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Improvement of English Major Students' Pronunciation Using Natural Language Processing

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บทคัดย่อ

งานวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาพัฒนาการการออกเสียงพยัญชนะภาษาอังกฤษ/θ/, /ð/ และ /dʒ/ ก่อนและหลังใช้แอปพลิเคชันระบบประมวลภาษา และเพื่อสำรวจความพึงพอใจของนักศึกษาต่อการใช้แอปพลิเคชันโดยเก็บข้อมูลกับนักศึกษาชมรมสัทศาสตร์ จำนวน 37 คน เครื่องมือที่ใช้ในการเก็บข้อมูล ได้แก่แบบทดสอบการออกเสียงแอปพลิเคชัน "English Pronunciation" และแบบสอบถามข้อมูลที่ได้นำมาประมวลผลโดยใช้สถิติเชิงพรรณาผลการวิจัยแสดงให้เห็นว่านักศึกษามีพัฒนาการในการออกเสียงพยัญชนะภาษาอังกฤษหลังใช้แอปพลิเคชันและมีความพึงพอใจต่อการใช้แอปพลิเคชัน "English Pronunciation" อยู่ในระดับมาก ($\overline{X}$ = 4.41) เมื่อพิจารณาเป็นรายข้อ พบว่านักศึกษาพึงพอใจต่อการแสดงสัญลักษณ์สัทศาสตร์ ($\overline{X}$= 4.68) การประยุกต์ใช้ที่เป็นประโยชน์ในการเรียนการสอน ($\overline{X}$ = 4.62) และการแสดงเนื้อหาทางสัทศาสตร์ ($\overline{X}$ = 4.59) มากตามลำดับ

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Abstract

This research aimed to measure students' development in producing the consonant sounds of /θ/, /ð/ and /dʒ/before and after using the NLP application, and to also study the students' satisfaction level. Thirty-seven students from the Phonetics club participated in the study. Research instruments used included pronunciation tests, the 'English Pronunciation' application and questionnaires. Collected data were computed using descriptive statistics. The findings revealed that the students' pronunciation significantly developed after the exposure to the application and they also rated their satisfaction in a very high level ($\overline{X}$= 4.41), Considering a particular item, it was found that the students highly satisfied with an obvious presentation of Phonetic symbols ($\overline{X}$ = 4.68), the implementation of the application in teaching and learning ($\overline{X}$ = 4.62), and Phonetics contents ($\overline{X}$ = 4.59) respectively.

Keywords: English pronunciation, natural language processing, English phonetics

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I. INTRODUCTION

In Thailand, the movement towards English proficiency is seen in the article 34 of the Association of Southeast Asian Nations (ASEAN) charter which states “The working language of ASEAN shall be English” (Association of Southeast Asian Nations, 2017, p. 29). Each ASEAN region utilizes different mother tongues, but proficient English has been strongly endorsed by associated governments as a requirement when discussing or engaging in trades and negotiation agreements. Consequently, this has been shaped the new direction of foreign language teaching and learning in Thai schools and universities. In Thailand, English knowledge and the ability to communicate has become the critical emphasis in English classrooms to aid learners to be able to apply English, learned from the classroom, in their daily life as well as their future careers (Khamkhien, 2010, p. 757).

According to the standard Thai curriculum, English is a mandatory subject in all levels of education. Every module must fall within four main areas of content: language for communication; language and cultures; language and relationship with other learning areas; and language and relationship with community and the world (Ministry of Education, 2008, p. 221). These requirements enable learners to acquire knowledge, develop positive attitudes towards language learning, increase their language proficiency to talk in several situations, pursue higher education, as well as understand a cultural diversity. Recent research, however, uncovered that Thai students have not possessed an English competency despite the 12 compulsory years of English subject, particularly in pronunciation. (Wei & Zhou, 2002, p.8-9; Kanokpermpoon, 2007, p. 57Khamkhien, 2010, p. 762; Noom-Ura, 2013, p. 139; Chakma, 2014, p. 113; Lamarca, Surasin, &Varasarin, 2016, p. 7). Clear and accurate pronunciation plays a critical role in communication and deliver messages (Garrigues, 1999). Many previous researches were conducted to examine Thai students’ ability and knowledge with regard to pronunciation, both segmental and suprasegmental levels.

Segmental level concerns with sound units. Tuaychareon (2003, p. 49) posted that English fricatives like /θ/ and /ð/ occurred as the challenging consonant sounds for Thai students to pronounce accurately including a voiced affricate of /ʤ/. The certain sounds appeared problematic for the students due to the first language interference. English consonant sounds of /θ/, /ð/, and /ʤ/ do not exist in Thai; the students then substituted Thai sounds for those ones. As similar to the study of Dee-in (2006), the problem of Thais’ English pronunciation included the consonant sounds of /v/, /θ/, /ð/,

/ʃ/, and /ʤ/ since manner of articulation between Thai and English pronunciation are different. Moreover, Chakma (2014, pp. 115) displayed that a number of Thai students mispronounced the consonant sounds of /θ/, /ð/, /x/, and /v/ in initial position.

Khamkhien (2010, p. 762) held the investigation on a level of suprasegmental pronunciation and revealed the unsatisfactory competence of Thai students in stressing five-syllable words the most and two-syllable words the least. The researcher noticed that gender appeared as the most significant factor affecting the participants' test scores. Another research showed that Thai undergraduates stressed long vowels, diphthongs, and consonant sounds wrong (Winaithan & Suppasetseree, 2012, p. 304). This research also disclosed several factors causing the pronunciation errors: a shortage of English basic knowledge of pronunciation, the use of Thai tones and intonation, less intention, unacquaintance with English intonation, infrequent use of English in daily life as well as anxiety when communicating in English.

Most previous research mentioned point that Thai students are still finding English intricated and not as expected. Educational Testing Service or ETS (2011) informed that the average TOEFL iBT and IELTs scores of Thai examinees were low comparing to other countries where English is used as foreign language. It indicates that English teaching and learning in Thailand needs to be regulated. In recent world with rapid expansion of knowledge, modern technologies are demanding and holding a significant role in education. Technology appears as a part of many curriculums, as a means for aiding the teaching process, or as a tool for enhancing learners' language ability (Raja & Nagasubramani, 2018, p. 34). As a consequent, the implementation of technological applications in pedagogical contexts can alter learners' behaviors and turn once passive activities into interactive activities.

Technology has become a learning source and a helper, for both teachers and learners, in acquiring a language. Some technologies allow a person to speak, to read, and to write natural languages corresponding with computers. This certain innovation is known as the Natural Language Processing (NLP). It is the sub-field of Computer Science, exclusively Artificial Intelligence (AI), that carries the key duty to program computer applications for analyzing and processing natural language data or human speech, which is literally unstructured and ambiguous (Tutorials Point, 2019, p. 1). Thai teachers, however, find it difficult to apply this new technology in their classrooms (Darasawang, 2007, p. 189). Nevertheless, teachers are expected to adapt to the technology in order that their teaching styles are not outmoded. Unfortunately, Thai English teachers are

struggling to keep up with the demand and construct effective, up-to-date, instruction methods that can support and boost their students to achieve a high level of English proficiency.

II. LITERATURE REVIEW

Key Factors Affecting Pronunciation Problems

Regarding Thai students who are learning English as a Foreign Language (EFL), getting to the point of flawless speaking and writing ability is against all odds. Many prior pieces of research can be summarized to reveal the following main factors that hinder students in mastering languages.

i. Native language interference

Each student naturally picks up their native language (L1) during an early Childhood from the surroundings while the ability to learn additional languages, or a target language (L2), comes subsequently (Saville-troike, 2012, pp. 2). During the L2 learning process, students tend to encounter with some difficulties in mastering it because the way they use their native language slightly or highly different from the target one. Lu (2014, p.4) highlighted that the L2 commonly differs from the L1 in several segments such as words used, word formation, sentence structures, and particularly speech sounds. That is to say, problems of pronunciation, intonation, rhythm and melody can result from distinct rules between the two languages. Hence, the native language interference or negative transfer is described as the remarkably influential factor in accounting for the students' pronunciation (Kenworthy, 1987, p. 4).

Defining dissimilar components between the two languages, referring to the L1 and L2, has been done by a contrastive analysis. Richards and Schmidt (2002, p.129-130) described this approach as an instrument to compare any similarities and to contrast any differences of the native to the target language. It is the useful method that aids teachers in figuring out possible problems that Thai students tend to have in learning English. Defense Language Institution (1974, p. 9) emphasized a great impact of Thai-English different sound units to non-native speakers learning a language. Previous comparative studies on Thai and English phonology revealed the difference on the consonant sounds (Bowman, 2000, p. 48; Tuaycharoen, 2003, p. 49; Kanokpermpoon, 2007, p. 58).In general, Thai consists of twenty-one consonant sounds whereas English composes twenty-four sounds. The tables below will illustrate the differences between sets of Thai and English consonants.

Table 1 Consonant sounds in Thai language system (Defense Language Institution, 1974, p. 13)

Thai consonants		bilabial	labiodental	dental	alveolar	post-alveolar	velar	glottal
stops	Aspirated (vl)	pʰ			tʰ		kʰ	
	Unaspirated (vl)	*p*			*t*		*k*	ʔ
	Unaspirated (vd)	b			d			
affricates	aspirated					tʃʰ		
	unaspirated					*tʃ*		
fricatives			f		s			h
nasals		m			n		ŋ	
laterals					l			
semivowels		w			r	j		

Table 2 Consonant sounds in English language system (Defense Language Institution, 1974, p. 11)

English consonants		bilabial	labiodental	dental	alveolar	post-alveolar	velar	glottal
stops	voiced	b			d		ɡ	
	voiceless	p			t		k	
affricates	voiced					*dʒ*		
	voiceless					tʃ		
fricatives	voiced		*v*	*ð*	*z*	*ʒ*		
	voiceless		f	θ	s	*ʃ*		h
nasals		m			n		ŋ	
laterals					l			
semivowels		w			r	j		

The two tables above can depict some problems of Thai students when having an attempt in learning or speaking English. It can be seen from Table 2 that English does not comprise unaspirated /p/, /t/, and /k/ whereas Thai system omits the sounds of /v/, /ð/, /θ/, /z/, /ʒ/, /dʒ/, and /ʃ/. Another research also discovered that the Thai students could not produce the consonant sounds of /r/, /ð/, /θ/, /v/, /z/, /ʒ/, and /dʒ/ (Wei & Zhou, 2002, p. 6-7; Jukpim, 2009, p. 396; Jantharaviroj, 2019, p. 37). For instance, a pair of /ð/ and /θ/ consonant. The students commonly mispronounced them and replaced those dental sounds with a fricative voiceless alveolar /s/ or the voiced alveolar /z/.Jantharaviroj (2019, pp. 38) found that the participants replaced the English voiced affricate/dʒ/ with [t͡ɕ], a Thai unaspirated voiceless affricate or voiced alveolar stop /d/; /ʒ/ as an English voiced fricative was substituted by a Thai aspirated voiceless affricate [t͡ɕʰ]. The researchers also identified a few causes concerning the students' incomprehensible English pronunciation which included borrowing of English words to Thai, an influence of Romanization in Thai language, teachers' Thai style English pronunciation, and students' shyness when speaking English as well as different sound units existed in English, but not in Thai.

ii. Shortage of target language practice

Another factor that also creates a barrier in mastering that target language pronunciation is a shortage of practicing. Many students unveiled that pronunciation was not the main focus of language teachers when studying at schools comparing to other aspects such as grammars, vocabulary, or reading (Rosyid, 2009, p. 440). This indicates that students who has often experienced and exposed to English language have much advantages in contributing improving accurate pronunciation when studying in a higher level (Senel, 2006, p. 115; Yangklang, 2006, p. 20).

iii. Lack of coding ability

According to Sahatsathatsana (2017, p. 73), an ability to differentiate sounds is sometimes required for non-native speakers learning a target language. As a result, the non-native speakers are able to imitate the target language sounds better when they discriminate the sounds of the two languages.

Technology used in pronunciation development

English pronunciation is considered as a basic skill of speech and plays a significant part in communication; however, it is treated the most abandoned aspect of learning and teaching language (Farhat & Dzakiria, 2017, p. 53). Teaching and learning

pronunciation in the current era can be accomplished easily through a usage of appropriate teaching materials. Fraser (2000, p. 22) stated that computer-based materials can provide a good assistance for those who learn English as a Second Language (ESL) and English as a Foreign Language (EFL).

Using technology in educational contexts provides some essential shifts for both teachers and learners. In essence, technologies have changed teacher roles from being a knowledge transmitter to a facilitator, a coach, and a creator who allow learners to make their decision on learning sources and contents (Weinberger, Fischer, & Mandl, 2002, p. 2). Learners will then become open-minded, active, creative, and being a medium negotiator. Technologies are moreover believed to perform a proper means of giving new opportunities for practicing English pronunciation; therefore, both teachers and learners can effectively develop their pronunciation competency (Gilakjani, 2018, p. 96). Many technologies are available recently, but the teachers are suggested to choose the best instrument that supports learning objectives, processes data effectively and correctly, function easily, and does not cost any fees (Yoshida, 2018, p. 196).

Apparently the 'English Pronunciation' application meets the above qualifications as the appropriate tool for aiding teaching and learning pronunciation. It is one of the computer-based applications in the field of computational linguistics or Natural Language Processing (NLP), which has been initiated as an intersection of artificial intelligence and linguistics (Nadkarni, Ohno-Machado, & Chapman, 2011, p. 544). The application of the NLP system carries the main task to highlight the productive outcomes of forming human language to create software to improve human-machine interaction. It is a tract to process human language by using the application of computational machines in useful ways such as detecting speech to text, correcting grammatical issues, and translating one language to another.

Furthermore, the 'English Pronunciation' application was invented following pedagogical tasks of teaching and learning pronunciation. Yoshida (as cited in Yoshida, 2018, p. 197) generated four main tasks of teachers teaching the pronunciation in which the appropriate technology should contain. Information concerning on teachers' tasks are described below in accordance with the NLP application format.

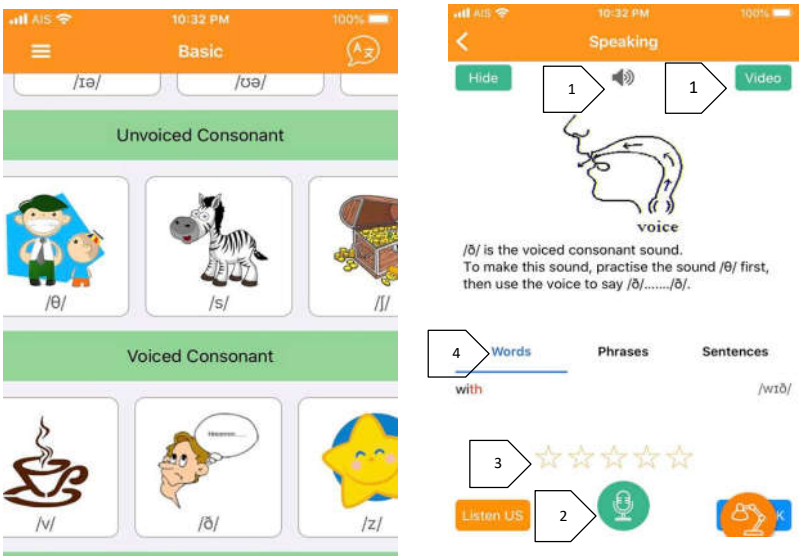

Figure 1: Application's Format

1. Teachers should provide students examples of the pronunciation for each single sound, word, and longer meaningful speech. The 'English Pronunciation' application is appropriated to use since it allows users to hear the sounds audibly by pressing the speaker button as well as to acquire which speech articulators are used in pronouncing the sounds by pressing the video button.

2. Teachers should benefit the students from recording and listening to their own pronunciation. The students can then learn and develop from their self-correctness. Consequently, the application above enables users to record their own voice by pressing the microphone button.

3. To develop intelligible pronunciation, teachers should give students feedbacks as a guide for future practice. So, the application is practical because it evaluates an accuracy of one's pronunciation and interpret in forms of stars. Users can see from red words shown above the stars concerning mistakes they make.

4. Teachers should offer independent practice to strengthen students' pronunciation skill. Similarly, the application covers all consonant and vowel sounds in which each sound comprises of different practice levels starting from words to sentences.

III. RESEARCH OBJECTIVES

1. To measure students' pronunciation achievement before and after exposing to the NLP application

2. To study students' satisfaction level towards the use of NLP application in teaching and learning

IV. RESEARCH METHODOLOGY

Sample

Thirty-seven students, members of the Phonetics club in semester 2/2019, were chosen by using a purposive sampling method. Participants were English major students of Phetchabun Rajabhat University.

Research Instruments

1. Pronunciation tests

During the first hour of the club, each individual participant took three pronunciation tests which targeted to test the sounds of /θ/, /ð/ and /dʒ/. Each test comprised a list of fifteen words drawn from the top fifteen words shown in the application practice.

2. 'English Pronunciation' application

Measuring the students' pronunciation could be less accurate without the use of computational applications. To ascertain the accuracy of the results, the application titled 'English Pronunciation' was applied. Regard a great number of available applications, the selected application is compatible with both IOS and android systems as well as no subscription costs.

3. Questionnaires

The questionnaires used aimed to examine the students' satisfaction level towards the 'English Pronunciation' application. The first part of each questionnaire asked the participants for their genders, year levels, and duration of smartphone browsing. In addition, the second part required the participants to rate their satisfaction on a quality of the 'English Pronunciation' application used, starting from 5 (excellent) to 1 (poor). Ten items concerning the application were evaluated: 1) being user-friendly, 2) holding to Phonetics' principles, 3) showing Phonetics symbols used, 4) giving simple description on each sound pronunciation, 5) presenting simple videos, 6) providing word, phrase, and sentence level, 7) processing data instantly and accurately, 8) showing possible mistakes on pronunciation, 9) boosting efficiency in

correct pronunciation, and 10) being a productive tool in teaching and learning. The perceptions of the respondents were based on the following Five-point Likert scales adapted from Galabo (2019, pp. 114):

Range of means	Interpretation
4.20-5.00	This means that the application quality as perceived by the participants is very high.
3.50-4.19	This means that the application quality as perceived by the participants is high.
2.60-3.49	This means that the application quality as perceived by the participants is moderate.
1.80-2.59	This means that the application quality as perceived by the participants is low.
1.00-1.79	This means that the application quality as perceived by the participants is very low.

Data Collection

Quantitative data was collected to complete the two research objectives. For both the pre-test and post-test, each participant was given 3 opportunities to pronounce the single selected word. After the pre-test on the first hour, the participants were instructed and given educational activities and games using the 'English Pronunciation' application. On the last day of the club, the participants were tested again to see if there was any progression as well as were asked to complete the questionnaires.

Data Analysis

Data from both the pre-test and post-test were collected and analyzed using descriptive statistics including frequencies and percentages. In addition, the participants' satisfaction level was then computed in terms of mean scores.

V. CONCLUSION AND DISCUSSION

Research findings

i. Participants' scores in both the pre-test and the post-test were computed to complete the main research objective, aiming to examine the students' achievement in pronouncing the sounds of /θ/, /ð/and /ʤ/ before and after exposing to the 'English Pronunciation' application. With regard to both the pre-test and post-test, each student

was required to pronounce the fifteen selected words embedded with the targeted consonants. The findings are then shown in the following tables.

Table 3 A comparison of participants' scores in pronouncing the sound of /θ/

Test	N	X	$\sum D$	$\sum D^2$	*t-test*
Pre-test	37	4.54	214	45,796	**21.294**
Post-test	37	10.32			

*** p-value ≤ .05*

Table 3 shows that the students gained the higher scores in pronouncing the sound of /θ/ after exposing to activities and games using the application ($\overline{X}$ = 10.32).

Table 4 A comparison of participants' scores in pronouncing the sound of /ð/

Test	N	X	$\sum D$	$\sum D^2$	*t-test*
Pre-test	37	4.32	216	1,280	48.845
Post-test	37	10.16			

*** p-value ≤ .05*

Additionally, the statistics presented in Table 4 can indicate a significant development of the students' pronunciation to the consonant sound of /ð/. Mean score of the post-test ($\overline{X}$ = 10.16) was higher than the pre-test scores ($\overline{X}$ = 4.32) significantly.

Table 5 A comparison of participants' scores in pronouncing the sound of /dʒ/

Test	N	X	$\sum D$	$\sum D^2$	*t-test*
Pre-test	37	4.08	233	1,503	38.450
Post-test	37	10.38			

*** p-value ≤ .05*

When exposing to the 'English Pronunciation' application, Table5points that the students' pronunciation ability has developed. The mean scores of all students after doing the post-test increased to ($\overline{X}$ = 4.32) as compared to the pre-test scores, which is ($\overline{X}$ = 4.08)

ii. Data drawn from the collected questionnaires were analyzed to access the level of the participants' satisfaction towards the quality of the 'English Pronunciation' application used in bettering their pronunciation ability. The findings are shown in the following table.

Table 6 Students' satisfaction level in using the application

No.	Aspects	$\overline{x}$	S.D.	Interpretation
1.	Functions of the application are easy to use.	4.54	0.51	very high
2.	Contents in the application are based on the Phonetics.	4.59	0.50	very high
3.	The IPA symbols are presented clearly in the application.	4.68	0.58	very high
4.	Description presented on the application is written simply and clearly for users' understanding.	4.30	0.66	very high
5.	Video clips present the way to produce sounds simply.	4.41	0.60	very high
6.	The application provides the tests on words, phrases, and sentences.	4.27	0.65	very high
7.	The application processes the data rapidly and accurately.	4.22	0.85	very high
8.	The application shows users the mistakes they make.	4.05	0.81	high
9.	The application strengthens users' better pronunciation.	4.43	0.60	very high
10.	Using the application is very helpful to teaching and learning	4.62	0.49	very high
	Total	**4.41**	**0.63**	**very high**

Table 6 displays that the overall satisfaction of the students towards the 'English Pronunciation' was in a very high level ($\overline{X}$ = 4.41). Considering a particular item, the students named the obvious presentation of Phonetics symbols ($\overline{X}$ = 4.68) and the positive advantages of using the application in teaching and learning ($\overline{X}$ = 4.62) as the most satisfying aspects, respectively. Adversely while still showing a very high level of satisfaction, the students showed less satisfaction to the application's processing to show pronunciation mistakes ($\overline{X}$ = 4.05).

Discussion

The current research findings provide at length data which in turn successfully completes the two research objectives. The first objective focusing on investigating the development of the students' pronunciation after they are exposed to the application. Before exposure to the 'English Pronunciation' application, the students had lower scores in pronouncing the targeted consonant sounds of /θ/, /ð/ and /ʤ/. This piece of research findings supports the studies of Jantharaviroj (2019, p. 38) and Jukpim (2009, p. 396) reporting that the three segmental sound units conveyed a great difficulty for Thai students when speaking English. An occurrence of this problem results from different manners of articulation between Thai and English languages as well as

the certain sounds are basically absent in Thai consonant system, but appear in English. Before conducting the post-test, the students participated in various activities and games that mainly depended on the 'English Pronunciation' application. They heard, they learned, they watched, and they practiced pronouncing the sounds repeatedly. As a consequent, the results of the post-test showed that their pronunciation significantly improved. It can be hypothesized that the students could master or get better in the L2 pronunciation when they are provided an opportunity to get familiar and to practice the target language. Intelligible English pronunciation is then enforced through repetition until the students can grasp the correct way to activate the articulators needed to produce the sounds. Frequent exposure to the target language can therefore lessen the students' difficulties in learning or speaking the language.

Furthermore, the second aim of this research was to study how the application was perceived by the students. Data findings presented in the collected questionnaires presented a very high satisfaction of the students towards the use of the 'English Pronunciation' application, aiming to develop the pronunciation ability. The results can point that using this technological tool in bettering students' pronunciation was productive. It is used to not only test student's pronunciation, but to also boost their motivation and eagerness to learn and practice the target language. Versatility of the application aids students, for example, to watch videos and to hear audios of a native speaker pronouncing a sound. It also provides practice which creates drive in students to push themselves to get higher results. As similar to the statement of Gilakjani (2018, p. 96), the 'English Pronunciation' application can be counted as one of effective learning resources for both teachers and students when having an attempt to develop their pronunciation skills. In this sense, the use of the application may become an alternative to the traditional classroom setting, called 'a mobile classroom', where the students are given the freedom of practicing according to their needs.

VI. RECOMMENDATIONS

The current research focuses on comparing students' development in pronouncing English consonant sounds using the NLP application as well as exploring their satisfaction. All findings were successfully reached with a few limitations. Other researchers should be aware of the strength of this smartphone's system in acquiring data and results. In regards to this research, it was found that an Android system tended to detect the sounds more quickly than the IOS system of the iPhone.

For the scopes of the study, further research is recommended to examine other English consonant sounds, which appear as problematic sounds for non-native speakers, in different positions: initial, middle, and final positions. This would offer a clear-cut picture as to which sounds and which positions of the sounds within English words remain challenging for Thai English students. Moreover, a further research comparing results between the English major and another major in Phetchabun Rajabhat University should provide more information on the factors affecting errors in pronunciation.

Lastly, the other NLP applications could aid Thai English students in accomplishing correct pronunciation, stress, and intonation. This may increase the language proficiency and confidence of students, both in class and in their daily situation.

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