The Common Pronunciation Errors Made by Taiwanese Second Language Learners

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ABSTRACT. *In terms of phonological system, Chinese is very different from that of English. It is universally recognized that certain English phonemes, which do not have corresponding Chinese phonemic counterparts are generally hard to acquire. Others resembling Chinese phonemes but not identical to them in pronunciation are easier to acquire once given appropriate instruction and sufficient practice. Therefore, realizing the common pronunciation errors that EFL (English as foreign language) students often commit will be of great help for English language teachers. The purpose of this study aims to investigate the common pronunciation errors that Taiwanese ESP (English for specific purposes) students usually make. Subjects were 334 non-English major freshmen from a technological university in Taiwan. A questionnaire was provided to investigate students' learning difficulties, learning habits as well as strategies relating to vocabulary acquisition and pronunciation skills often used. The El Paso Phonics Survey was also utilized to evaluate students' phonemic awareness. From the analysis of high error frequency, Taiwanese adult ESP learners tend to make similar errors while articulating sounds with soft g, soft c, consonant clusters such as initial s-clusters, -r clusters, and consonant digraphs dw, qu, and tw. Vowels with silent e, -r (ar, er, ir, ur), short o, short a, short u, and diphthongs such as au, aw, ai, ay, and ow were also found with high error frequency. It is hoped that the findings may serve as reference for EFL teachers.*

Keywords: *Augmented reality, AR book, English learning, mobile augmented reality, learning achievement*

I. Introduction and Motivation

For several decades, language educators have made every effort in an attempt to assist EFL (English as foreign language) students struggling with insufficient abilities to cope with course requirements in their process of learning a foreign language. In the 1960s, Paul Pimsleur (1968) referred to this type of EFL students as "underachievers" to depict the perplexed EFL students with learning difficulties. Around the world, cross-cultural and cross-linguistic researches (Gatbonton, Trofimovich, & Magid, 2005; Swan & Smith, 1987) are aware of the special needs of individuals with learning difficulties. Taking the example from EFL students in Taiwan, with very limited phonological training, they often lose confidence of their performance in English learning. Morley (1998) claims

that insufficient pronunciation skills could restrict social interactions, undermine learners' self-confidence, and negatively impact estimations of a speaker's credibility and abilities. Although pronunciation instruction to EFL students has long been neglected (Wei, 2006) or even excluded from the syllabus in the past decades (Cheng, 1998); yet according to Tindall and Nisbet (2010) and Florez (1998), in recent years, the role that pronunciation plays in adults' overall communication competence has been attached much importance; consequently, pronunciation is emerging from its often marginalized place in adult ESL/EFL instruction.

Language is mainly for communication. According to the experts in oral communication and linguists, 85% of interpersonal communication is manipulated orally (Underhill, 1994). The major factors for a smooth conversation lie in clear speech, pleasant intonation, and graceful rhythm. All of these have close relationships with pronunciation. With this view in mind, pronunciation instruction (whereupon EFL) is hence the key to the success of foreign language learning (Chung, 1999). Inspired by researchers' insights, the purposes of this study are fourfold: (1) to examine ESP (English for specific purposes) students' pronunciation and spelling strategies; (2) to explore the common pronunciation errors of ESP students at a technological university; (3) to help English teachers realize Taiwanese ESP students' background and learning process; and (4) to suggest implications for EFL teachers throughout the world. Thus, this study set the following two research questions:

1. What are ESP students' needs of pronunciation and their spelling strategies?
2. What are ESP students' common pronunciation errors?

ESP students in Taiwan

Based on the fact that English in Taiwan is learned in an EFL setting, students mostly acquire English only in fixed language classes with very limited time allotted to English learning after school, especially speaking. Guided by the national college entrance exam, which does not test students' listening and speaking abilities, most students focus their learning on reading comprehension and grammar, like Golombek and Jordan's (2005) case study that Taiwanese test-driven educational systems neglect students' oral communication. As a result, both English teaching and learning ignore sound recognition, phonemic awareness and pronunciation drills from the very first step, not to mention emphasizing on the part of suprasegments such as intonation, rhythm, linking, and sound change.

Recently, a dramatic educational reform in Taiwan allows a lot more graduates from vocational high schools to be admitted to the so-called "university of science and technology" or "institute of technology". Generally speaking, vocational high school students are often discouraged and less motivated due to being screened out from entering high schools, which are regarded as the prerequisite learning stage toward comprehensive universities, and thus the teaching objective is focused on the preparation for academic performance. Unlike that of high schools, the goal of English education for vocational students is set to be English for specific purposes (ESP). In other words, they learn English

mainly for their professional needs. Preparing them for workplace communication and oral skills is important (Derwing & Munro, 2009; Wood 2009). Therefore, it is assumed that there will be a great diversity of syllabi and teaching approaches between these two educational systems.

A Taiwanese local study conducted by Shih and Lin (1998) indicated that the teaching materials for vocational schools are far from being practical and useful, and that both our society and school authorities generally ignore the English education provided for vocational students. With the neglected attitude toward English teaching and learning, it is rarely possible for the graduates to have competitive commands in English to meet the needs for current technical world. Once these students are admitted to technical colleges, where they are required to read extensively many textbooks and articles written in English, they usually appeared to be hopelessly incapable of dealing with the schoolwork. From the researchers' teaching experiences, the major problem that technical college students confront could be traced back to the very beginning when they started learning English in junior high schools which equals to the seventh grade or earlier.

Compared with reading and writing skills, English listening and speaking skills used to be considered as less important in Taiwan since the entrance examination does not have pronunciation questions or oral tests. Both teachers and students seldom put much emphasis on the phonological system of English. Consequently, they show great anxiety, low motivation, lack of confidence, and cannot but shrink away from possible chances when they are requested to communicate or even read aloud in English. The affective factors mentioned above such as anxiety, motivation and confidence do have more or less correlation with FL achievement, which is in accordance with the findings proposed by the researchers (Burstall et al., 1974). Ganschow and Sparks (2001) claimed that "attitude and motivation were influenced by achievement in the language (i.e., success breeds success)" (p. 82). Nevertheless, taking the example from Taiwan ESP students' learning process, it would be better to conclude that frustration mainly results from constant failures. It also corresponds to National Reading Panel (2000) and Morley (1998) in that limited pronunciation skills can undermine learners' self-confidence, restrict social interactions, and negatively influence estimations of a speaker's credibility and abilities. Similar studies are also found in Taiwan. Yao (1998) pointed out that technical college ESP students tend to have more anxiety than university students do; whereas Wu (2000) emphasized that personal factors such as interest, ability, need, and learning environment all influence the learning achievements. Therefore, it is nearly impossible to learn good pronunciation without strong desire and motivation.

Realizing the background and the inappropriate learning priority of Taiwanese EFL students, the researchers believe that they do not enjoy learning English due to lack of confidence with which they need to improve reading English. The dissatisfaction with their pronunciation performance thus forms chief obstacles to further in-depth learning.

II. Literature Review

1. Chinese speakers' phonological problems

Since Mandarin Chinese and English have extremely different phonological systems, Taiwanese students who learn English as foreign language may have confronted many difficulties in pronouncing English sounds. Based on Chang (1987, 2001), speakers whose mother tongue is Mandarin always experience difficulties to pronounce the following vowels and consonants (see Table 1):

Table 1 Chinese Speakers' Confused Vowels and Consonants

No.	Vowels	Consonants
1.	/i:/ and /I/ are a confused pair.	/b/, /d/, and /g/ are uttered to lose the voiced feature.
2.	/u:/ and /U/ are a confused pair.	/v/ is treated like /w/ or /f/.
3.	/æ/ is confused with / ɑ:/, /Λ/, and /e/	/n/ is replaced by /l/
4.	/ɑ/ is pronounced like /ɔ:/, /aʊ/, and /ʊ/.	/θ/ is replaced by /t/, /f/, or /s/; /ð/ is replaced by /d/ or /z/.
5.	/Λ/ is replaced by /a/.	/h/ becomes an aspirated velar fricative.
6.	Diphthongs are pronounced too short.	/z/ is substituted by /s/.
7.		/dʒ/, /tʃ/, and /ʃ/ are pronounced strangely.
8.		/l/ and /r/ are confused.
9.		Extra consonants are dropped and then become a glottal or unreleased stop.
10.		/l/ which is in final position, is usually pronounce as /r/, followed by /ə/, or dropped.

In terms of consonant clusters, Chang (1987) stated that the common errors for Chinese speakers are either "to insert a slight vowel sound between the consonants" (p. 226), or to simplify final clusters or to add additional syllables behind final clusters. In order to explore Mandarin Chinese learners' problems in pronunciation, Ma (1994) conducted a study which invited 16 Chinese university students who spoke English as second language and 16 Americans to pronounce a sentence that included five American English front vowels. The results showed that among the five front vowels, /ey/ and /æ/ are the easiest ones for Chinese speakers, but /I/ and /ɛ/are the most difficult for them to pronounce. Interestingly, although /I/ and /ey/ sound similar to the Chinese vowels, Mandarin Chinese speakers felt difficult to pronounce /I/, but felt easy to pronounce /ey/.

According to Juffs (1990), Mandarin Chinese speakers could not correctly pronounce some English vowels and consonants due to the influence of their mother tongue. Since tone is important in Mandarin Chinese, Chinese speakers may misunderstand that the stress in English is the tone in Chinese. They may neglect the pitch height in pronouncing an English word, lengthen the syllable, and

make it tonic. Tinloy et al. (1988) also believed that people usually apply their mother tongue to help them learn foreign languages. Thus, they concluded that Chinese speakers have a tendency to apply the regulation of Chinese to pronounce English. For example, they may pronounce “think” as “sink”. Beebe (1984) also reported that Mandarin Chinese felt difficult to clearly identify the front vowel contrast “I” and “i” because Chinese does not have any similar vowel contrast which is phonemic.

2. Pronunciation and Spelling Strategies

In his series of researches, Ehri (1978, 1980) claimed that learners of a language may utilize various ways to memorize words. A lexicon, that is, a store of words may be possessed in memory. When people read words by sight or lexical access, they make use of prior information that has been remembered about the words from previous experiences reading those words. On seeing the orthographies, readers retrieve their lexicon memory such as the lexicon’s pronunciation, its possible meaning, its appropriate syntactic, morphemic features and orthographic identities to identity the new words (Ehri, 1978, 1980). In brief, words are read by analogizing to known words, by orthographic structure, and contextual guessing (Ehri, 1991; Schmitt, 2000).

For children (i.e. L1) attempting to read with a visual-cue strategy, reading is a kind of paired-associate task of linking a word’s look with its pronunciation and meaning (Bruning, Schraw & Ronning, 1995). Because English spelling system is not perfectly consistent (grapheme-phoneme correspondence), it is apparently insufficient for readers to decode unknown words simply by adopting visual-cue strategy. Some alternative pronunciation skills, such as phonetic-cue reading, phonological recoding, and analogy-based skill, are hence needed to cultivate “real” readers (Ehri, 1991; Ehri & Wilce, 1987; Munro & Derwing, 2006; Stahl, Duffy-Hester, & Stahl, 1998).

Similar to the strategies employed by L1 children while learning to read, adult EFL learners should apply these strategies to reading and be trained more intensively step by step. The linkage should be smooth in a systematic way. Nevertheless, such linkage to the Mandarin Chinese learners of English is not so successfully connected because Chinese orthographic characters belong to those of non-alphabetic written language which “symbolize concepts rather than pronunciations” (Ehri, 1991, p. 413). Thompson (1999) has argued that students learn phonics in two distinct ways: from instruction and from experiences with print. In the latter case, students develop implicit unconscious knowledge about letter-sound relationships as they encounter words sharing similar features in their reading. In this regard, Johnston (2001) suggests that both sources of knowledge can develop concurrently and are available for students when they encounter an unfamiliar word. In retrospect to the learning styles of Chinese EFL students, unfortunately, they lack both sources of explicit phonics instruction and extensive reading experiences. Besides, under the influence of L1 acquisition pattern, Chinese EFL learners tend to neglect the phonetic cues as useful phonological access routes to linking symbols with meanings. In light of limited phonological training, the intervention of explicit remedial phonological instructions thus seems to be urgent once students are detected with difficulties in this concern no

matter what levels they are at. From the implications of children phonics instruction, the researchers suggest that a short-term systematic instruction might be needed to accelerate EFL students to become independent readers.

3. The Need for Phonological Remedial Instruction

Due to the limited class hours (usually 2 hours per week) in vocational high school and a neglected attitude toward English learning, a majority of ESP technological college students in Taiwan still have problems with English learning, especially on phonological skills. Based on a related questionnaire analysis of the learning strategies of new words, 82% of the ESP subjects of a certain technological university in Southern Taiwan expressed that they have very insufficient vocabulary size to meet the academic needs, and about 85% of subjects declared that they needed further instruction of phonological skills to equip them with instant but effective methods to improve their English (Lin, Su, & Huang, 2001).

In another study on the English-speaking problems of Chinese students in Taiwan (Su, 1996), 51 native college teachers of English, with an average length of 7 years and 9 months of teaching English in foreign countries including Taiwan, indicated that, in terms of speech problems, pronunciation takes the first place, rhythm second, and intonation follows. Very interestingly, this sequence is always the same for students of different levels. This finding may also support the need for remedial phonological instruction. However, it is essential to diagnose ESP students' common errors in pronunciation before offering remedial phonological instruction programs. This study, therefore, aims to investigate the common pronunciation errors frequently uttered by students at a technological university in southern Taiwan. We do hope that the findings may serve as reference for ESP teachers.

III. Research Method

1. Subjects

In this study, the subjects who study in a university of science and technology in Southern Taiwan are mostly graduates from vocational high schools. Totally 334 non-English major freshmen were randomly selected. The distribution of the subjects is schoolwide from different departments. Most of them take Basic English as a required course. 263 (78.7 %) of them are graduates of vocational high schools while 71 (21.3%) are from senior high schools. They come from every part of Taiwan and speak Mandarin Chinese as their mother tongue. The average age is 19 years and 6 months, and their English learning period is approximately 6 years and 8 months.

2. Instrument

The instruments of this study are arranged as follows: (1) a questionnaire (Appendix 1), and (2) El Paso Phonics Survey (Ekwall, 1979) (Appendix 2). The questionnaire was provided to investigate students' difficulties of English learning and their previous learning habits relating to vocabulary

acquisition and pronunciation skills as well as strategies they often use. The El Paso Phonics Survey, consisting of two parts: consonants and vowels, was also utilized to evaluate students' phonemic awareness. It consists of totally 90 items; with 58 consonants and 32 vowels respectively. The words in the El Paso Phonics Survey are pseudo-words.

3. Procedures

During the first few weeks of teaching, the researchers found that most of the ESP students were highly anxious and poorly motivated in English class. They felt frustrated and hopeless whenever they were requested to come up with any utterance. After the mid-term exam, the researchers gave students some time to adapt themselves to the new learning environment and textbooks. The questionnaire then was given one week before the El Paso Phonics Survey to collect subjects' personal information and their strategies in word acquisition. The El Paso Phonics Survey was then administered by recording non-word pronunciations. In the language lab, all the subjects were requested to pronounce each individual sound and to produce a corresponding non-word pronunciation. Each item was given a 5-second pause in a prerecorded cassette. The recording period for each subject lasted for about 8.5 minutes. Totally 334 cassettes were then carefully listened and evaluated by the researchers. However, only 326 cassettes were available for analysis because 8 of them were recorded incompletely. Undoubtedly, it was an extraordinarily tedious and time-consuming task in an attempt to detect the common pronunciation errors of ESP adult learners. This was probably an innovative research for adult learners in Taiwan EFL field.

4. Data Analysis

After all scoring was done, the Statistical Package for Social Sciences (SPSS) was utilized with scores of collected data to examine the common pronunciation errors. In the El Paso Phonics Survey, if a student could correctly pronounce a word, s/he could earn one point. Its total possible score is 90, including 58 for consonant test and 32 for vowel test. Descriptive statistic procedure was used to analyze the data and Chi-square is used to test the differences among the variables.

IV. Results and Discussion

1. Results of questionnaire

Based on the data analysis of the questionnaire, no participant self-reported that his/her English competence was excellent. However, 133 (39.82%) out of 334 subjects claimed that their English competence was good while 120 (35.93%) freshmen believed that their English competence was fair. Only 81 (24.2%) of the participants self-evaluated their English competence as being poor. The differential self-reports among four choices of the subjects' English competence were statistically significant, $\chi 2 = 13.16$, $df = 2$, and $p < .01$. That is, the freshmen have very different English competence.

Upon the question "Did you ever learn phonological skills before?" The result shows that 86 (25.75%) out of 334 students claimed that they never learned phonological skills before, while 248 (74.25%) out of them self-reported that they had learned phonological skills. The difference of the subjects' experiences of learning phonological skills was significant, $\chi 2 = 78.58$, df = 1, and $p < .01$. The researchers found that about one out of four students have never learned how to correctly pronounce English words. If the response was "Yes," they were then requested to answer the consecutive question: "When did you learn those skills?" Seventy-eight (31.45%) out of 248 students had learned phonological skills before they entered junior high schools. The outcome implies they had learned the skills at elementary school level or private cram schools. Most (n = 143) of them (57.66%) self-reported they learned those skills at junior high instructional level. The result is in conformity with the fact that Taiwanese students receive formal English instruction starting from junior high school, and only less 10.89% (27 out of 248 subjects) students self-reported that they learned those skills at senior high instructional level, $\chi 2 = 81.72$, df = 2, and $p < .01$.

When asked, "Do you think English course at college/university level should reinforce phonological instruction?" Two hundred and ninety-seven (88.92%) out of 334 students agreed that college/university teachers should help their students acquire more phonological knowledge skills. Only 35 (10.48%) of them disagreed with it, $\chi 2 = 206.76$, df = 1, and $p < .01$. Their responses were statistically different. Most students who self-reported that their phonological skills were poor expected that they could learn more phonological knowledge in the university instructional level.

When asked if they still needed phonological instruction at technological university level, 283 (84.73%) out of 334 participants regarded it as a helpful remedial instruction to acquire phonological skills; only 15.27% of them believed it was not needed. Students who needed remedial instruction were given multiplex choices. One hundred and eighty-one (63.96%) out of 283 declared that they needed more letter-sound correspondence instruction. In fact, more than half of the participants felt they still needed to learn phonetic symbols (51.24%), intonation (56.54%), and junctures (51.59%) once they are given further chances. The subjects' responses showed that their needs of learning phonetic symbols, intonation, and junctures were statistically insignificant, $\chi 2 = 5.35$, df = 3, and $p = .15$. That meant that the participants believed that technological university students still need to receive the training of phonetic symbols, intonation, junctures.

As for the relation between pronunciation and vocabulary acquisition, more than 95% participants believed that phonological skills could help them improve their vocabulary acquisition. Inspiringly, none of them denied the benefit of phonological skills on vocabulary development. As a matter of fact, most of the ESP students significantly understood the importance of phonological features on vocabulary acquisition, $\chi 2 = 138.62$, df = 2, and $p < .01$.

However, when asked to self-estimate their vocabulary competence, more than half (55.69%) of the participants claimed that their vocabulary size was insufficient, while only 3 (0.90%) of them

regarded their vocabulary size as being sufficient. Overall, 274 (82.04%) of them reported that their vocabulary size was rather insufficient and very insufficient, $\chi 2 = 165.67$, df = 2, and $p < .01$. Since ESP students only had very limited vocabulary knowledge, they hope that acquiring phonological skills could help their vocabulary size.

In order to examine the strategies that Mandarin Chinese speakers often employ when memorizing new words, the participants were requested to recall the method they were used to apply. One hundred and seventy-eight (53.29%) out of 334 participants expressed that when they learned a target word, they read it first and then spelled it out, while 63 (18.86%) of them learned it in reverse order. Some (20.96%) students stated that they memorized it by spelling out the alphabets of the target word. Interestingly, 6 (1.8%) of them merely read the target word without spelling it. However, 9 (2.69%) participants claimed that they could not remember English words regardless of using any method. The differences among those responses were statistically significant, $\chi 2 = 297.77$, df = 4, and $p < .01$.

2. Results of El Paso Phonics Survey

Table 2 investigates the means and standard deviations of consonants and vowels scores in the El Paso Phonics Survey, which totally consists of 90 items (with 58 consonants and 32 vowels respectively). The data show that the participants' mean of consonant score was 34.22 (59%) with a standard deviation 11.08, while their means of vowel score was 13.63 (42.59%) with a standard deviation 4.23. Overall, the subjects could only correctly pronounce 53.18% of the sound patterns given. According to the findings, the subjects could not correctly pronounce 41% of consonants and 57.41% of vowels from the El Paso Phonics Survey. Since Taiwanese technical students could only pronounce half of consonants and vowels correctly, it is no doubt that they usually feel difficult to improve their English competence and vocabulary knowledge or they may avoid speaking with English native speakers. Table 2 Means and Standard Deviations of Consonants and Vowels Scores in El Paso Phonics Survey (N = 334)

	Means	SD	Percent
Consonants	34.22	11.08	59.00
Vowels	13.63	4.23	42.59
Total	47.86	13.95	53.18

Note: The total score for consonant test is 58 while the total score for vowel test is 32.

The total score of consonant test and vowel test is 90.

Apparently, in a normal distribution, technical students can only pronounce some consonants and vowels, but they cannot correctly pronounce others when they confront a meaningful linguistic discourse. In order to help technical teachers effectively and efficiently remedy their students'

pronunciation and promote their students' English competence, it is necessary for the researchers to thoroughly diagnose the common pronunciation errors that Taiwanese technical students usually make.

(1) Highly erroneous consonants

Based on the results of descriptive statistics from the El Paso Phonics Survey (see Appendix 2 for reference), Table 3, ranked by error frequency, shows the percentage of inaccuracy and common errors of the top 19 consonants mispronounced by more than half (50.60%) of the subjects. In descending order, they are soft g, sch, soft c, sm, sn, thr, shr, sp, scr, dw, qu, spr, sc, squ, tw, wr, pr, sk, and spl.

For the sake of detecting learners' consonants, the El Paso Phonics Survey is formulated with basic sounds -am, -up, and -in except for one –ox (as in mox). From the analysis of high error frequency, we found Taiwanese adult technical students tend to make similar errors in articulating sounds with soft g, soft c, consonant clusters such as initial s-clusters, -r clusters, and consonant clusters dw, qu, and tw.

(2) Highly erroneous vowels

Of the 32 vowels, more than half (50.90%) of the subjects failed to pronounce successfully the top 19 vowels which were ranked by the error percentage in Table 4. In the order of frequency, they are u, u-e, i-e, ir, au, e-e, o, aw, ew, ur, ai, ay, a-e, oe, am, ow (as in crow), er, ar, ow (as in cow). What surprised the researchers most is that a majority of subjects (80.24%) made errors for the top 10 vowels. However, only about 84% of the subjects made top 3 consonant errors. In contrast, vowel sound patterns in English seem to be more complicated than those in consonants. Our findings coincide with Chang's (1987) and Lin & Kuo's (2001) in that Chinese learners tend to make more errors of vowels than those of consonants. A plausible explanation might be there are more vowel contrasts in English than in Chinese, and therefore leads to complexity in terms of position of articulation. It also suggests that more efforts are required to distinguish or acquire them.

Table 3 High Error-Frequency Consonants (N = 326)

Consonants	Non-words	Inaccurate No.	Accurate No.	% of inaccuracy	Mispronounced as
g	gin		297	29	91.1 hard g/ grin
sch	scham	290	36	89.0	sham/ s-cham/ cham
c	cin	274	52	84.0	hard c
sm	smin	237	89	72.7	seem/ sam/ min
sn	snup	224	102	68.7	sup/ nup
thr	thrup	220	106	67.5	thup/ trup
	shr		shrup	213	11365.3 shup
	sp		spam	205	121 62.9 sam/ span

	scr		scrup	204	122	62.6 scup/ shup
	dw		dwin	189	137	58.0 drin/ dew
		qu	quam	189	137	58.0 gram/ cam/ quan
spr	spram	186	140	57.1	spam/ pram/ span	
sc	scup	182	144	55.8	sup/ cup	
squ	squam	179	147	54.9	sham/ scam	
tw	twam	168	158	51.5	tram/ wam	
wr	wrin	167	159	51.2	win/ w-rin	
pr	pram	166	160	50.9	pam/ ram	
sk	skam	165	161	50.6	sam/ sank	
spl	splin	165	161	50.6	spin/ slin/ plin	

Table 4 The Percentage of Inaccuracy of Vowels (N = 326)

Vowels	Words	Inaccuracy	Accuracy	Percentage of Inaccuracy
u	tum	315	11	96.6
u-e	pune	309	17	94.8
i-e	tipe	303	23	92.9
ir	irt	300	26	92
au	dau	288	38	88.3
e-e	rete	285	41	87.4
o	sot	282	44	86.5
aw	awp	272	54	83.4
ew	bew	263	63	80.7
ur	urd	261	65	80.4
ai	ait	218	108	66.9
ay	tay	205	121	62.9
a-e	sape	204	122	62.6
oe	poe	202	124	62
a	pam	195	131	59.8
ow	crow	193	133	59.2
er	ert	177	149	54.3
ar	arb	167	159	51.2
ow	cow	166	160	50.9
ou	tou	141	185	43.3
oa	oan	139	187	42.6
ea	head	133	193	40.8
ea	meat	130	196	39.9

e	nep	127	199	39
o-e	sote	125	201	38.3
i	rit	101	225	31
ee	eem	98	228	30.1
or	orm	94	232	28.8
oi	doi	84	242	25.8
oy	moy	65	261	19.9
oo	foot	64	262	19.6
oo	food	63	263	19.3

3. Discussion

The outcomes of questionnaire can be applied to explain research question 1, “What are ESP students’ needs of pronunciation and their spelling strategies?” According to the results of questionnaire, the researchers found that ESP participants (about 82%) possessed only very limited vocabulary size. Similar to Lin, Su, and Huang’s (2001) findings, due to the ESP students’ limited phonemic awareness and the influences of their mother tongues, they cannot correctly read and spell the words and effectively memorize them. In this study, the researchers found that no participant self-responded that his or her English competence was excellent. However, 60 % of them believed that their English competence was fair or poor. It is apparent that ESP learners need confidence which they can learn English well.

In terms of acquiring phonemic awareness, most participants (about 95%) believed that after acquiring phonological skills, they can improve their vocabulary knowledge and increase their English competence. They realized that the lack of phonological skills of English caused their poor English competence. Therefore, when they were asked “Do you think you still need phonological remedial instruction at technological university level,” about 85% of the participants regarded remedial instruction as a good opportunity to acquire phonological skills. Most of them indicated that they needed to learn more letter-sound correspondence instruction. Half of the participants expressed their needs of learning phonetic symbols, intonation, and junctures.

Since there is a high relation between learners’ spelling strategies and vocabulary memory, the researchers need to understand what spelling strategies ESP students use to memorize new words and unknown words. The results showed that when they memorized a target word, half of the participants read it and then spelled it out. This method of memory spent more time, but it is a good way for EFL students to double check and to accurately memorize the target word. Since EFL teachers in Taiwan usually apply this teaching method to teach new words in junior high instructional level, Taiwanese students gradually forested this spelling strategy when they need to memorize a new word. Only 6 of them can read the target word and memorize it without spelling it out. Their spelling strategy can save more time and acquiring vocabulary incidentally. Incredibly, 9 participants self-reported that they

could not memorize any words regardless of using any method. According to Coady's (1997) and Nation's (2001) study, extensive reading is an effective strategy to acquire vocabulary knowledge. Based on their studies, since ESP learners did not have a habit of extensively reading English materials, they cannot acquire new words through extensive reading. Only using the strategy of reading and spelling, ESP students cannot effectively memorize and retrieve the target word.

The results in Table 2, 3, and 4 answer research question 2, "What are ESP students' common pronunciation errors?" Based on the high error frequency consonants in Table 3, soft g ranks as the number ne high-error-frequency consonant with a very high percentage of inaccuracy. If we retrospect the learning process of Taiwanese learners of English, it is no doubt that they might mix up soft g (as in gel, gen, or ginger) with hard g (as in gas, got, gum), since in Mandarin Chinese, there is one phonetic symbol for one sound and hard g has a similar Chinese sound, ESP learners intuitively apply this regulation to pronounce soft g as hard g. Without specific and clear pronunciation instruction, including phoneme identification, word recognition, minimal pairs of soft g and hard g and so on, it is inevitable to mispronounce the soft g. Soft c encounters a similar fate by ranking the third high-error-frequency consonant. Language teachers of ESP students should attend to the tricky discrepancies between soft c (as in cent and Cindy) and hard c (as in can, cop, and cut). The researchers suggest that always start teaching hard c and hard g before introducing soft c and soft g since students can start from easier and common ones to more difficult and less common ones.

Table 3 also shows that ESP learners with poor language command tend to neglect one or two of the consonant clusters. Clusters initial with s-, especially sch (with 89% of inaccuracy), erred extremely high (from about 50% to 89%). In descending order, they are sch, sm, sn, shr, sp, scr, spr, sc, squ, sk, and spl. The results indicate that more than half of the subjects pronounced the s- clusters wrongly. It is assumed that since there is no any consonant cluster in Mandarin Chinese and students might lack in-class pronunciation instruction of s- consonant clusters and after–class practice in junior and senior high instruction level, ESP learners always felt difficult to pronounce s- clusters. In Chang's (1987, 2001) study, Chinese speakers always experience mispronunciation of single consonants; however, in this study, ESP learners more difficult to pronounce consonant clusters, not single consonants.

In term of vowels, high error-frequency vowels that ESP students often confront are shown in Table 4. From the analysis, the ESP students are apt to make similar errors in articulating vowels with silent e, -r (ar, er, ir, ur), short o, and diphthongs such as au, aw, ai, ay and ow. On the whole, an extremely high rate of mispronouncing short u manifests the difficulty that ESP student most likely encounter and it turns out that the majority of the subjects are apt to treat short u (letter sound) as the counterpart of its identical phonetic symbol. As a result, the non-word tum is most likely mispronounced as tomb or tume. Words with -VCe type, such as same, Pete, ripe, June, or nose, are also confusing to ESP learners. The finding is consistent with Gates and Yale's (2011) study. Of the five single final vowel-consonant-e (-VCe) type, u-consonant-e ranks the third place; however,

a-consonant-e and o-consonant-e seem a bit easier for them to cope with.

The next troublesome high error-frequency vowels are vowels with –r, such as ar, er, ir, ur. Interestingly, or is not in the list of high error-frequency probably because of its similar identity (namely, the spelling itself is identical to its pronunciation). However, of the rest four vowels with –r, ir (with 92% of inaccuracy) is the most troublesome for ESP learners to acquire. Words with ur reach about 80% of inaccuracy, but words with er (with about 54% of inaccuracy) and ar (with about 51% of inaccuracy) tend to be much easier to pronounce. According to the detailed list of ESP subjects' commonly mispronunciation, it is obviously seen that ESP students with poorer English command tend to regard the spelling (letter or letters) as phonetic symbols. For example, irt is mostly mispronounced as eart.

V. Conclusion and Pedagogical Implications

Based on the above findings, the percentage of high-frequency errors shows that 38 out of 90 sound patterns were frequently mispronounced by half of the technical students. This implies the majority of technical learners are in great demand of phonological remedial instruction. Otherwise, the lack of phonological knowledge might cause an obstacle to successful reading.

In terms of phonological system, Chinese is very different from that of English. It is universally recognized that certain English phonemes, which do not have corresponding Chinese phonemic counterparts, such as */th/, /v/, /z/, soft g*, the final consonant */m/, short a*, and */u/* (as in c<u>u</u>p), are generally hard to acquire. Others resembling Chinese phonemes but not identical to them in pronunciation are easier to acquire once given appropriate instruction and sufficient practice. Therefore, it seems inevitable for EFL learners to make phonemic mistakes. However, if one is to fully express a language with confidence, the phonological competence undoubtedly plays a crucial role. Of the four language skills, EFL learners read somewhat better than the other three skills because they are unconfident in articulating difficult words. In other words, they might have difficulties predicting the pronunciation of the new words. In this regard, it is suggested that the letter-sound correspondence, which is commonly adopted in early child reading for native speakers, should be reinforced in teaching at-risk adult EFL learners or technical underachievers once the teacher detects students with such difficulties.

Under the circumstances that totally about one fifth of the world's population is mainly native speakers of Mandarin Chinese, and they are impacted by the globalization, English has become more and more important. English learners are thus dramatically increasing. The job market for English teachers may offer a new trend for native speakers as well as a big challenge for textbook publishers. Noticing and realizing the background and the deficiency of the Chinese, EFL and technical learners would get benefit from language teachers, researchers and textbook publishers as well.

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