays a highly significant role in realizing lexical stress through the alternation of a full and reduced vowel. It also provides acoustic cues for segmenting connected speech. Despite its significance, this vowel has had scarce attention and interest from researchers and EFL classroom teachers.

This study has some limitations. It is based on the actual classroom settings, which means there are more valuables to control than the laboratory setting. For instance, the treatment was supposed to be given consecutively three times a week over a month. However, due to some school schedules, the treatment was given once or twice a week, and it took almost about a month and a half to complete the treatment. In interpreting the results, caution needs to be paid to this different setting compared to other studies.

As pointed out earlier, schwa is characterized as a high variation of its F1/F2 formants, and it is easily assimilated to adjacent phonemes in the process of coarticulation. Therefore, if the analysis had broken down according to the position of schwa (like an initial, medial, and final position), its results would have provided a more broad and detailed picture of this phenomenon.

This study has implications on classroom teaching as well. Realistically, it is difficult for classroom teachers to design a whole class for teaching one specific language form in a meaningful context. There are too many things to teach, but there is limited time for all of them. This study suggests teachers that teaching language form explicitly sometimes works. When it comes to teaching pronunciation, explicit instruction, and multiple repetitions with timely feedback might result in intended target production by students. That might be because pronunciation is associated with a learner's motor skills as well as cognitive reasoning skills.

There are some areas for further research in the future. In this study, the speech data was collected right after the end of the treatment.

Therefore, this study did not offer a clear window into how the time-lapse after the treatment might affect the test results. Another question this study left behind for future research is whether the time allotment for each session of the treatment could affect the results. In this study, it took five to ten minutes to complete one session of the treatment. Therefore, the research on different time allotments for each session might help expand the insight on the effectiveness of explicit FFI.

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