The effectiveness of pronunciation teaching to Greek state school students

Eleni Tsiartsioni

Aristotle University of Thessaloniki

Abstract

This paper examines the effectiveness of pronunciation teaching to Greek state school students of three different ages (10, 13 and 15 years old). In particular, it examines the production of VOT of word initial /p, t, k/ and /b, d, g/ and preceding vowel duration of word-final stops. Recordings of students' speech samples were made before and after the teaching intervention, which involved 12 pronunciation lessons embedded in the regular English language lessons at the state school. The study examines: (a) the effectiveness of pronunciation teaching in a foreign language (FL) context, (b) the role of students' age, (c) the relation of the results to theories of phonological acquisition. The results suggest that pronunciation instruction is applicable and effective in a FL context and could be integrated into EFL curricula in Greece.

Keywords: pronunciation teaching, phonological acquisition, English L2

1. Introduction

1.1 Review of research on pronunciation teaching

This article presents part of the results of a pilot study on the effectiveness of pronunciation teaching to Greek EFL learners of ten, thirteen and fifteen years old by examining the production of aspirated /p, t, k/, the devoicing of /b, d, g/ and vowel lengthening before word final voiced stops.

Since the Reform Movement in the late 19th century, which supported that the findings of phonetics should be applied to language teaching, the interest in pronunciation instruction has revived only in the last few years. Goodwin, Brinton and Celce-Murcia (1994: 5) observe that "the teaching of pronunciation has at times been considered almost a luxury in the ESL/ EFL curriculum, unlike reading, writing, listening and general speaking fluency". Derwing and Murno (2005: 379) support that "the study of pronunciation has been marginalised… as a result, teachers are often left to rely on their own intuitions with little direction". This observation is confirmed by Pardo's (2004) review of studies on teachers' attitude to pronunciation teaching, in

which he concludes that many teachers are unsure of the effectiveness of pronunciation for intelligibility and communication.

A central question is therefore whether pronunciation can be effectively taught. Pardo (2004) reviews 25 studies on the effect of pronunciation instruction and concludes with the following implications for teaching: first, there is a positive effect of well-planned, quality pronunciation training (out of the 25 studies reviewed, 23 reported improved pronunciation after instruction); second, use should be made of specific teaching techniques; pronunciation is not simply 'picked-up'. It is important to stress at this point that the vast majority of the studies reviewed by Pardo examined phonological acquisition that occurs in an environment where the target-language is the main means of communication and involved immigrant population and students who lived in a target-language community.

Empirical research on pronunciation instruction which occurs in a formal EFL setting also seems to confirm the positive effect of pronunciation teaching (Ekstrand 1982, Olson and Samuels 1982, Thogmartin 1982). Regarding the role of learners' age, contrary to what appears to happen in naturalistic L2 settings, where younger learners have an advantage over older learners in terms of pronunciation ability, research on phonological acquisition that takes place in a foreign language environment tentatively suggests that older students are better at acquiring target-language pronunciation than younger students (Ekstrand 1982, Fullana 2006, Thogmartin 1982). However, it has been shown that the differences between younger and older learner appear to minimise once the younger learners reach the same state of cognitive development as older learners (Muñoz 2003, 2006).

1.2 Theories of phonological acquisition

A number of theoretical frameworks have attempted to explain the nature of second language acquisition and to shed light to the processes through which it is accomplished. The results of the present study will be interpreted in relation to two theoretical frameworks of phonological acquisition, namely *Markedness Theory* and Flege's *Speech Learning Model* (SLM).

Theories of markedness employ a distinction between unmarked and marked phenomena. According to Eckman (1987: 60) a phenomenon A is more marked than B if the presence of A in a language implies the presence of B, but not necessarily vice versa. Such theoretical models suggest that unmarked phenomena, for example the

voiceless stops, will be easier to acquire and will appear earlier in the acquisition sequence than marked phenomena, such as aspiration and vowel duration differences.

Other theoretical models suggest that the process of acquisition of an L2 sound is determined by the degree of phonetic similarity the particular L2 sound bears to an L1 sound. A distinction employed by many linguists is that of 'new' versus 'similar' sounds; 'new' are the L2 sounds which are not found in the phonological repertoire of L1, whereas the L2 sounds which bear some degree of phonetic similarity to L1 sounds are considered 'similar' to them. Flege deals extensively with the new versus similar sounds in his *Speech Learning Model* (SLM). According to Flege (1986, 1997), *equivalence classification* is a cognitive mechanism, due to which, learners fail to develop accurate perceptual targets for L2 sounds with a direct counterpart in L1 (Flege 1991a: 251). This means that L2 learners can produce and perceive new sounds faster and more accurately than sounds similar to L1 ones. For the present study, we follow Flege and Hillenbrand's (1987: 187-188) arguments on English and French stops and assume that the acquisition of word initial stops involves a similar contrast in Greek and English. Under this perspective, it is expected that Greek learners of English will fail to produce native-like voiced and voiceless stops, because they will fail to create new phonetic categories for these sounds.

Previous studies on the production of L2 English voiceless stops by adult speakers whose L1 lacked aspirated stops showed that the L2 English VOT values are longer than in L1, however they never reach the target-like values (Flege and Eefting 1987, Flege and Port 1981, Major 1987, Williams 1979). Research has also suggested that those who begin learning English as children in an L2 environment produce stops more accurately than late learners (Flege 1991b).

1.3 Differences between the Greek and English stop system

The Greek consonant system comprises two series of plosives which differ according to voicing (there are fully voiced and voiceless plosives), as for example the initial segments in the words 'παίζω' ('I play', /'pezo/), 'τέρμα' ('ending' /'terma/) , 'κάνω' ('do', /'kano/), 'μπάλα' ('ball', /'bala/), 'ντύνω' ('to dress', /'dino/), 'γκάμα' ('variety', /'gama/. In Greek, stops occur word-initially and medially but not word finally (see Arvaniti 2007 for a review).

The English consonant system comprises two series of plosives, however, VOT[1] distinguishes 'voiced' from 'voiceless' stops in word initial and final positions; voiceless stops are strongly aspirated[2] in stressed syllables before vowels, for example as in the words 'take' (/t^{h}e□k/), 'puzzle' (/p^{h}□zl/, 'come' (/k^{h}□m/), whereas voiced stops are usually devoiced and unaspirated, as in the words 'bag' (/bæg/), 'game' (/ge□m/) , 'dance' (/dæns/). Also, word-finally, preceding vowel duration signals the distinction between 'voiced' and 'voiceless' stops (Chen 1970, House 1961, House and Fairbanks 1953, Luce and Charles-Luce 1985, Peterson and Lehiste 1960, Zimmerman and Sapon 1958), for example the vowel in the words 'bad' (/bæd/), 'cab' (/kæb/), 'bag' (/bæg/), is longer than in the words 'bat'(/bæt/), 'cap' (/kæp/), 'back'(/bæk/).

It follows from the above description that in this study pronunciation teaching comprised practice on how students can (a) produce aspiration, (b) devoice word initial stops and (c) produce longer vowels before voiced stops than before word final voiceless stops.

2. Questions of the study

The present research aims at exploring the following questions:

1. Is pronunciation teaching to children effective in a foreign language (FL) environment?

2. Does age play a role in the acquisition of pronunciation in a foreign language environment? For example, are students of younger age more favourably predisposed to acquiring FL pronunciation, as happens in naturalistic second language settings?

3. Are some phonological features acquired more successfully than others? To what extent are the theoretical models discussed in the previous section confirmed?

[1] VOT is the time interval between the articulatory release of the stop and the onset of vocal folds vibration (Abramson and Lisker 1970, Lisker and Abramson 1964). The onset of voicing may precede the release of stops, as in Greek /b, d, g/ sounds, or may follow the release, as in Greek and English /p, t, k/ sounds.

[2] Aspiration is a term which refers to the voiceless noise interval between the release of the stop and the onset of glottal vibration and it sounds like a puff of air, as for example in the English words: 'pie', 'tale', 'cat'.

3. Methodology

3.1 Subjects

In the present study two groups of subjects were recorded, an experimental group (n=12), which received pronunciation instruction, and a control group (n=12) which followed the regular English classes at school. Each group was subdivided into three subgroups comprising students of three different ages. In particular, the students who were recorded in each group were: 4 ten-year-old students: age group A (4th grade of the Primary School), 4 thirteen-year-old students: age group B (1st grade of High School), 4 fifteen-year-old students: age group C (3rd grade of High School). The particular ages have been selected so as to capture, as far as possible, the ages which have been claimed to represent the end of the critical or sensitive period for native-like mastery of pronunciation in naturalistic second-language settings (age 6 according to Long 1990, age 12 according to Scovel 1988, age 16 according to Patkowski 1990). It would be interesting to see if a similar effect of age is also observed in foreign-language contexts, in settings where students are not exposed to the target language in their everyday life but learn it in a formal environment, such as a school or a language institute; and this is the case examined in the present experiment. The youngest age examined in this study does not coincide with the earliest suggested end of the sensitive period, i.e., 6 years of age, because under the Greek educational system the teaching of English begins at the age of 9 (3rd grade of primary school) and not earlier.

All students began learning English at around the age of 9. None of the 24 children examined reported having been taught the English pronunciation before the study. The students of the experimental group received 12 lessons of pronunciation instruction on English stops and speech rhythm. Each lesson lasted from 20-40 minutes. The pronunciation lessons were taught by the researcher, who was also the main English teacher of the Gymnasium classes. The framework of pronunciation teaching which is used in the present study is adopted from Celce-Murcia, Brinton and Goodwin (1996), who propose five teaching stages for pronunciation teaching which move away from controlled to free activities.

Additional recordings were also made by six native Greek and six native English children (two children of each age group) on their L1 production.

3.2 Speech materials/ recording procedure/data analysis

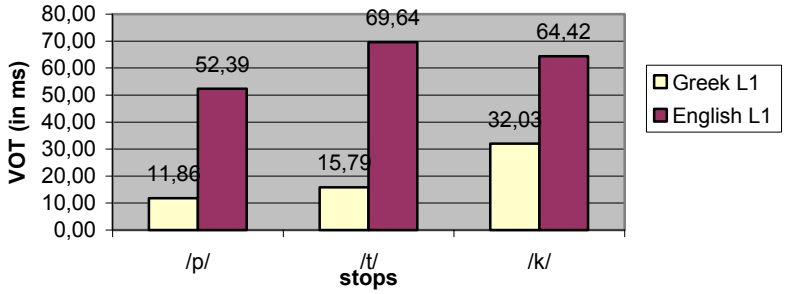
Recordings of students' speech samples were made twice, before and after the teaching intervention (Time 1 and Time 2, respectively). During the recordings, which took place in a quiet room in the students' schools, the speakers were asked to read a list of words (for English: 'pack', 'tab', 'cab', 'bag', 'dab', 'gab', 'gap', 'bat','bad', 'back'; for Greek : 'πάσα' /'pasa/, 'Τάσα' /'tasa/, 'κάσα' /'kasa/, 'μπάλα' /'bala/, 'γκάμα' /'gama/, 'ντάμα' /'dama/) embedded in carrier phrases (' Say ____ again to John' and '_____λέω πάλι'). Each sentence was repeated ten times and for the purposes of this study, three repetitions of each word were measured. The sentences were analysed acoustically with the use of waveforms and digital spectrograms generated by the speech analysis software *PRAAT* (Boersma and Weenink 2003).

4. Results

4.1 Initial voiceless stops

Figure 1 shows the results on the production of /p, t, k/ stops in Greek and English L1 by the native Greek and native English subjects, respectively.

Figure 1. Mean VOT (in ms) for initial /p, t, k/ in Greek and English L1



Our results agree with previous descriptions of Greek and English, since it is clear that Greek displays unaspirated /p, t, k/ with very short VOT values, whereas English displays aspirated voiceless stops with long VOT. This observation is also confirmed by the paired-sample T-test, which shows that the difference in VOT between the Greek and English stops is statistically significant ($p<0.05$) for all places of articulation and all age groups.

Figures 2, 3 and 4 show the VOT results for the students of the control and the experimental groups before and after the teaching intervention.

Figure 2. VOT for voiceless stops for age group A at Time 1 and at Time 2

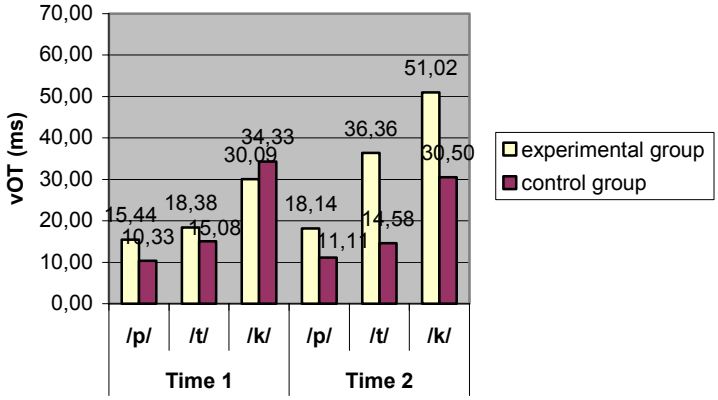


Figure 2 displays the VOT for English voiceless stops produced by the 10-year-old groups at Time 1, before the teaching intervention, and at Time 2, after the teaching intervention. It can be observed that before the teaching intervention, there is no big difference between the groups, since both groups produce unaspirated Greek-like /p, t, k/. After the teaching intervention, however, the experimental group, which is the group that received the teaching intervention, produced slightly longer VOT values for /p/ and much longer VOT values for /t/ and /k/ than the control group which received no pronunciation teaching. The T-tests support these observations, since no statistically significant difference is found in the VOT values of the control group between Times 1 and 2, however for the experimental group there is a statistically significant difference in the production of /k/ sound ($p<0.00$). The lack of statistical significance for the VOT of /t/ sound could be explained by the large standard deviation of this group (22ms) at Time 2, since one of the four speakers produced very short VOT (11ms), whereas the other three speakers produced much higher VOT values (33ms, 32ms and 66ms, respectively).

Figure 3. VOT for voiceless stops for age group B at Time 1 and at Time 2

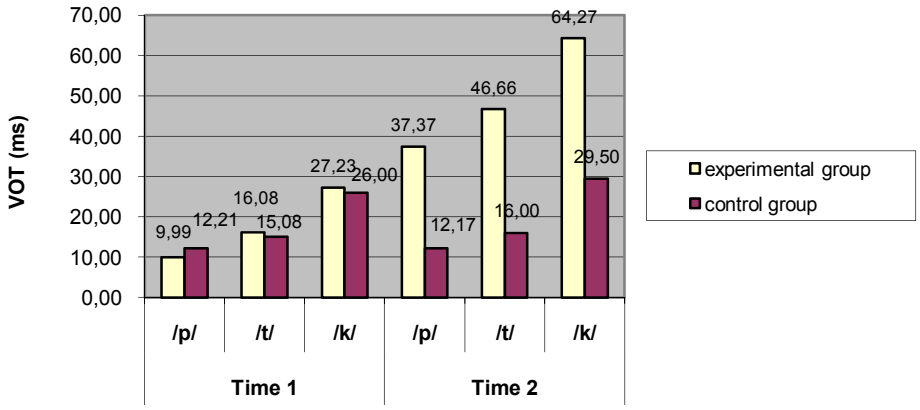


Figure 3 shows the results of the production of English /p, t, k/ by the 13-year-old students before and after the teaching intervention. It is clear that at Time 1 both groups produce unaspirated stops for all places of articulation and the differences between the groups are very small. The results for Time 2 show that the group which received pronunciation instruction outperformed the control group and showed a considerable improvement in aspiration for all places of articulation. For this group the VOT values for /t/ and /p/ are intermediate between the Greek and English L1 values, whereas the VOT values for /k/ completely overlap with the English values. The T-tests show that the control group did not produce statistically significant VOT values at Time 1 and 2, however, for the experimental group there is a statistically significant difference for /k/ ($p<0.05$) and also a marginal difference ($p<0.1$) for /p/ and /t/ (Figure 3).

Figure 4. VOT for voiceless stops for age group C at Time 1 and at Time 2

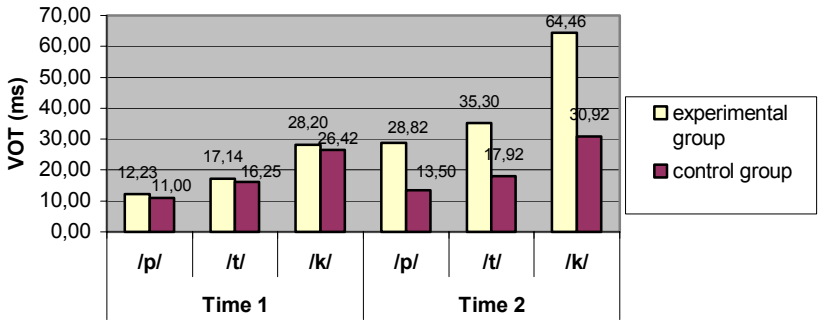


Figure 4 displays the results of the 15-year-old students. As happened with the younger groups, these age groups also produce unaspirated Greek-like stops for all places of articulation before the teaching intervention. This is surprising, because

despite the years of exposure to the foreign language, as all subjects had been learning English since the age of 9, their VOT values are not different from the VOT values displayed by the younger groups prior to the teaching intervention. At Time 2 the group which received pronunciation teaching showed a statistically significant improvement in the production of voiceless stops ($p<0.05$ for /t/ and /k/). The VOT for /p/ also increased but not to a statistically significant degree. As with group B, the experimental group C also produced native-like VOT values for sound /k/ (Figure 4).

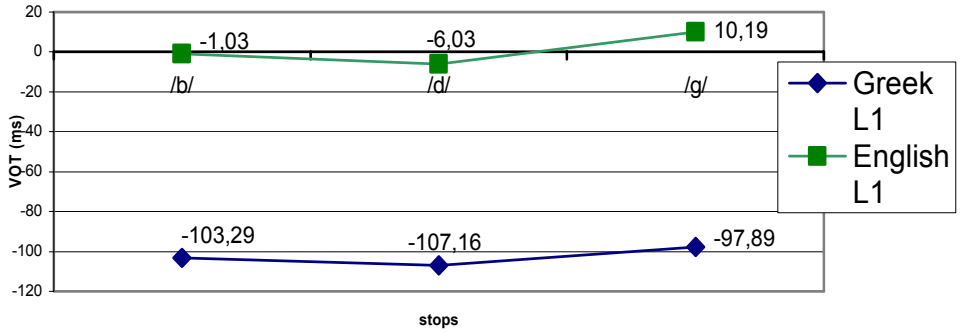
Summarising the results for the production of English voiceless stops, it can be concluded that the experimental groups of all ages showed an increase in the VOT values for stops of all places of articulation after the teaching intervention. The only exception is the sound /p/ of age group A where a big improvement was not observed. In all other cases, the values exhibited after the teaching intervention were intermediate between Greek and English. It is worth mentioning, too, that groups B and C displayed target-like VOT values for sound /k/.

In order to determine which experimental age group showed the biggest improvement, we conducted a one-way ANOVA where we compared the difference of the mean VOT values across the speakers of each age group at Time 1 and 2. The difference in the VOT values between Time 1 and Time 2 was set as the dependent variable and the age group as the factor. The results of the ANOVA showed that the age group B displays the biggest difference in the VOT between Time 1 and 2 compared to groups A and C. However, the post hoc analyses (Bonferroni) showed that the difference is not statistically significant ($p>0.05$).

4.2 Initial voiced stops

This section presents the results on the production of word initial voiced stops. Figure 5 shows the VOT values displayed by the native Greek and native English group.

Figure 5. Greek and English L1: mean VOT for word initial voiced stops



In accordance with literature, Greek displays fully voiced /b, d, g/ at word initial position. In English, on the other hand, /b, d, g/, are produced weakly voiced or voiceless with short VOT.

Table 1 shows the L2 English VOT values for /b, d, g/ of the control and experimental groups for each age before and after the teaching intervention. The analysis of the data showed that at Time 2, a number of repetitions were produced with partly voiced stops, with the closure phase exhibiting a voiced and then a voiceless part; for this reason, Table 1 also includes data on the mean duration of voiced part in the partly voiced repetitions, as well as the number of speakers of each group who produced partly voiced stops. The results indicate that for the production of voiced stops, there was no improvement for the control groups of all ages, since the subjects produced fully voiced Greek-like stops both at Time 1 and at Time 2.

Table 1. VOT for the voiced stops and the duration of the voiced part of partially voiced stops before and after the teaching intervention

		Control Group, Time 1	*Control Group, Time 2*	*Experimental Group, Time 1*	*Experimental Group, Time 2*
age group A	Mean VOT - /b/	-138,4	-128,5	-124,4	-99,6
	Mean VOT - /d/	-124,2	-111,1	-119,8	-87,3
	Mean duration of the voiced part of /d/ (in ms)				58,5 (1 speaker)
	Mean VOT - /g/	-127,9	-96,8	-119,8	-87,3
	Mean duration of the voiced part of /g/ (in ms)				78 (1 speaker)
r	Mean VOT - /b/	-112,3	-102,1	-121,6	-114,4

	Mean duration of the voiced part of /b/ (in ms)				64,1 (3 out of 4 speakers)
	Mean VOT - /d/	-99,1	-98,6	-104	-80,5
	Mean duration of the voiced part of /d/ (in ms)				58 (1 out of 4 speakers)
	Mean VOT - /g/	-98,8	-90,5	-100,6	-74,9
	Mean duration of the voiced part of /g/ (in ms)				54 (2 out of 4 speakers)
age group C	Mean VOT - /b/	-105,6	-85	-115	-41,1
	Mean duration of the voiced part of /b/ (in ms)				64 (1 speaker)
	Mean VOT - /d/	-104,4	-105,8	-105,6	-68,6
	Mean VOT - /g/	-86,4	-102,3	-51,9	-49,8

For the experimental group A, the mean values after the teaching intervention are negative, denoting voiced stops. The statistical analysis for this group showed a statistically significant difference only in the VOT for /d/ sound between the two recordings ($p<0.05$).

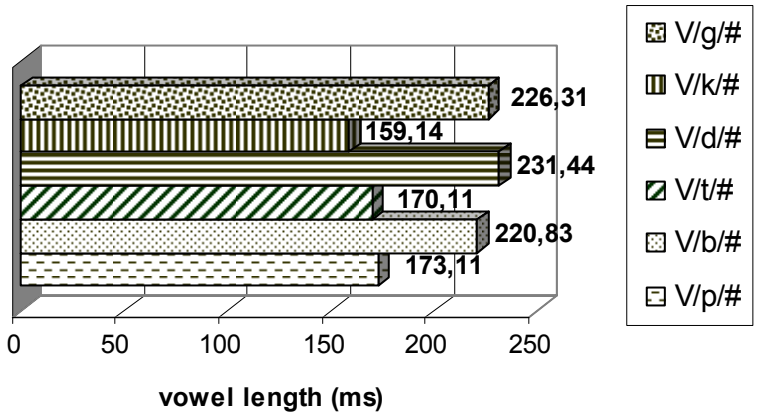
Looking at the speakers individually, however, after the teaching intervention one of the four subjects partly devoiced 66% of the repetitions of /d/ and /g/ (i.e., two out of the three repetitions were partly devoiced for this speaker), and also one of the subjects produced devoiced target-like /g/ (mean VOT 25,7ms). The analysis of individual speakers suggests that some students began to show some improvement, even though this improvement is not depicted in the mean values of the group results. In group B all four speakers showed some improvement; three out of four subjects partly devoiced /b/ in most repetitions, one out of four subjects partly devoiced /d/ at 33% of the repetitions (i.e., at one out of three repetitions) and two out of four subjects produced partly voiced /g/ at 33% of the repetitions (i.e., at one out of the three repetitions). The T-tests for this group between Time 1 and Time 2 showed a statistically significant difference for the VOT for /g/ only. As for the experimental age group C, after the instruction the negative VOT values were reduced, showing a tendency of students to control voicing and produce more target-like /b, d, g/. In particular, two out of four subjects produced voiceless target-like /b/ (mean VOT: 17,53ms and 12,33ms for each speaker respectively), and one subject partly devoiced 33% of the repetitions for /b/ (one out of the three repetitions). Also, one out of four subjects devoiced all three stops at initial position (mean VOT for this speaker: 17,53ms for /b/, 16,13ms for /d/ and 5,63ms for

/g/), which shows that this speaker has learned the target-like production for English /b, d, g/. However, the T-tests showed no significant difference in the mean VOT for this age group.

4.3 Vowel length before word final stops

This section presents the results on the production of vowel length before word final stops. Since in Greek stops do not occur word finally we have data on English as L1 only, based on the six English speaking subjects of the study (Figure 6).

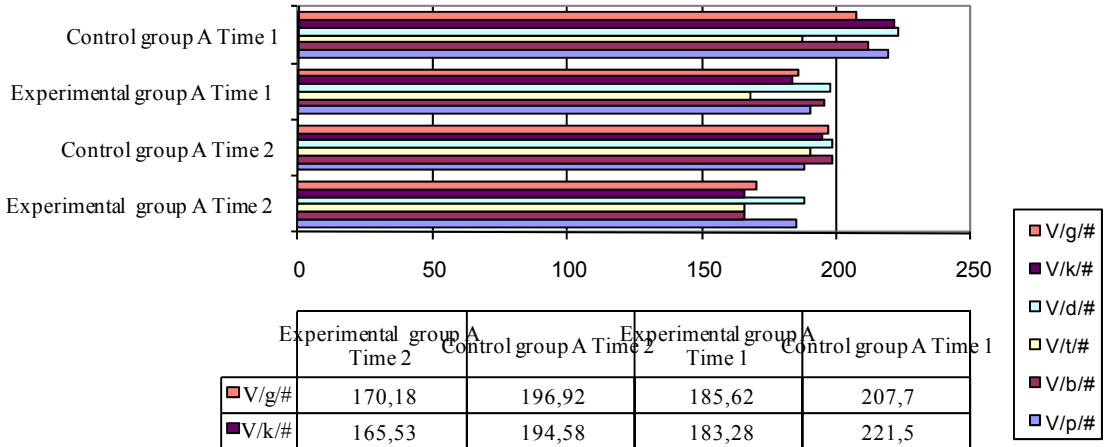
Figure 6. Vowel length before word final stops in English L1



Our results agree with literature in that for English L1, vowel duration before word final voiced stops is considerably longer than before word final voiceless stops (Chen 1970, House 1961, House and Fairbanks 1953, Luce and Charles-Luce 1985, Peterson and Lehiste 1960, Zimmerman and Sapon 1958).

Figure 7 presents the results on vowel length before word final stops, as produced by the 10-year-old students before and after the teaching intervention (due to space limitations the graphs for age groups B and C are not included in this paper). The results indicate that the vowel duration differences, where they exist, are very small and probably within the universal limits (Chen 1970), which shows that the vowel duration difference has not been learnt by the speakers of this group.

Figure 7. Vowel length before word final stops, age group A



	Experimental group A Time 2	Control group A Time 2	Experimental group A Time 1	Control group A Time 1
V/g/#	170,18	196,92	185,62	207,7
V/k/#	165,53	194,58	183,28	221,5
V/d/#	187,8	198,75	197,35	223,17
V/t/#	165,88	190	167,9	187,33
V/b/#	165,53	198,42	195,79	211,75
V/p/#	185,34	188,33	190,12	218,92

vowel length (ms)

Paired-sample T-tests between the first and second recording of each group were conducted in order to determine if there is a statistically significant difference in the production of vowel length before and after the teaching intervention. The results of the statistical analyses showed no statistically significant difference in the vowel length for any age group and for any consonant environment. It can therefore be concluded that the production of vowels was not improved by instruction.

5. Discussion

This section discusses the questions posed at the beginning of the study. The first question refers to the effectiveness of pronunciation teaching in a FL environment. The results of the present study suggest that strategically planned pronunciation teaching seems to be effective with children and teenagers even in a FL environment, despite all the limitations that characterise it (for example, lack of interaction in the target language outside the classroom, non-native teachers, limited amount of exposure and practice). It has been shown that even though the teaching intervention was rather short (only 12 mini-lessons that lasted 20-40 minutes), students' pronunciation improved in two of the three features that they were taught, namely the aspiration of /p, t, k/ and devoicing of /b, d, g/. In particular, VOT increased for all places of articulation and all experimental

age groups at Time 2, however not always to a statistically significant extent. Also, regarding /b, d, g/ devoicing the results showed attempts of individual speakers to reduce voicing either by producing partly voiced repetitions or even target-like voiceless ones. On the other hand, as expected, the groups who did not receive specific pronunciation instruction showed no improvement at all in their pronunciation.

The second question is related to the role that student's age plays in the learning of English pronunciation. Our results show that contrary to what happens in naturalistic settings, the students of younger ages do not acquire English pronunciation more easily or faster than older students. This study suggests that the 13-year-old students showed the biggest improvement in pronunciation. In particular, they displayed the biggest improvement of all groups in the production of aspirated stops (though not statistically significant, according to the ANOVA) and also all speakers of the group showed some tendency to produce target-like voiced stops. A possible explanation could be, on the one hand, the cognitive development of the 13-year-old students; this may explain their advantage over the younger group in a formal foreign language setting which involves explicit learning and memory skills (Cenoz 2006, Muñoz 2006); on the other hand, we can hypothesise that fossilisation has not occurred in their speech yet, therefore their pronunciation was subject to change as a result of the teaching intervention. Regarding the oldest group, the effect of fossilisation might have hindered them from displaying the biggest improvement in pronunciation, despite their greater cognitive development and maturity (similar findings were obtained in Cenoz' 2003 study on EFL acquisition, where the lack of statistically significant difference in pronunciation between students of the 2nd and the 5th year of High School was attributed to fossilisation). Another possible explanation could be related to affective factors, such as the attitude and potential lack of motivation for the 15-year-old students; however, these are parameters that have not been tested in the present study.

The third question asks if some phonological features are acquired more successfully than others. In the present research, aspiration was the feature that showed the biggest improvement of all pronunciation features that were taught. With the exception of the bilabial voiceless plosive for group A, where the VOT increase at Time 2 was very small, VOT increased at all groups for all places of articulation. Also, according to the teacher's diary, aspiration was the first feature to be learnt compared with stop devoicing and vowel lengthening. Some tentative explanations could be the perceptual salience of aspiration, or the fact that aspiration might be easier to demonstrate with

visual aids while teaching, compared to devoicing. In addition, the learning of aspiration, involving a frication feature, may be easier than the learning of a time feature, such as vowel length.

The final question attempts to relate our results to the theoretical models of phonological acquisition. Our expectation that stop devoicing would be easier to acquire than aspiration due to markedness is not confirmed by our data. Even though aspiration is considered to be a marked feature, it appears easier to learn than an unmarked feature, namely the devoicing of stops. Markedness, however, can explain the lack of improvement for vowel lengthening which is considered to be a marked feature. Also, for the majority of stops after the teaching intervention, speakers displayed VOT values which were intermediate between Greek and English, confirming Flege's *Speech Learning Model* which predicts imperfect realisation for similar sounds due to the mechanism of equivalence classification. An exception for this, however, is found in the production of sound /k/ by the 13- and 15-year-old subjects, whose L2 production was within the VOT values displayed by the native English group. The results are in agreement with previous studies reporting intermediate VOT values between L1 and L2 (Flege and Eefting 1987, Flege and Port 1981, Major 1987, Williams 1979), although it needs to be pointed out that the methodological differences between the present study and previous ones do not make the results of the present and previous studies directly comparable (i.e., children and adolescents versus adult speakers, FL versus L2 environment, formal instruction versus daily exposure to the target language).

6. Conclusion

The conclusions of this study can be summarised as follows:

1. Aspiration was the first feature to be learnt (according to the teacher's diary) and showed the biggest improvement compared to stop devoicing and vowel lengthening.
2. The 13-year-old group showed the biggest improvement in pronunciation, perhaps due to their cognitive maturation and lack of fossilisation in their pronunciation.
3. The years of exposure did not result in better pronunciation. The results of the first recordings show that prior to pronunciation instruction, there was no difference in pronunciation among the age groups, since they all produced voiced and voiceless stops according to L1 categories.
4. With the exception of vowel length distinction, which was not improved by instruction, there was a positive effect of pronunciation instruction for the production

of aspirated and devoiced stops, even after only 12 pronunciation mini-lessons. This shows that pronunciation teaching seems to be not only applicable but also quite effective.

5. In FL contexts improvement in pronunciation appears to be a result of explicit and strategically planned pronunciation instruction. Contrary to what happens in naturalistic settings, the results of the present study suggest that pronunciation is difficult to be acquired in FL contexts unless it is taught; it is not simply 'picked up'.

These conclusions have important implications for planning language curricula and designing language lessons in foreign language contexts.

Acknowledgments

I would like to thank my PhD supervisors, Dr K. Nicolaidou, Dr M. Mattheoudaki and Dr C. Nakas; also the anonymous reviewers for their comments on the paper. All the mistakes remain, of course, my own.

References

Abramson A.S. and L. Lisker (1970). Discriminability along the voicing continuum: cross-language tests. In B. Hála, M. Romportl and P. Janota (eds), *Proceedings of the 6th International Congress of Phonetic Sciences, Prague 1967*. Prague:Academia, 569-573.

Arvaniti A. (2007). Greek phonetics: State of the art. *Journal of Greek Linguistics* 8: 97-208.

Boersma P. and D. Weenink (2003). Praat. Doing phonetics by computer (version 4.0.13). http://www.praat.org/

Celce-Murcia M., D. Brinton and J. Goodwin (1996). *Teaching pronunciation: A reference for teachers of English to speakers of other languages.* Cambridge: Cambridge University Press.

Cenoz J. (2003). The influence of age on the acquisition of English: General proficiency, attitudes and code-mixing. . In M.P. Garcia-Mayo and M.L. Garcia-Leccumberri (eds), Age and the acquisition of English as a foreign language. Clevedon: Multilingual Matters, 77-93.

Chen M. (1970). Vowel length variation as a function of the voicing of the consonant environment. In *Phonetica* 22: 129-159.

Derwing T.M.and M.J. Murno (2005). Second language accent and pronunciation teaching: A research based approach. *TESOL Quarterly* 30: 379-397.

Eckman F.R. (1987). Markedness and the contrastive analysis hypothesis. In R.C. Scarcella and M.H. Long (eds), *Issues in second language research*. Massachusetts: Newbury House, 55-69.

Ekstrand L.H. (1982). English without a book revisited: The effect of age on second language acquisition in a formal setting. In S. Krashen, R. Scarcella and M.H. Long (eds), *Child adult differences in second language acquisition.* Roley, M.A.: Newbury House, 136-158.

Flege E.J. (1986). Effects of equivalence classification on the production of foreign language speech sounds. In J. Allan and J. Leather (eds), *Sound patterns in second language acquisition*. The Netherlands: Foris Publications, 9-40.

Flege E.J. (1991a). Perception and production: The relevance of phonetic input to L2 phonological learning. In T. Huebner and C.A. Ferguson (eds), *Crosscurrents in second language acquisition and linguistic theories.* The Netherlands: John Benjamins B.V., 249-290.

Flege E.J. (1991b). Age of learning affects the authenticity of voice onset time (VOT) in stop consonants produced in a second language. *Journal of the Acoustical Society of America* 89: 395-411.

Flege E.J. (1997). English vowel production by Dutch talkers: More evidence for the 'similar' versus 'new' distinction. In J. Allan and J. Leather (eds), *Second language speech: Structure and process.* Berlin: Mouton de Gruyter, 11-52.

Flege J.E . and W. Eefting (1987). The production and perception of English stops by Spanish speakers of English. *Journal of Phonetics* 15: 67-83.

Flege J.E. and J. Hillenbrand (1987). Limits on phonetic accuracy in foreign language speech production. In R.C. Scarcella and M.H. Long (eds), *Issues in second language research.* Massachusetts: Newbuty House, 176-203.

Flege J.E. and R. Port (1981). Cross-language phonetic interference: Arabic to English. *Language and Speech* 24: 125-146.

Fullana N. (2006). The development of English (FL) perception and production skills: Starting age and exposure effects. In C. Muñoz (ed.), *Age and the rate of foreign language learning.* Clevedon: Multilingual Matters, 41-64.

Goodwin J., D. Brinton and M. Celce-Murcia (1994). Pronunciation assessment in the ESL/EFL curriculum. In J. Morley (ed.), *Pronunciation, pedagogy and theory: new views, new directions*. TESOL, 3-16.

House A.S. (1961). On vowel duration. In *Journal of the Acoustical Society of America* 33: 1174-1178.

House A.S. and G. Fairbanks (1953). The influence of consonant environment upon the secondary acoustic characteristics of vowels. In *Journal of the Acoustical Society of America* 25: 105-113.

Lisker L. and A.S. Abramson (1964). A cross-language study of voicing in initial stops: Acoustical measurements. In *Word* 20: 384-422.

Long M. (1990). Maturational constraints on language development. In *Studies in Second Language Acquisition* 12: 251-285

Luce P.A. and J. Charles-Luce (1985). Contextual effects on vowel duration, closure duration, and the consonant/vowel ratio in speech production. In *Journal of the Acoustical Society of America* 78: 1949-1957.

Major R. (1987). English voiceless stop production by speakers of Brazilian Portuguese. In *Journal of Phonetics* 15: 197-202.

Muñoz C. (2003). Variation in oral skills development and age of onset. In M.P. Garcia-Mayo and M.L. Garcia-Leccumberri (eds), *Age and the acquisition of English as a foreign language*. Clevedon: Multilingual Matters, 161-181.

Muñoz C. (2006). The effects of age on foreign language learning: the BAF project. In C. Muñoz (ed.), *Age and the rate of foreign language learning*. Clevedon: Multilingual Matters, 1-39.

Olson L.L. and S.J. Samuels (1982). The relationship between age and accuracy of foreign language pronunciation. In S. Krashen, R. Scarcella and M.H. Long (eds), *Child adult differences in second language acquisition*. Roley, M.A.: Newbury House, 84-92.

Pardo D.B. (2004). Can pronunciation be taught? A review of research and implications for teaching. *Revisita Alicantina de Estudios Inglesses* 17: 6-38.

Patkowski M. (1990). Age and accent in a second language: A reply to James Emil Flege. *Applied Linguistics* 11: 73-89.

Peterson G. and I. Lehiste (1960). The duration of syllable nuclei in English. *Journal of the Acoustical Society of America* 32: 693-703.

Scovel T. (1988). *A time to speak: A psycholinguistic inquiry into the critical period for human speech*. Roley, M.A.: Newbury House.

Thogmartin C. (1982). Age, individual differences in musical and verbal aptitude, and pronunciation achievement by elementary school children learning a foreign language. *International Review of Applied Linguistics* 20: 66-72.

Williams L. (1979). The modification of speech perception and production in second-language learning. *Perception and Psychophysics* 26: 95-104.

Zimmerman S.A and S.M. Sapon (1958). Note on vowel duration seen crosslinguistically. *Journal of the Acoustical Society of America* 30: 152-153.