

A Case Study of Pronunciation Performance of English Word Initial Consonant Clusters

Gloria Hui-chu Chen

Instructor of General Education Center

Abstract

No consonant clusters are allowed in Chinese syllable structure, so Taiwanese students may have difficulty pronouncing the word initial consonant clusters in English. Thus, this study is motivated to conduct an empirical case study of the pronunciation performance of onset consonant clusters by De Lin English majors and investigate the relative difficulty of different types of English onset consonant clusters. The results of this study conclude that the clusters beginning with /s/ and the clusters ending with /y/ are easy for these De Lin English majors while three-consonant clusters in English word initial and the /r/ clusters are the most difficult. As different types of English onset consonant clusters do not appear congruously difficult to the students, teachers should pay due attention to the more difficult clusters in their pronunciation instruction.

Key words: word initial consonant cluster, pronunciation problems, pronunciation error analysis

英語字首子音連音發音困難之研究

陳慧珠

通識中心 講師

摘要

中文的語音系統並沒有連續子音出現在音節中，因此一般認為臺灣學生在發英語字首子音連音時有其相當的困難。本研究即是以實地搜集德霖英語主修學生英語字首子音連音之發音語料，進行分析討論以了解不同的連音群對德霖英語主修學生所產生的困難。本文研究結果顯示英語字首中連續三個子音與含流音/r/的連音，對德霖英語主修學生最為困難，而以/s/開始的連音群與以/y/結尾的連音最容易。學生在連續得子音中加入弱母音/ə/、/p/、/t/，與 /k/在/s/發吐氣的音、/r/的捲舌不夠是造成錯誤發音的主要原因。教師可引導學生做辨音練習，聽出正確與錯誤發音之差異，來導正學生發出清楚的字首子音連音而能使語意正確表達。

關鍵字：字首子音連音、發音困難、發音錯誤分析

I. Introduction

The mastery of clear and correct pronunciation of English is certainly the first prime goal in the initial learning stage of developing English proficiency. Accurate English pronunciation can accelerate the L2 learners' motivation and confidence while poor pronunciation may hinder these learners' interests and efforts. Thus, English teachers should provide their students with meaningful and effective instruction to develop their pronunciation skills. Besides, teachers need to be aware of the influence of native language on learning the target language English to understand their students' problems or difficulties, so they can help their students to develop abilities to monitor and correct their own speech sounds. This implies that English teachers should have adequate phonological knowledge to give necessary information and constructive feedback to guide their students for developing communicative pronunciation skills. Thus, the researches on the phonological development of English sound system of Taiwanese students are required to support English teachers to understand certain pronunciation phenomenon or features and reflect on some effective means to enhance their students' pronunciation learning skills.

The contrastive analysis of the phonological system between English and a certain L1 is generally conducted to understand and explain various aspects of L2 phonological development. The L2 phonological acquisition or development is surely an extremely complex process, which demands the surveys on the phonemic, phonotactic, and suprasegmental features of L2 learner phonological performance. This study aims to explore the phonotactic aspect of the phonological development of Taiwanese EFL learners; that is, the syllable structure and the segment consonant cluster types allowed in the syllables. In Mandarin and Taiwanese phonological systems, no consonant clusters are permitted anywhere in the syllable; therefore, the consonant clusters are commonly considered as pronunciation problems for Mandarin or Taiwanese EFL students. The pronunciation problems of consonant clusters have been mentioned by many English teachers or researchers in Taiwan (Su, 1996; Chen, 1996; Wei, 1998; Wang, 1999; Lee, 2000); however, they are rarely empirically studied and analyzed to investigate the errors or difficulties in pronouncing the consonant clusters. Thus, this study is motivated to conduct an empirical survey of the pronunciation performance of onset consonant clusters by Taiwanese EFL students and offer suggestions to the teaching of English onset consonant clusters to Taiwanese students.

For the purpose to investigate the pronunciation performance of English consonant clusters of De Lin English majors and understand their difficulty in pronouncing these onset clusters, this study includes the following research questions:

1. How well do these English majors pronounce these English onset consonant clusters?
2. What are the easy and the difficult consonant clusters to these English majors?
3. What are their problems in pronouncing correct onset consonant clusters?
4. What is the difficulty hierarchy indicated from the students' consonant cluster pronunciation and the intrinsic cluster complexity as predicted by Eckman and Iverson (1993)?

II. Literature Review

A. Predicted Difficulty of English Onset Clusters

Errors are a salient feature in language learning process, revealing problems or difficulties of learning an L2 and indicating certain language production strategies or L1 influence. To explain the L2 phonological errors, researchers generally count on the Markedness theory from the typological universal to interpret the interlanguage phonological patterns. For example, Eckman and Iverson (1993) based on Clements' (1990) Sequential markedness principle along with typological markedness and proposed the relative difficulty level of English onset consonant clusters as below:

1. voiced stop + liquid/glide is more difficult than voiceless stop + liquid/ glide
2. voiced fricative + liquid/glide is more difficult than voiceless fricative + liquid/ glide
3. voiceless fricative + liquid/glide is more difficult than voiceless stop + liquid/ glide

The 17 English onset consonant clusters in Eckman and Iverson's study (1993) were labeled by three relative markedness: least, intermediate, and most. The least marked clusters were the easiest for L2 learners to acquire, while the most marked clusters are the most difficult to acquire. Their predicated difficulty level for these onset clusters is listed as following:

1. *pr/pl* < *br/bl* < *py*
2. *pr/pl* < *fr/fl*
3. *tr* < *dr* < *tw*
4. *tr* < *θr*
5. *kr/kl* < *gr/gl* < *kw/ky*

This consonant clusters difficulty scale will be served as the basis to interpret the pronunciation performance and compare the exact pronunciation difficulty as reflected in the collected data.

B. Initial Consonant Clusters Permitted in English

There are forty-seven initial consonant clusters permitted in English (Prator & Robinett, 1985, p.175), thirty-eight of which are two-consonant clusters and nine of which are three-consonant clusters. These clusters are grouped here according to the natural class of the first element of the cluster.

1. Voiceless stop + liquid/glide
/pl/: play */pr/*: pray */py/*: pure
/tr/: tree */ty/*: tune */tw/*: twelve
/kl/: clear */kr/*: cross */ky/*: cure */kw/*: quick
2. Voiced stop + liquid/glide
/bl/: blue */br/*: bring */by/*: beauty
/dr/: drink */dw/*: dwell */dy/*: due
/gl/: glad */gr/*: great */gw/*: Gwen */gy/*: gewgaw
3. voiceless fricative + liquid/glide
/fl/: fly */fr/*: free */fy/*: few

- /sl/: sleep /sw/: sweet
/ʃr/: shrink
/θr/: three /θw/: thwart
/hy/: huge
4. voiced fricative + liquid/glide
/vy/: view
5. voiceless fricative + voiceless stop
/sp/: speak /st/: still /sk/: sky
6. voiceless fricative + voiceless fricative
/sf/ : sphere
7. voiceless fricative + nasals
/sm/: small /sn/: snow
8. nasal + glide
/my/: mute /ny/: new
9. three-consonant clusters
/skl/: sclerosis /spl/: split /skr/: scratch
/spr/: spring /str/: street /skw/: square
/sky/: skew /spy/: spew /sty/: stew

Among these forty-seven consonant clusters, four clusters are so rare that they are not included in this study, which are /gw/ /θw/ /gy/ /skl/. Prator & Robinett (1985) have also made some statements about learning of English initial consonant clusters. They thought some L2 learners had little or no trouble with the clusters made up of a consonant plus /y/ or /w/ because these clusters are permitted by the phonotactic rules of L2 native languages. The clusters ending in /l/ or /r/ were quite difficult for many L2 learners since they had trouble pronouncing /l/ and /r/ in any position. They also considered the most troublesome initial clusters for the largest number of students seemed to be those consisting of an initial /s/ followed by one or more other consonants. The initial /s/ clusters were difficult for breaking the phonotactic rules of the L2 learners' native language. From the above statements, it is clear that Prator & Robinett stressed the influence of the L1 on the difficulty of learning English initial consonant clusters.

C. Taiwanese EFL students' phonological development of onset consonant clusters

Though the problems of pronouncing onset consonant clusters of Taiwanese EFL learners are commonly noticed, the development and acquisition of English onset clusters is seldom to be investigated comprehensively to provide more effective teaching to help Taiwanese students pronounce the more difficult initial clusters. Nevertheless, Chen's study of Chinese students' pronunciation problems in English liquids (Chen, 2003) briefly discussed the learning of English onset /r/ and /l/ clusters. She used one oral reading text composed of 25 single words, five sentences, and a

short passage to examine her subjects' pronunciation of English liquids in different syllable positions. Her subjects were fifty first-graders, 25 males and 25 females, from a senior high school in Taoyuan. There were totally 15 target initial /r/ and initial /l/ clusters words in her study: *grandpa*, *cream*, *tree*, *bridge*, *bright*, *groom*, *frog*, *front*, *black* (2 tokens), *fly*, *played*, *blight*, *blue*, *clock*, and *slowly*. The average error rate of initial /r/ clusters was 15.8% and the one of initial /l/ clusters was 85.8%, so the initial /l/ clusters were far more difficult to the subjects than initial /r/ clusters. She also identified the error types of initial /l/ and initial /r/ clusters made by her subjects (Chen, 2003, p.60-63). The major error type for initial /l/ clusters was the addition of schwa / ə / ; the second major error type was the substitution of / r. / for /l/, which sounds like a tongue-tip flap at the area of alveolar ridge without the tongue curling for a normal /r/ nor the tongue contact required for a normal clear /l/. The /l/ substitution plus schwa addition was reported as the major error type for initial /r/ clusters and the addition of schwa before /r/ as the second major error type.

Even Chen (2003) has concluded the initial /l/ clusters were more difficult to her subjects than the initial /r/ clusters, the relative difficulty scale among the initial liquid clusters remained unexplored. Since Chen's study only presented a partial understanding to the acquisition of English initial consonant clusters, further studies on this area are required to furnish the understanding and knowledge to the phonological development of Taiwanese EFL learners.

III. Methodology

A. Subjects

All the subjects in this study are English majors at De Lin Institute of Technology. They were chosen for similar academic training in pronunciation and their more acute awareness about their pronunciation. There were two groups of students: Group A (Sophomores) were seven fifth graders of the five-year junior college program, age 19 or 20, and Group B (Seniors) were nine second graders of the two-year senior college program, who are older than 22. Students Group A share the same English learning experience for the previous four and half years, while students Group B indicate greater variance because four were English majors while five were non-English majors in their previous educational stage.

B. Research Instruments

The major instrument to survey the subjects' pronunciation performance of English onset consonant clusters is a wordlist (Appendix A) of 164 single words and 34 phrases. The singles words are arranged and grouped according to the onset consonant cluster types and the phrases are made as 17 minimal pairs of onset /l/ clusters and onset /r/ clusters. The chosen words are basically of one syllable in order to simplify the phonetic components of the target onset consonant clusters for studying their relative difficulty level for Mandarin or Taiwanese English learners. For those productive onset clusters, there are five instances of the cluster conjoined with different rimes, but less examples are listed for those consonant clusters with the more restricted combination of the onset

cluster and the rime.

C. Data collection and analysis

All the subjects got the wordlist before the recording, so they could check on the words unfamiliar to them. The instructor also explained how the wordlist was designed to the subjects when they met for the recording. The subjects were told to pronounce the words or phrases as clearly and slowly as possible. As the subjects requested to record their pronunciation by themselves without the presence of the instructor, some fragments of the recording posed difficulty for transcription. So, the instructor's classmate assisted the transcription of the subjects' pronunciation. As for the scoring of correct cluster pronunciation, the correct pronunciation of each cluster in the five-word group got one point and the relative score was given to the correct cluster in the less-than-five group on an equivalent basis in order to compute their relative difficulty. For example, the correct pronunciation of *shrine* was given 1.25. The score results were tabulated in Excel and computed by SPSS for further analysis and discussion.

IV. Results and Discussion

The analysis of the pronunciation performance of English word initial clusters by the English majors at De Lin will proceed first to report the results of accuracy means of all the English initials consonant clusters pronounced by these English majors and examine the correlation between the performance score and the two groups of students, then to identify the easier and the more difficult initial consonant clusters for the subjects, next to set up the relative difficulty scale among the initial consonant cluster types, and finally to discuss the errors found in the more difficult initial consonant clusters.

A. Pronunciation Performance of English Initial Consonant Clusters

The complete frequency mean for the correct pronunciation of each consonant cluster pronounced by the subjects is recorded in Table 1.

Table 1: Frequency Mean for the Correct Cluster Pronunciation

Item No.	Consonant Cluster	Mean	Std. Deviation
1	/b/	3.44	1.86
2	/p/	3.06	2.08
3	/f/	3.69	1.92
4	/s/	4.69	1.25
5	/g/	3.31	2.06
6	/k/	3.44	2.06

Item No.	Consonant Cluster	Mean	Std. Deviation
7	/br/	3.62	1.82
8	/dr/	3.88	1.93
9	/fr/	3.44	1.90
10	/gr/	3.69	1.49
11	/kr/	3.06	1.88
12	/pr/	3.69	1.58
13	/šr/	1.95	1.82
14	/tr/	4.88	.34
15	/θr/	3.00	2.19
16	/dw/	2.08	2.06
17	/kw/	5.00	.00
18	/tw/	5.00	.00
19	/sw/	4.94	.25
20	/sf/	3.75	2.24
21	/sk/	3.69	1.20
22	/sm/	5.00	.00
23	/sn/	5.00	.00
24	/st/	4.94	.25
25	/sp/	4.69	.60
26	/by/	5.00	.00
27	/dy/	3.94	1.48
28	/fy/	3.98	1.04
29	/hy/	4.53	1.36
30	/ky/	4.38	1.44
31	/my/	4.69	1.25
32	/ny/	4.69	1.25
33	/py/	3.91	2.03
34	/ty/	4.06	1.55
35	/vy/	5.00	.00
36	/spl/	1.80	2.23
37	/skr/	1.00	1.55
38	/spr/	3.54	1.60
39	/str/	1.7969	1.9348
40	/skw/	2.50	2.28
41	/sky/	0.31	1.25

Item No.	Consonant Cluster	Mean	Std. Deviation
42	/spy/	1.25	2.25
43	/sty/	4.375	.7454
Score		157.66	35.56
Mean		3.6664	.7035

According to Table One, the subjects as a whole scored the mean of 3.67 for the forty-three clusters, which indicates these English majors performed barely satisfactorily in pronouncing initial consonant clusters. The Sophomore Group scored a total of 139.15 (mean=3.24), which was significantly ($p=0.025$) lower than 172.05 (mean=4.00), the total scored by the Senior Group. So, the seniors actually performed satisfactorily in pronouncing English initial consonant clusters, while the sophomores performed not satisfactorily. It also indicates, shown in Table Two, that the pronunciation performance was positively correlated ($p=0.025$) to the subjects' age range and their learning years. As for the senior group, the previous English majors, scoring a total of 175.93, did not perform significantly better ($p= 0.30$) than those was not previous English majors, scoring the total of 168.93.

Table Two: Correlation between Groups of Students and Score

		Group	SCORE
Group	Pearson Correlation	1.000	.557*
	Sig.(2-tailed)	.	.025
	N	16	16
Score	Pearson Correlation	.557*	1.000
	Sig.(2-tailed)	.025	.
	N	16	16

B. Relative Difficulty Scale of English Initial Consonant Clusters

In order to understand the relative difficulty of each cluster for the subjects to pronounce, the clusters are sequenced in decreasing score mean to present the performance rank of these forty-three clusters, which is presented as Table Three.

Table 3: The Consonant Clusters Ranked in Decreasing Score Mean

Item No.	Consonant Cluster	Mean	Std. Deviation
17	/kw/	5.00	0
18	/tw/	5.00	0
22	/sm/	5.00	0
23	/sn/	5.00	0
26	/by/	5.00	0
35	/vy/	5.00	0
19	/sw/	4.94	0.25
24	/st/	4.94	0.25
14	/tr/	4.88	0.34
4	/sl/	4.69	1.25
25	/sp/	4.69	0.6
31	/my/	4.69	1.25
32	/ny/	4.69	1.25
29	/hy/	4.53	1.36
30	/ky/	4.38	1.44
43	/sty/	4.375	0.7454
34	/ty/	4.06	1.55
28	/fy/	3.98	1.04
27	/dy/	3.94	1.48
33	/py/	3.91	2.03
8	/dr/	3.88	1.93
20	/sf/	3.75	2.24
3	/fl/	3.69	1.92
10	/gr/	3.69	1.49
12	/pr/	3.69	1.58
21	/sk/	3.69	1.2
7	/br/	3.62	1.82
38	/spr/	3.54	1.6
1	/bl/	3.44	1.86
6	/kl/	3.44	2.06
9	/fr/	3.44	1.9
5	/gl/	3.31	2.06
2	/pl/	3.06	2.08
11	/kr/	3.06	1.88
15	/θr/	3.00	2.19
40	/skw/	2.50	2.28
16	/dw/	2.08	2.06
13	/ʃr//	1.95	1.82

Item No.	Consonant Cluster	Mean	Std. Deviation
36	/spl/	1.80	2.23
39	/str/	1.7969	1.9348
42	/spy/	1.25	2.25
37	/skr/	1.00	1.55
41	/sky/	0.31	1.25

The easiest clusters are /kw/, /tw/, /by/, /vy/, /sm/, and /sn/, which scored the mean of 5, indicating that all the subjects had no troubling pronouncing these clusters. The clusters which scored the mean higher than 4 can be also regarded as easy for the subjects. In this range of clusters, there are four clusters beginning with /s/ and six clusters ending with /y/. The following group of clusters, scoring between 4 and 3.75, included three clusters ending with /y/. From these score means, it is obvious that the subjects can pronounce three types of consonant clusters with great ease: the clusters starting with /s/ and the clusters ending either with /w/ or /y/ except for /dw/ and /skw/. The two clusters /dw/ and /skw/ are difficult probably due to the unfamiliarity to these two clusters. The most erroneous clusters for the subjects are the ones with three consonants: /spl/, /str/, /spy/, /skr/, and /sky/. The second difficult cluster group, which scored the mean between 3.69 and 3.0, are those clusters ending with /l/ or /r/. The most difficult two-consonant initial /l/ cluster is /pl/ with the mean of 3.06 and the most two difficult two-consonant initial /r/ cluster are /θr/ with the mean of and /šr/ with the mean of 1.95.

The forty-three clusters can be furthered labeled in a five-point difficult scale to mark their relative difficulty to the English majors:

1. Difficulty level 5: the accuracy mean below 2.5
Clusters: /skw/, /dw/, /šr/, /spl/, /str/, /spy/, /skr/, /sky/
2. Difficulty level 4: the accuracy mean between 3.5 and 3.0
Clusters: /spr/, /bl/, /kl/, /fr/, /gl/, /pl/, /kr/, /θr/
3. Difficulty level 3: the accuracy mean between 3.98 and 3.62
Clusters: /fy/, /dy/, /py/, /dr/, /sf/, /fl/, /gr/, /pr/, /sk/, /br/
4. Difficulty level 2: the accuracy mean between 4.88 and 4.06
Clusters: /tr/, /sl/, /sp/, /my/, /ny/, /hy/, /ky/, /sty/, ty/
5. Difficulty level 1: the accuracy higher than 4.9
Cluster: /kw/, /tw/, /sm/, /sn/, /by/, /vy/, /sw/, /st/

According to Table Four, the relative difficulty level among different initial consonant cluster types is:

/s/ clusters < /y/ clusters < /w/ clusters < /l/ clusters < /r/ clusters < /skC/

Table Four: The Frequency Mean of Different Cluster Types

Types	Categories	Mean
/l/	6	3.61
/r/	9	3.43
/s/	7	4.57
/y/	10	4.42
/w/	3	4.02
/skC/	8	2.07

The relative difficulty level among the six cluster types affirms the major difficulty in learning English initial consonant clusters is to master the production of liquid initial clusters and those three-consonant clusters.

C. Minimal pairs of /r/ initial clusters and /l/ initial clusters

As the liquid initial clusters are the major types in English initial clusters, the subjects were requested to pronounce them in minimal pairs in order to find out their problems in pronouncing these clusters. Table Five presents the frequency mean for the pronouncing each liquid initial in a minimal-pair task.

Table Five: The Minimal Liquid Initial Pairs Ranked in Decreasing Score Mean

Rank	C Cluster	Mean	Std. Deviation
1	fright	1.00	.00
2	flight	1.00	.00
3	blue	1.00	.00
4	fly	0.94	.25
5	free	0.94	.25
6	present	0.94	.25
7	fry	0.87	.34
8	braid	0.87	.34
9	play	0.81	.40
10	pray	0.81	.40
11	freeze	0.81	.40
12	frames	0.81	.40
13	fleas	0.75	.45
14	crime	0.69	.48
15	breed	0.69	.48

Rank	C Cluster	Mean	Std. Deviation
16	crow	0.69	.48
17	climb	0.63	.50
18	prow	0.63	.50
19	crash	0.63	.50
20	flee	0.63	.50
21	grass	0.56	.51
22	bleed	0.56	.51
23	clash	0.56	.51
24	claw	0.56	.51
25	growing	0.56	.51
26	blade	0.56	.51
27	crew	0.5	.52
28	clue	0.5	.52
29	brew	0.5	.52
30	pleasant	0.38	.50
31	glass	0.37	.50
32	flame	0.37	.50
33	plow	0.25	.45
34	glowing	0.19	.40

According to Table Five, these liquid initials clusters can be classified into five relative difficulty groups:

1. Difficulty level 5: the accuracy mean below 0.38
pleasant, glass, flame, plow, glowing
2. Difficulty level 4: the accuracy mean between 0.56 and 0.5
grass, bleed, clash, claw, growing, blade, crew, clue, brew
3. Difficulty level 3: the accuracy mean between 0.63 and 0.69
crime, breed, crow, climb, prow, crash, flee
4. Difficulty level 2: the accuracy mean between 0.75 and 0.87
fry, braid, play, pray, freeze, frame, fleas
5. Difficulty level 1: the accuracy mean above 0.9
fright, flight, blue, fly, free, present

In this minimal-pair pronunciation task, the accuracy of pronouncing the liquid clusters seemed related to the vowel quality. Among the difficulty level 1 and 2 liquid initial clusters, only one cluster /bl/ was before /u/, while the difficulty level 4 three clusters were before /u/. The vowel quality in relation to the accuracy of liquid initial clusters would require further investigation for a

more definite conclusion.

As for distinguishing the subjects' performance in the ten cluster types in the minimal-pair task, the frequency mean is listed in Table Six for discussion.

Table Six: The Ten Liquid Initial Clusters Ranked in Decreasing Score Mean

Rank	C Cluster	Mean	Std. Deviation
1	/fr/	0.89	.008
2	/pr/	0.79	.16
3	/fl/	0.74	.25
4	/bl/	0.71	.25
5	/br/	0.69	0.18
6	/gl/	0.64	.37
7	/kr/	0.63	.008
8	/kl/	0.56	.005
9	/gr/	0.56	.00
10	/pl/	0.48	.29

As indicated in Table Six, the more accurately pronounced cluster types are those clusters with labials before a liquid consonant, while the more difficult liquid initial are the clusters with velar consonants before a liquid consonant. The most difficult cluster type /pl/ was most erroneous because of the low accuracy of pronunciation *plow* and *pleasant*. Regarding the pronunciation performance for the two broader /r/ initial clusters group and /l/ initial clusters group, the subjects performed better in /r/ initial clusters (mean=0.71) than in /l/ initial clusters (mean=0.63). The higher accuracy of /r/ initial clusters might be due to the task influence. The subjects were more aware of curling the tongue to distinguish the minimal pairs.

D. Errors in English initial clusters pronunciation

In order to help the students improve their pronunciation, the teachers must offer constructive feedback to make their students understand why they pronounce the words wrong. Thus, the errors when producing English initials clusters will be discussed in order to offer suggestions to improve the subjects' pronunciation performance. The discussion will be mainly concerned about the most difficult initial cluster types for the subjects.

1. /l/ initial clusters:
 - a. Epenthesis of a schwa /ə/ between the two consonants was the first main error types in producing /l/ initials clusters.
 - b. The substitution of / r. / for /l/ before the vowel /u/ was the second main error type. The subjects produced a flap sound as an unretroflexed /r/ sound.

2. /r/ initial clusters:
 - a. The substitution of /r. / for /r/ was the first or error type. The subject produced a flap sound as an unretroflexed /r/ sound.
 - b. Epenthesis of a schwa /ə/ between the two consonants was the second main error types in producing /r/ initials clusters.
3. /spl/ initial clusters:
 - a. Epenthesis of a schwa /ə/ between the first two consonants was the first main error types
 - b. The substitution of an aspirated /p/ for an unaspirated /p/ was the second main error type.
4. /skr/ initial clusters:
 - a. The substitution of /w/ for /r/ was the first main error type.
 - b. The substitution of an aspirated /k/ for an unaspirated /k/ was the second main error type
5. /spr/ initial clusters:
 - a. Epenthesis of a schwa /ə/ between the first two consonants was the first main error types
 - b. The substitution of an aspirated /p/ for an unaspirated /p/ was the second main error type
6. /str/ initial clusters:

The substitution of an aspirated /t/ for an unaspirated /t/ was the major error type.
7. /skw/ initial clusters:
 - a. The substitution of an aspirated /k/ for an unaspirated /k/ was the first main error type.
 - b. The substitution of /w/ for /r/ was the second main error type.

From the above examination of the subjects' errors, it is certain that the subjects would need more efforts to practice curling the tongue to produce a more retroflexed /r/ to enhance their accuracy in pronouncing the more difficult cluster types.

V. Conclusion

English initial consonant clusters are common syllable components which L2 learners must manage these clusters and acquire the competence of pronouncing them. This study attempts to describe and analyze the subjects' pronunciation performance in order to compute the empirically supported relative difficulty scale among all the permitted initial consonant clusters in English. The main findings of this study are summarized below:

1. The pronunciation performance of English initial consonant clusters is positively correlated to the years of English learning. The English senior majors at De Lin performed significantly better than the sophomores.
2. The relative difficulty level of English initial consonant clusters drawn from the subjects' performance is

/s/ clusters < /y/ clusters < /w/ clusters < /l/ clusters < /r/ clusters < /skC/

3. The initial consonant clusters ending with glides are easy for the subjects to pronounce, which is not exact as predicted by Eckman and Iverson (1993).
4. The initial consonant clusters beginning with /s/ are the easiest cluster groups for the subjects, which is also not in accordance with Prator & Robinett's observation (1985).
5. English liquid initials clusters beginning with labials are easier to the subject students than those beginning with velars. Therefore, the teachers should spare more instruction time and energy on these clusters.
6. The substitutions of a non-retroflexed /r./ for /r/ and aspirated voiceless stops for unaspirated voiceless stops are major errors in learning English consonant initial clusters. The teachers should ask the students to consciously practice curling the tongue to get used to such a tongue movement.
7. The accuracy of pronouncing initial consonant clusters seems to be correlated to the conjoined

vowels after the clusters, which needs further systematic exploration to investigation if any possible correlation exists.

The acquisition of L2 phonological competence is definitely dynamic with various linguistically intrinsic and extrinsic factors involved in the acquisition process. The present study have approached the development of English initial consonant clusters of Taiwanese EFL students comprehensively and empirically; however, the proposed relative difficulty level among English initial consonant clusters was drawn from the analysis and computation of the pronunciation performance of 16 English majors only. Besides, the criteria for labeling the accuracy value of the pronunciation of the consonant clusters were difficult to be set up or kept constant. Consequently, a further study with more acute and standardized criteria and adequate subjects is necessary to verify the relative difficulty level among English initial consonant clusters and present a more profound understanding to the phonotatic development of Taiwanese EFL learners' interlanguage.

References

- Blevins, Wiley. (2001). *Teaching Phonics & Word Study*. New York: Scholastic Inc.
- Chen, Chien-ping. (1996). Error Analysis on English Pronunciation and Second Language Learning Development. 復興崗學報.
- Chen, Huei-jen. (2003). *A Study of Chinese Students' Pronunciation Problems in English Liquids*. Unpublished Master's Thesis at National Taiwan Normal Univeristy.
- Eckman, Fred R. & Iverson, Gregory K. (1993). Sonority and markedness among onset clusters in the interlanguage of ESL learners. *Second Language Research* 9 (3): 234-252.
- Lee, Ing. (2000). 談兒童英語教學中的發音問題. 英語教學 25 (2): 4-15.
- Prator, Clifford H. & Robinett, Betty Wallace. (1985). 4th Ed. *Manual of American English*

- Pronunciation.* Orlando: Harcourt Brace & Company.
- Su, Brenda S.C. (1996). A Study on the English-speaking Problems of Chinese Students in Taiwan. *Bulletin of National Pingtung Polytechnic Institute 5 (1):75-86.*
- Wang, Chilin Catherine. (1999). Phonological Aspects of Second Language Acquisition. 東海學報, Vol. 40 (1): 39-64.
- Wei, Chin-lung. (1998). 淺談我國學生常見的發音問題及可行的教學對策英語教學, 23 (1): 37-55.

Appendix A

Wordlist for Recording English Initial Consonant Clusters.

- 1 /bl/: (1) block (2) blame (3) bleed (4) blow (5) blue
- 2 /pl/: (1) plot (2) place (3) please (4) plow (5) plum
- 3 /fl/: (1) flop (2) flame (3) fleece (4) flow (5) flu
- 4 /sl/: (1) slot (2) slave (3) sleep (4) slow (5) slue
- 5 /gl/: (1) glide (2) glaze (3) gleam (4) glow (5) glue
- 6 /kl/: (1) clock (2) clay (3) clean (4) close (5) clue
- 7 /br/: (1) bra (2) break (3) bring (4) broke (5) broom
- 8 /dr/: (1) drop (2) drain (3) dream (4) drove (5) drew
- 9 /fr/: (1) frog (2) friend (3) freeze (4) frozen (5) fruit
- 10 /gr/: (1) graph (2) great (3) green (4) grow (5) group
- 11 /kr/: (1) crop (2) craze (3) creep (4) crow (5) cruise
- 12 /pr/: (1) problem (2) praise (3) priest (4) probe (5) prove
- 13 /ʃr/: (1) shrine (2) Shrek (3) shrimp (4) shrewd
- 14 /tr/: (1) tropic (2) train (3) tree (4) trophy (5) truth
- 15 /θr/: (1) thrive (2) threat (3) three (4) throw (5) threw
- 16 /dw/: (1) dwine (2) dwell (3) dwarf
- 17 /kw/: (1) quiet (2) quake (3) quick (4) quote
- 18 /tw/: (1) twice (2) twelve (3) twin (4) two
- 19 /sw/: (1) swan (2) swear (3) sweet (4) swollen (5) swoop
- 20 /sf/: (1) sphere
- 21 /sk/: (1) sky (2) skate (3) ski (4) scope (5) school
- 22 /sm/: (1) smart (2) smell (3) Smith (4) smoke (5) smooth
- 23 /sn/: (1) snob (2) snake (3) sneeze (4) snow (5) Snoopy
- 24 /st/: (1) star (2) stay (3) steal (4) stone (5) stood
- 25 /sp/: (1) spy (2) spare (3) speech (4) spoke (5) spoon
- 26 /by/: (1) beauty (2) beautiful
- 27 /dy/: (1) due (2) dual (3) deuce (4) duke (5) during

- 28 /fy/: (1) few (2) fuel (3) fume (4) fuse
 29 /hy/: (1) huge (3) humor
 30 /ky/: (1) cure (2) cute
 31 /my/: (1) music (2) museum
 32 /ny/: (1) new (2) nuclear
 33 /py/: (1) pure (2) purify
 34 /ty/: (1) tube (2) Tuesday
 35 /vy/: (1) view (2) viewer
 36 /spl/: (1) splash (2) splendid (3) split (4) splint
 37 /skr/: (1) scream (2) scrap (3) scratch (4) scramble (5) screen
 38 /spr/: (1) Sprite (2) spread (3) spring
 40 /str/: (1) strike (2) straight (3) street (4) straw
 41 /skw/: squash (2) square (3) squeeze
 42 /sky/: (1) skew
 43 /spy/: (1) spew
 44 /sty/: (1) student (2) steward
- | | |
|----------------------|----------------------|
| 45 time to play | 46 time to pray |
| 47 a high crime | 48 a high climb |
| 49 the bad fleas | 50 the bad freeze |
| 51 a pointed plow | 52 a pointed prow |
| 53 have a crew | 54 have a clue |
| 55 a sudden fright | 56 a sudden flight |
| 57 walk on the glass | 58 walk on the grass |
| 59 the blue selector | 60 the brew selector |
| 61 a long drain | 62 a long train |
| 63 in the flames | 64 in the frames |
| 65 fly high | 66 fry high |
| 67 a fine breed | 68 a fine bleed |
| 69 the car clash | 70 the car crash |
| 71 flee the people | 72 free the people |
| 73 the bird's crow | 74 the bird's claw |
| 75 a glowing light | 76 a growing light |
| 77 a present memory | 78 a pleasant memory |
| 79 a big blade | 80 a big braid |

