Reducing Thai EFL Students' Pronunciation Anxiety through a CAPT-Based Reading Progress Application

การลดความวิตกกังวลในการออกเสียงของนักเรียนไทยที่เรียนภาษาอังกฤษเป็นภาษาต่างชาติด้วยแอปพลิเคชัน Reading Progress ในการฝึกออกเสียงโดยใช้คอมพิวเตอร์ช่วย

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Abstract

This research investigated the effects of implementing a Reading Progress (RP) application and an Immersive Reader (IR) tool as a computer-assisted pronunciation training (CAPT). It was utilized with the goal of 1) lessening the students' pronunciation anxiety, 2) assessing their pronunciation skills, and 3) exploring their degree of satisfaction with the utilization of the pronunciation application. A pre-experimental (one-group

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pretest posttest) research design was conducted with thirty students from two state universities, who were selected by simple random sampling. The pronunciation performance test, pronunciation anxiety scale, and a questionnaire focusing on the levels of satisfaction for the utilization of the application were obtained. The data was collected using the recordings of the pre-tests, 12 reading practices, and the post-tests, which were held over 4 weeks of intervention on Microsoft Teams. The pronunciation performance tests were evaluated by three raters. Meanwhile, the descriptive statistics and t-test were analyzed using SPSS version 20. The findings indicated that there was a statistically significant effect of CAPT on pronunciation skills and the reduction of pronunciation anxiety. In conclusion, the students' pronunciation anxiety lessened, and their pronunciation improved significantly ($p < 0.01$). Additionally, their satisfaction regarding the utilization of the application was significant.

Keywords: pronunciation, pronunciation anxiety, application, computer-assisted pronunciation trainin (CAPT), automatic speech recognition (ASR)

บทคัดย่อ

งานวิจัยนี้ศึกษาการนำแอปพลิเคชัน Reading Progress และเครื่องมือ Immersive Reader ไปใช้ในการฝึกการออกเสียงโดยใช้คอมพิวเตอร์ช่วยของนักศึกษา มีวัตถุประสงค์เพื่อ 1) ลดความวิตกกังวลในการออกเสียง 2) ศึกษาความสามารถในการออกเสียง และ 3) ศึกษาความพึงพอใจต่อการใช้แอปพลิเคชันในการฝึกการออกเสียง การวิจัยนี้เป็นการวิจัยก่อนการทดลอง (แบบแผนการทดลองกลุ่มเดียวทดสอบก่อนหลัง) โดยกลุ่มตัวอย่างเป็นนักศึกษาจาก

มหาวิทยาลัยของรัฐสองแห่ง โดยใช้เทคนิคการสุ่มตัวอย่างแบบง่าย จำนวน 30 คน เครื่องมือวิจัย ได้แก่ แบบทดสอบประสิทธิภาพการออกเสียง แบบวัดความวิตกกังวลในการออกเสียง และแบบสอบถามวัดความพึงพอใจต่อการใช้แอปพลิเคชันในการฝึกการออกเสียง เก็บข้อมูลจากการทดสอบก่อนการฝึกแบบฝึกการอ่าน 12 ครั้ง และการทดสอบหลังการฝึก รวม 4 สัปดาห์ของการทดลองบน Microsoft Teams ซึ่งการทดสอบประสิทธิภาพการออกเสียงให้คะแนนโดยผู้ประเมินสามคน โดยใช้ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และสถิติทดสอบที ด้วยโปรแกรมสำเร็จรูปทางสถิติ ผลการวิจัยพบว่า หลังการใช้แอปพลิเคชัน นักศึกษามีความวิตกกังวลในการออกเสียงลดลง มีความสามารถในการออกเสียงเพิ่มขึ้นอย่างมีระดับนัยสำคัญทางสถิติที่ระดับ 0.01 และมีความพึงพอใจต่อการใช้แอปพลิเคชันในการฝึกออกเสียงภาพรวมในระดับมาก

คำสำคัญ: การออกเสียง ความวิตกกังวลในการออกเสียง แอปพลิเคชันการฝึกการออกเสียงโดยใช้คอมพิวเตอร์ช่วย การรู้จำคำพูดอัตโนมัติ

Introduction

Skills for the 21st century refer to a range of abilities and competencies. These include communication, problem-solving, collaboration, creativity, and innovation (Zaitseva, 2020). Communication skills are needed in recruitment as they are crucial for productive performance in a globalized job market (Lee, 2020). Although communication skills (i.e., oral communication, public speaking, and presentations) are one of the most vital skills for undergraduates to learn and practice throughout their education to ensure career success (Gallego et al., 2021), many business learners lack communication skills (Lee, 2020). The development of communication skills is as important as technical competence for those, who want to

find jobs and keep them (Robles, 2012). The foundation of effective spoken communication, which includes successful language learning, is all connected to good pronunciation (Garrigues, 1999).

English pronunciation is one of the most difficult areas for English as a Foreign Language (EFL) learners to acquire and improve (Hu, 2017; Ruengwatthakee, 2021). It is an integrated and essential part of language learning and consists of focused elements that are more important than the sounds of consonants and vowels. It includes the elements of rhythm and intonation, which support the communicative process (Wei, 2006). Therefore, if any EFL learners want to gain communicative competence, they have to study pronunciation. Without sufficient pronunciation skills, learners' ability to communicate can be limited (Otlowski, 1998). The skills required for listening comprehension, the ability to speak a language, and pronunciation are interconnected (Gilbert, 1984). Although pronunciation is a critical element of spoken and communication skills, it is not taught as it should be (Wiriyachitra, 2002). Further, it has been neglected in the teaching of English (Alonso-Herrero & Herrarte, 2019; Haryadi & Aprianoto, 2020; Sridhanyarat, 2017; Wei, 2006; Wongsuriya, 2020). English pronunciation is simply ignored in the curriculum of some universities in Thailand (Wei & Zhou, 2002). Pronunciation is often categorized as an elective course, which may not sufficiently be of interest for learners, who register in several Thai universities.

Pronunciation problems, leading to communication breakdown (Fraser, 2000; Kholis, 2021), are raised from two principal areas: the segmental and suprasegmental aspects, which influence the learners' accents, their confidence to speak out, and their feelings about inferior or unintelligible speech and sounding monotonous. In addition, their accents are affected by off-target vowels, wrong or missing consonants, misplaced stress, and odd intonations. Regardless of how

excellent their grammar and vocabulary are, non-native English speakers (NNES) will encounter oral communication problems if they are below the threshold level of pronunciation. Despite errors in other areas, those with good pronunciation are considered more intelligible and comprehensible. It can be difficult to understand individuals with poor pronunciation (Fraser, 2000; Wong, 1987). A lack of pronunciation knowledge could even impact the learners' reading and spelling (Wong, 1993). This was presented in Duncan's (1983) study in which there was a significant positive relationship between phoneme production and reading achievement for first to fifth graders of Anglo children.

According to Era 4.0, education should support learners to learn autonomously by accessing online educational applications. Since such applications meet the learning needs of digitized learners, it is necessary to provide pronunciation learning tools, which are technologically based. This study implies the integration of technology into the English classroom where EFL learners can gain benefit from self-practice and from using their voice recordings outside the context of the classroom. Online applications can help reduce anxiety when learners speak English (Dong, 2013). The computer-assisted pronunciation training (CAPT) system, which is used by NNES to improve their English pronunciation (Agarwal & Chakraborty, 2019), meets the requirements of pronunciation training for the following reasons: 1) it helps to address the problems of individual learners; 2) each learner can train at his/her speed depending upon the amount of free time; 3) individual training leads to a reduction in language anxiety (Young, 1990); and 4) learners and instructors can monitor problems and gauge improvement according to the recorded log-files (Lee, 2008; Neri et al., 2002).

Literature Review

Pronunciation is a pivotal part of speaking skills; however, many students experience anxiety as a result of poor pronunciation. To date, educational technology has been utilized to help with pronunciation anxiety.

1. Pronunciation and Anxiety

Primarily, the reason for speaking anxiety is a lack of competence in the foreign language linguistic items, particularly pronunciation. In a safe environment, repeated exposure to fear can reduce fear itself (Shin & Newman, 2018). The fear of public speaking can be reduced by frequent practice (Kalra & Siribud, 2020). In the EFL context, students are most nervous and anxious when they need to speak in front of the classroom. In higher education, the students are supposed to speak or give effective presentations in front of the class (Bunrueng, 2008). Consequently, it is possible to reduce pronunciation anxiety with frequent practice using the CAPT application.

According to theories of pronunciation, there are two core elements of pronunciation: the segmental and the suprasegmental aspects. The segmental level of sound structure in pronunciation is concerned with vowels, consonants, monophthongs, diphthongs, and clusters. Meanwhile, the suprasegmental aspect is concerned with syllable structure, stress, rhythm, pauses, linking or liaison, variation, and intonation. The native languages of the EFL learners influence their English pronunciation problems, and these are the so-called first language/linguistic interference (Brown, 2000) or negative transfer (Senel, 2006). In other words, the Thai language (L1) influences the learners' English (L2) pronunciation. The

problems occur when the rules for combining the sounds in syllable forms are different in the two languages. Many EFL learners have major difficulties with pronunciation (Fraser, 2000) such as the differences in the phonological systems between L1 and L2 (Li et al., 2016; Narksompong, 2007; Yangklang, 2006), and the stress placement in their pronunciation (Bourjan, 2003).

When pronouncing L2 words with the L1 interference in the classroom, learners might encounter repeated negative experiences, which may provoke performance anxiety (PA). PA consists of three sub-categories: communication apprehension, test anxiety, and fear of negative evaluation (Horwitz et al., 1986). The first sub-category is caused by the unwillingness to communicate with others, while the second one is centrally related to the expected scenarios of negative test results. The last one arises when a person feels afraid of being judged by his/her peers in a variety of situations owing to negative self-perception. MacIntyre (2017) unveiled the effects of foreign language anxiety on L2 learners. Firstly, it has an effect on academic performance, which can be observed in lower grades or test scores, negative self-evaluations of L2 competence, and putting more effort into L2 learning due to receiving lower than expected grades, scores, or performance. Secondly, anxious L2 learners encounter effects on their social lives. Thirdly, they tend to have cognitive processing, which is obscured by foreign language anxiety. Szyszka (2017) elaborated upon the effects of anxiety on mental processes by adopting the three stages of information processing: input, processing, and output, as proposed by Tobias (1979). In the input stage, the attention to linguistic stimuli is diverted, resulting in the processing of fewer

linguistic stimuli in the next stage. Fewer stimuli are mentally processed in the second stage. Working memory (limited mental working capacity) plays a role in temporarily storing and processing the stimuli. To comprehend and process the stimuli, working memory also retrieves prior linguistic knowledge from long-term memory. L2 learners, who are influenced by their anxiety, take more time in processing the linguistic stimuli or find that their mental processes are disrupted. In the output stage, written or verbal responses to the stimuli are partially or completely inappropriate.

2. Thai EFL Students' English Pronunciation Problems

L2 learners are more likely to encounter difficulty learning L2 sounds that do not exist in the L1, particularly in terms of categorizing and discriminating sounds between both languages. English has four pairs of voiceless-voiced fricatives at an initial, intervocalic, and final position, whereas Thai has only two initial voiceless fricatives (Roengpitya, 2011). Native Thai speakers tend to articulate English voiceless fricatives as voiceless, English voiced fricatives as voiced (Roengpitya, 2011), and assimilate the English sound to the sound closest in the Thai sound system (Kitikanan, 2017). Thai intonations are applied to English pronunciations, and Thai final consonants are always unaspirated and unvoiced (Wei & Zhou, 2002). This applies when Thai EFL learners pronounce words in English in Thai ways, resulting in a lack of stress and intonation outcomes. Most of the Thai non-English major students at universities pronounce English words or sentences without knowing how to properly pronounce stress and intonation. This includes the fact that their pronunciation of English sounds monotonous. According to Lin (1995), when listening to English, many EFL

students pay more attention to sounds, vocabulary, and grammar, but pay little attention to pitch changes. This results in their vocal sounds being monotonous when they speak (Yangklang, 2013).

Several studies have investigated the enhancement of Thai EFL students' English pronunciation and the pronunciation problems they have frequently encountered. The studies have mostly been concerned with consonants and vowels, intonation, and stress. Some of which include: 1) mispronounced /-s/ (Narksompong, 2007; Sahatsathatsana, 2017; Ruengwatthakee (2021); 2) the linking sounds between words as linking does not occur in Thai sound system (Sahatsathatsana, 2017); 3) the final /-l/ sound (Yangklang, 2006); 4) back vowels /u/ and /ʊ/(Nusartleart & Pattanasorn, 2015); 5) L1-L2 differences in phonological systems or some sounds in the Thai language may not exist in English pronunciation (Narksompong, 2007; Wongsuriya, 2020; Yangklang, 2006); 6) final clusters created by grammatical endings, whereas there are no final consonant clusters in Thai (e.g., the past tense ending /t/ when added to "glimpse' creates the 4-consonant cluster /mpst/) (Narksompong, 2007); 7) /z/ (voiced alveolar fricative) (e.g., "is" /iz/) (Ruengwatthakee, 2021); 8) /d/ sound (Kanokpermpoon, 2005); 9) -ed ending sounds "relaxed" /-kst/ (e.g., /t/, /d/, and /Id/) (Likitrattanaporn, 2014; Ruengkul, 2020); and 10) the pronunciation of English sounds by using Thai consonant sounds (e.g., "salmon" is usually pronounced as /sælmən/ instead of /sæmən/ by most Thai learners since they cannot differentiate between the spoken and written forms as the spoken and written forms in Thai resemble and go hand in hand with the word) (Machackova, 2012; Malarak, 1998; Mano-im, 1999)

The pronunciation features pointed out in the study are based on mispronunciation (e.g., beginning-mid-final consonants sound, /-s/), omitting consonants (e.g., omitting /r/ "grade" /greɪd/ pronounced as /geɪd/)), (e.g., replacing /s/ with /d/ "happiness" /hæpin̪s/ pronounced as /hæpin̪d/) stress, and intonation. /s/ is one of the phonemes that Thai EFL students frequently mispronounce (Narksompong, 2007; Sahatsathatsana, 2017). As Ruengwatthakee (2021) pointed out, /-s/ also functions as a suffix in morphology and signals plural, possessive, and subject-verb agreement. Mispronouncing or omitting /-s/ therefore causes writing errors as well. The target sounds in this study are the final consonants and final /-s/, which play a vital part in English grammar, but /-s/ is often omitted and mispronounced by Thai EFL students (Ruengwatthakee, 2021). Therefore, making students aware of the consonant sounds, stress, and intonation is necessary to improve their pronunciation.

3. Computer-assisted Pronunciation Training (CAPT)

Based on the prevalence of several applications and digital platforms, the utilization of technology, which has been employed as a language learning tool for EFL learners to practice their speaking and pronunciation, has been emphasized (Calvo Benzies, 2017; Rogerson-Revell, 2021). The computer-assisted pronunciation training (CAPT) system, which was first developed by Kalikow and Swets (1972) for NNES to improve their pronunciation, has, for a decade, gained much attention predominantly in the field of foreign language instruction (Henrichsen, 2021; Rogerson-Revell, 2021). A CAPT tool records the speech of a learner; detects and diagnoses incidences

of mispronunciation (performance analysis); and suggests ways to correct them (Agarwal & Chakraborty, 2019). Consequently, CAPT can help teachers to address the problems of individual learners by allowing them to practice at their own pace, as well as to self-regulate, self-access, and self-monitor their English pronunciation performance and autonomous learning without the presence of their teacher and peers (Neri et al., 2002) and in a stress-free environment (Rogerson-Revell, 2021). Such conditions may reduce foreign language classroom anxiety and allow the teacher and student to identify individualized problems and monitor improvements. The more confident learners feel about initiating practice to communicate in English, the more likely they will be to improve their pronunciation (Brown, 2000). CAPT systems can detect up to 86% of mispronunciations in a speech and can help learners reduce incidences of mispronunciation by up to 23% (Agarwal & Chakraborty, 2019). Several studies have revealed that English learners, who had been taught using the CAPT tool, were able to significantly outperform their counterparts in vocabulary acquisition (Wu et al., 2021), and pronunciation (Pourhosein Gilakjani & Rahimy, 2020). For example, there was a 7% decrease in mispronunciation after using CAPT for 2 months (Akima et al., 1992), and a 23% improvement in pronunciation performance (Jing & Yong, 2014).

Objectives

The study aimed at: (1) investigating whether the integration of an English pronunciation application could reduce the students' pronunciation anxiety, (2) assessing the learners' English pronunciation competence, and (3) exploring the learners' levels of satisfaction after utilizing the pronunciation application.

Research Methodology

1.The Participants in the Study

The population of the study was public university students (non-English majors), aged 19-22, who were studying Business English in the academic year of 2021: 425 students from K1 University and 149 students from K2 University. The participants were 30 Thai EFL university students who were selected by simple random sampling: seventeen from K1 University (56.67%) and thirteen from K2 University (43.33%). There were five males (16.67%) and twenty-five females (83.33%) with ages ranging from 19-22. Of them, 14 (46.67%) had finished studying English Pronunciation, 10 (33.33%) had completed Listening and Speaking, and 6 (20%) had completed Public Speaking before participating in this research. The grade results for the 30 students in the previously mentioned courses related to communication were as follows: A (40%), B+ (16.67%), B (20%), C+ (16.67%), C (3.33%), and D+ (3.33%).

2.The Instruments

2.1 The Pronunciation Anxiety Scale. The scale, which was adapted from the version by Kralova et al. (2017), was used to examine the participants' English pronunciation anxiety levels before and after the intervention. Its design was inspired by the Foreign Language Classroom Anxiety Scale (FLCA) (Horwitz et al., 1986) and the Phonetics Learning Anxiety Scale (Baran-Lucarz, 2013) and was based on the researchers' teaching experiences in speaking and communication courses, which had indicated the most frequently occurring weaknesses found in the Thai EFL learners' English pronunciation. The questionnaire included twenty declarative statements to survey the learners' perceptions of their English pronunciation and required the participants to indicate the extent to

which they agreed or disagreed with the statements based on a 5-point Likert scale (5 –strongly agree, 4 –agree, 3 –neutral, 2 –disagree, 1 – strongly disagree). The questionnaire comprised six sub-components: personal background information, oral performance apprehension, self-concern over the pronunciation, pronunciation self-image, pronunciation self-efficacy, and attitudes toward English pronunciation.

2.2 The Pronunciation Performance Test. The pronunciation test included a pre-test and a post-test, which consisted of a list of thirty words designed from the most problematic English words with /-s/ and consonant sounds appearing in either the initial or final position. The test was designed to identify the participants' pronunciation abilities before and after using the training program. In the test, the participants were required to pronounce stress and to record it, before and after using the training program. To examine the participant's levels of English pronunciation proficiency and to establish the reliability of the measurements, three raters (one native speaker of English and two Thai instructors specializing in applied linguistics, who were all teaching EFL courses) conducted a subjective auditory evaluation of the students' English pronunciation quality using the interval 5-point Likert scale (5 –excellent, 4 –very good, 3 –quite good, 2 –not very good, 1 – poor (see Appendix). The scale reflects the extent to which the participants' accents diverge from the British English pronunciation norms (Received Pronunciation). Before and after the intervention, each participant's pronunciation was recorded and evaluated.

2.3 Questionnaire on Learning Satisfaction. The 16-item questionnaire measured the students' learning satisfaction with the CAPT program, i.e., RP and IR. The survey was designed to be used after the post-test. Closed-end questions were divided into two parts: the background information of the respondents and the level of student satisfaction with their use of the CAPT application. The questionnaire

was designed by employing a 5-level Likert scale corresponding from the levels of least to most concerning each student's level of satisfaction.

2.4 Application and Tool. Reading Progress (RP), recently launched in Microsoft Teams (MS Teams) by Office 365 in 2021, is an Automatic Speech Recognition (ASR) that provides a separate pronunciation assessment (formative assessment) and feedback on accuracy. RP is used as a principal tool for students to read the assigned texts aloud, which provides them with an audio-visual record of themselves as presented in Figure 1. *Immersive Reader (IR)*, which was first developed in 2015, is a tool that is available in Teams and allows students the opportunity to participate in enhanced reading instruction by listening to the voices of native speakers (either male or female) and to read along with the given texts so that they can imitate the sounds (see Figure 2). It implements techniques that can improve the students' reading (Jarke et al., 2020), and is used as an accompanying feature, which in this study, has been incorporated with RP. Reading fluency is an essential part of any student curriculum, and each student must have opportunities to build his/her reading skills and in turn, increase his/her confidence. However, some assessments, which were provided by RP, were not found to be consistent with feedback from the pronunciation instructors. This is why the one-on-one meetings, which included the instructor's feedback, were provided for the students in this research.

The instruments were tested on a pilot group of 20 students for reliability. The results showed that Cronbach's alpha coefficients were 0.89, 0.86, and 0.94 respectively, which is greater than 0.7, indicating that the scale, test, and questionnaire had an acceptable level of confidence.

Figure 1
RP: The Student's View of the Reading Text Being Recorded

Figure 2
IR: The Voice of a Native English Speaker

This study is a pre-experimental (one-group pretest posttest) research design (Johnson & Christensen, 2012). Initially, there were thirty-two participants, but two participants dropped out of the study. The participants consisted of thirty non-English major students (19-22 years old), who were taking a Business English course during the Academic Year of 2021. The study was conducted between January and February 2022 utilizing the experimental Teams platform.

A volunteer invitation was announced for those, who wanted to participate in the training. The volunteers were invited to join the Line group since it is considered one of the most famous social media platforms, which is used to send notices and reminders to participants. The ethical clearance from the university research committee was approved (COE No. 65/003), and a consent form was sent to the volunteers individually.

For this study, an experiment channel was created on the Teams platform for the following purposes: demonstrating, addressing notices, delivering twelve reading texts for practice, creating voice recordings, monitoring, evaluating, and providing one-on-one consultations. Before participating in the study, participants were given a training session on how to use the applications (both IR and RP) for their pronunciation practices. The steps of research methods are as follows:

1) The participants were required to complete a pronunciation anxiety scale and have a pronunciation performance pre-test as a voice recording.

2) During the twelve sessions held over the 4-week intervention period, the participants submitted twelve voice recordings, and based on those recordings, they were provided with pronunciation feedback from the instructor, which consisted of an interpretation of the graphical presentation from the application.

3) A weekly 10-minute one-on-one live meeting in which tailored advice was given to each learner focusing on his/her problems.

4) After they had finished the twelve sessions over the four weeks, they were asked to complete the following: 1. the pronunciation anxiety scale, 2. the Pronunciation Performance Post-test, and 3. the online questionnaire, which focused on gauging their levels of satisfaction about using the applications.

This pre-experimental research with the one-group pretest posttest design, which is shown in Table 1, was divided into three stages: the pre-intervention, the ongoing intervention, and the post-intervention. The pre-test was conducted to evaluate the participants' abilities before beginning the training program, and then the post-test was conducted after the 4-week intervention. The Pronunciation Performance tests were rated by three raters consisting of one native English-speaking instructor and two Thai English instructors, who are

specialists in EFL teaching and applied linguistics. Their mission was to assess the participants' levels of ability regarding their English pronunciation (particularly in producing the English /-s/ and consonant sounds).

Table 1

The One-Group Pretest Posttest Study Design

O_1	X	O_2
pronunciation anxiety	A 30-minute pronunciation practice three times/week and weekly one-on-one meetings for a month	pronunciation anxiety
pronunciation performance		pronunciation performance
		satisfaction with the application utilization
O_1 = pre-test	x = intervention	O_2 = post-test

The collected data was of the quantitative type and was made up of two kinds of variables: *Independent Variables* (the CAPT application) and *Dependent Variables* (pronunciation anxiety, pronunciation performance, and the level of satisfaction with utilizing the application).

Twelve different business-related reading texts with an average length of 250 words were assigned and uploaded three times a week for a month. In general, these texts were customized for participants' reading levels. Given that the app was streamlined by integrating with the Teams' Education Insights dashboard, instant

feedback on reading accuracy, mispronunciations, repetitions, omissions, self-corrections, and insertions was provided from the auto-detect feature as shown in Figure 3.

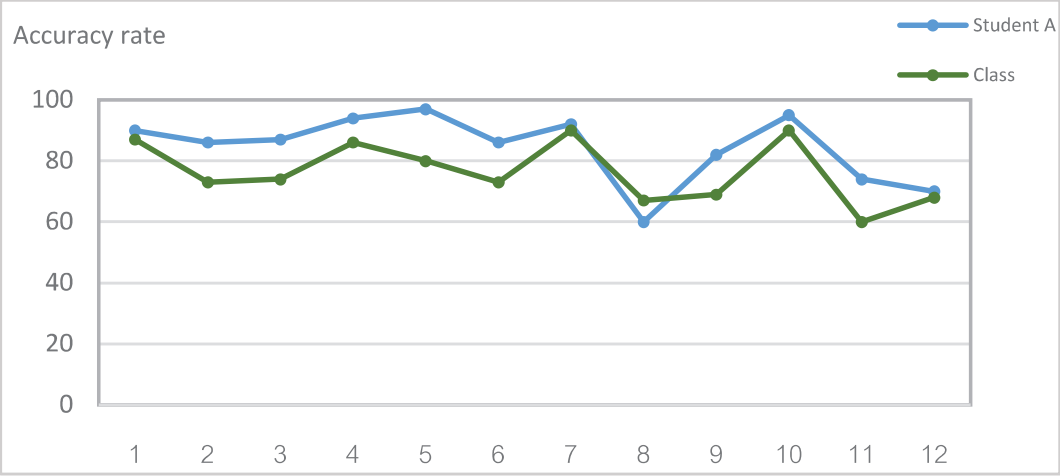
Figure 3

RP: The Teacher's View (The student's audio-visual clip was recorded with the number of correct words per minute, the accuracy rate, the mispronunciations, omissions, insertions, repetitions, and self-corrections.)

Over the 12-session intervention, each student's reading accuracy rate was compared to others in the class, which allowed the participants to track their progress. In addition, the students were able to receive individualized corrective feedback from the instructor, which was given during one-on-one meetings as shown in Figure 4.

Figure 4

The Individual Student's Accuracy Rate Compared to the Class During the 12-Session Intervention



To account for different speech patterns and accents, it was possible to set the pronunciation sensitivity levels. Some of the inaccuracies, which the auto-detect feature had highlighted, were overridden by the instructor since both tracking systems needed to go hand-in-hand to track the results more accurately. Moreover, the most mispronounced words were shown both individually and as an overall group as illustrated in Figure 5. The participants were, therefore, able to realize the words that they had most frequently mispronounced and could correct their errors.

Figure 5

A Word Cloud of the Most Frequently Mispronounced Words

Not only was the sound structure provided, but the text was broken into syllables and was highlighted as it was read aloud. Furthermore, grammatical structures (i.e., the parts of speech) were also offered by IR as shown in Figure 6 and Figure 7 accordingly.

Figure 6

IR: Syllables

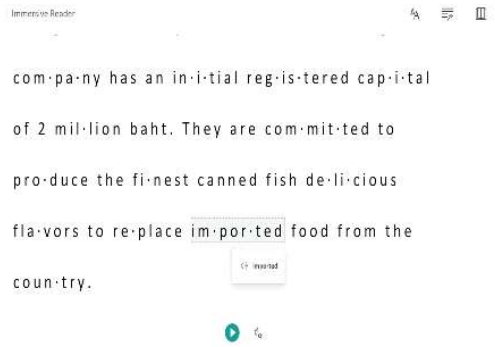


Figure 7

IR: Grammar Options

3. Analysis

After the participants had submitted their first voice recordings of thirty words as the pre-test, all three raters listened and recorded on the score sheets. The same process was conducted again for the post-test. During the 12-session data collection over the four weeks, the /-s/ and initial or final consonants were continuously practiced. The preliminary data analysis for the participants' demographic descriptions was conducted by using descriptive statistics (e.g., age, gender, faculty, and grade). The test scores were then analyzed using SPSS version 20. The statistics employed to complete the students' pronunciation performance were means, standard deviations, and percentages. The paired samples t-test was conducted to analyze the pre-test and post-test scores for pronunciation anxiety and pronunciation performance.

Findings

1. Thai EFL Students' Pronunciation Anxiety

The data from the pronunciation anxiety pre-test and post-test were analyzed. There was a significant difference between the pre-test and post-test. Table 2 shows that the mean score of the participants for pre-pronunciation anxiety was 3.48 (SD 0.40), while the post-pronunciation anxiety was 3.06 (SD 0.43). The participants' pronunciation anxiety significantly lessened at 0.01 after the training.

Table 2
T-test (Pronunciation Anxiety)

	mean	SD	df	t	Sig.
Pre-test	3.48	0.40			
Post-test	3.06	0.43	29	4.101	0.00**
Paired	0.42	0.56			

2. Thai EFL Students' Pronunciation Performance

The results of the pronunciation performance pre-test scores were assessed by three raters (one native speaker of English and two Thai instructors, who specialized in applied linguistics and were teaching EFL courses) as seen in Figure 8. For the pre-test of the thirty participants, the pronunciation performance was at a moderate level with a mean score of 3.13. The student with the highest score had an average score of 3.96: Rater #1 rated 4.13, Rater #2 rated 3.80, and Rater #3 rated 3.97. On the contrary, the student with the lowest score had an average score of 2.37: Rater #1 rated 2.00, Rater #2 rated 2.53, and Rater #3 rated 2.56.

Figure 8

The Inter-raters' Scores for the Pronunciation Performance Pre-test

Figure 9 illustrates the results of the pronunciation performance post-test scores evaluated by the three raters. For the Post-test of thirty participants, the pronunciation performance showed a high level with a mean score of 4.01. The pronunciation performance of all students appeared to have improved. The student with the highest score had an average score of 4.73 (Rater #1 rated 4.95, Rater #2 rated 4.83, and Rater #3 rated 4.42). Conversely, the student with the lowest score had an average score of 3.24: Rater #1 rated 3.68, Rater #2 rated 3.30, and Rater #3 rated 2.73.

Figure 9

The Inter-raters' Scores for the Pronunciation Performance Post-test

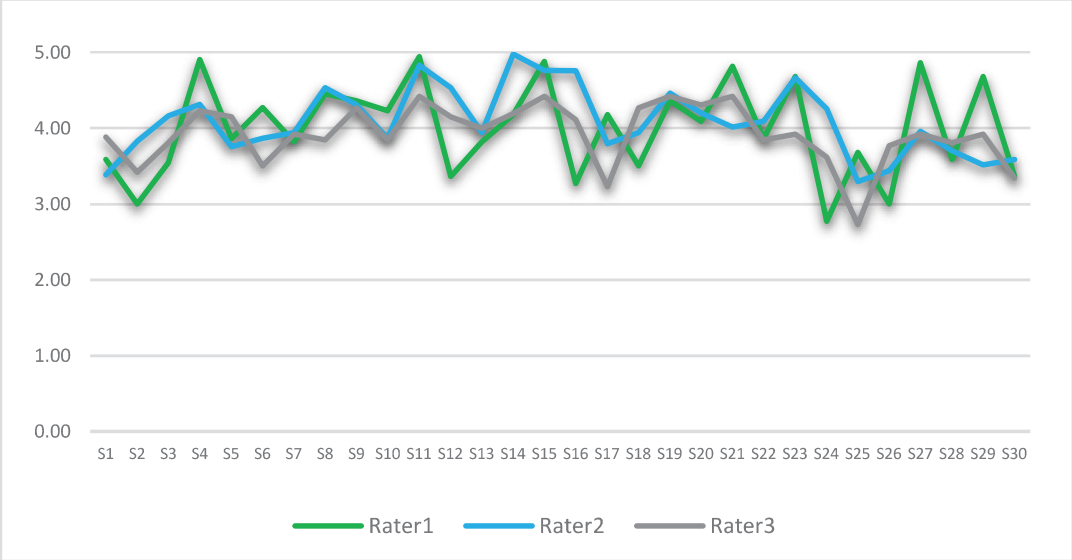


Table 3 illustrates the effects of using the app to improve the students' pronunciation. The scores of the pre-test and post-test pronunciation tests were compared. The mean score of the participants on pre-pronunciation performance was 3.16 (SD 0.44), while that for post-pronunciation performance was 4.34 (SD 0.25). There was a significant difference between the pre-test and post-test scores for pronunciation performance. The mean score of the post-test was higher than the pre-test ($p < .01$), indicating that the participants' pronunciation performance had improved significantly after the training. In other words, students had made significant gains as shown by the post-test after four weeks (twelve sessions) of intervention.

Table 3

T-test (The Pre-test and Post-test Pronunciation Performance Test)

	mean	SD	df	t	Sig.
Pre-test	3.16	0.44			
Post-test	4.34	0.25	29	-12.40	0.00**
Paired	-0.98	0.52			

3. Satisfaction with the Utilization of the Pronunciation Application

The results from the students' satisfaction questionnaire, which focused on the utilization of the application, revealed that most of the EFL students had exhibited a positive attitude toward RP, indicating that the application had been an effective medium that could be implemented in supporting the EFL students to improve their pronunciation skills. RP was determined to be beneficial in supporting and improving the students' pronunciation skills.

Table 4 reveals that before practicing with the application, most of the students had felt highly anxious about their pronunciation. The overall level of satisfaction of the EFL learners with the use of the pronunciation application was found to be significant ($\bar{x}$ = 4.48). Most participants were strongly satisfied with the following: 1) the IR's native speaker voices to imitate ($\bar{x}$ = 4.74) 2) the unlimited number of attempts to record ($\bar{x}$ = 4.56), 3) the pronunciation scores that were provided on the teacher's view ($\bar{x}$ = 4.52), 4) personal feedback from the instructor ($\bar{x}$ = 4.67), 5) individual practice on their own ($\bar{x}$ = 4.74), 6) pronunciation practice outside the class ($\bar{x}$ = 4.52), and 7) the application's activities ($\bar{x}$ = 4.59)

Table 4

The Degree of Satisfaction with the Utilization of the Pronunciation Application

Items	Mean	SD	Interpretation of Results
1. In general, I was comfortable with the experience of practicing my English pronunciation with the computer.	4.48	0.70	Satisfied
2. I did not have any difficulty operating the computer to proceed with the pronunciation exercises.	4.26	0.94	Satisfied
3. It was helpful to hear the native speakers' voices and to imitate those voices before the recordings of my attempts.	4.74	0.53	Strongly satisfied
4. It was helpful when there were unlimited attempts to record my voice on the application.	4.56	0.58	Strongly satisfied
5. It was helpful to monitor the pronunciation scores from the application from the teacher's view.	4.52	0.64	Strongly satisfied
6. Feedback from the instructor on my pronunciation practice was helpful.	4.67	0.48	Strongly satisfied
7. The one-on-one advice from the instructor about my pronunciation practice was helpful.	4.41	0.84	Satisfied
8. Practicing with the application on my own has helped me to improve my English pronunciation.	4.74	0.45	Strongly satisfied

Items	Mean	SD	Interpretation of Results
9. Before practicing with the application, I felt anxious about speaking in front of others because of my pronunciation.	4.78	0.51	Strongly satisfied
10. I feel less anxious about my English pronunciation now due to the practice I had with the application.	4.07	0.87	Satisfied
11. The application has helped me to improve my English pronunciation.	4.44	0.64	Satisfied
12. The application motivates me to practice English pronunciation outside of the class.	4.52	0.64	Strongly satisfied
13. The application has helped to build my confidence when pronouncing English.	4.44	0.64	Satisfied
14. The application has helped me to reduce anxiety when pronouncing English.	4.19	0.74	Satisfied
15. The application has helped me to increase my confidence when speaking English.	4.30	0.67	Satisfied
16. Overall, I enjoyed the application activities.	4.59	0.57	Strongly satisfied
The overall level of satisfaction	4.48	0.65	Satisfied

Discussion

This study aimed at examining the use of a Reading Progress (RP) application and an Immersive Reader (IR) tool to reduce the students' pronunciation anxiety, increase their pronunciation competence, and investigate their level of satisfaction. The statistical analysis revealed significant differences in the levels of pronunciation anxiety and pronunciation performance scores. The students' experiences of using the application were positive. This implies that RP and IR are enjoyable applications that can lessen the pronunciation anxiety of the students and can enhance their pronunciation performance.

Firstly, their pronunciation anxiety might have decreased as a result of self-directed learning on a computer, which allowed the L2 learners to establish a sense of being in control of their learning process (Pourhossein Gilakjani & Rahimy, 2020; Shams, 2006). The application and tool provided the students with opportunities to be exposed to the voices of native speakers. They could listen to and imitate the reading texts pronounced by the tool. Moreover, before recording their voices, they could listen and re-listen to the texts until they felt confident about pronouncing the texts correctly. After they had finished recording, they could listen to their voices to check whether they were satisfied with the recorded voices and could then submit them. Secondly, pronunciation training via a computer may reduce performance anxiety, especially communication apprehension and the fear of receiving a negative evaluation. L2 learners with negative communication experiences have high communication apprehension (Szyszka,

2017). In addition, negative self-perceptions of limited pronunciation competence, which might lead to embarrassing moments in the classroom, are a major factor in triggering anxiety (Baran-Łucarz, 2013; Saito et al., 2018). In this study, the intervention was designed to limit peer pressure and social interaction, which could have triggered both communication apprehension and fear of negative evaluation. Instead of pronouncing the texts in the classroom in which their classmates and the teacher could be the witnesses, the students were required to privately pronounce the texts in front of a computer.

Because of the decreased level of anxiety, the acquisition of pronunciation is assumed to be more effective, and thereby, results in better pronunciation performance. Based on Tobias's (1979) three stages of L2 information processing, two stages: input (perception) and internal processing, have been adopted to explain the probable causes. At the input stage, L2 learners with an elevated level of anxiety are mentally blocked from taking in L2 pronounced stimuli (Szyszka, 2017). This leads to an inability to pay attention to L2 auditory stimuli, and as a result, the amount of intake is distorted or reduced. Next, foreign language anxiety could prevent this mental process from continuing as normal (Eysenck et al., 2007) in working memory, which is responsible for processing intake, retrieving existing linguistic information from long-term memory, and combining the intake with the retrieved information. Without anxiety, L2 learners were able to accomplish the following: 1) compare and match segmental and suprasegmental information, which are embedded in the intake, with mental semantic representations; 2) could retrieve existing pronunciation knowledge; and 3) could relate to and integrate new pronunciation knowledge to the existing one. Based on thepronunciation errors detected by the application, the students' interlanguage was heavily

influenced by Thai (L1) at the beginning of the training. Gradually, they were able to demonstrate the awareness to correctly pronounce the final consonants, especially /-s/, consonant clusters, /r/ and /l/, and -ed ending sounds through the twelve reading practices. They ultimately showed less L1 interference and better pronunciation in the post-test.

At the end of the intervention, the students completed an exit survey exploring their levels of satisfaction. They were satisfied with the experience of using the application and receiving feedback from the instructor. Under self-directed and low-anxiety circumstances, the students had been able to take pleasure in the applications' features, which had assisted them in improving their pronunciation, such as the VDO and voice recordings, the text-to-speech generator, the automatic pronunciation error detection, and the pronunciation performance tracker, etc. In the one-on-one sessions, the teacher provided pronunciation feedback in a supportive manner, which allowed the students to perceive and accept their mispronunciation as an inevitable learning outcome. The results of this study are consistent with a study conducted by Gao and Hanna (2016), who insisted that the combination of teacher-led and software-led instruction could optimize the improvement of both attitudes and performance. In the Thai context, Arunsirot (2020) supported the advantages of using an educational technology tool. For Thai university students, the use of Augmented Reality interventions could have a positive impact on English pronunciation and could allow the students' levels of satisfaction to reach the highest level.

Conclusion

This study used a one-group pretest posttest design to investigate the effects that the application had on the students' anxiety levels, pronunciation performance, and satisfaction. The application allowed 30 EFL participants at two universities to listen to computer-generated native speaker voices with unlimited access. In the training process, they were required to be exposed to a series of pronunciation practices, which were delivered on the application, and recorded their pronunciation. The teacher then gave individualized pronunciation feedback. The anxiety level after the training, which was compared with the anxiety before the training, was found to be significantly different ($p < .01$). Better pronunciation performance was observed when comparing the scores between the pre-test and the post-test pronunciation tests. The students had also felt positive about the practice that they had received via the application and from getting feedback from the teachers.

In a classroom environment, some learners seem passive during communication tasks. They might be anxious learners, who are worried about receiving negative attitudes from their peers due to their inadequate pronunciation performance. As the results have shown, the learners in this study might have had lower anxiety when they learned about the application, which resulted in pronunciation acquisition. Therefore, the application should be seamlessly integrated into classroom lessons and activities. To do so, two conditions need to be considered. When learners are eager to participate in a communicative task, they might have less performance anxiety. In class, the teacher could encourage learners to consult the application and provide their

peers with pronunciation feedback. Unlike those learners, who tend to hide away from communication activities, the teacher should assign a pronunciation activity via the application before the class meets. The pronunciation activity would allow learners to familiarize themselves with pronouncing the words that are related to a topic or a communicative task in the classroom. If time allows, a teacher could offer one-on-one sessions to give individualized feedback. In a big class, the teacher could point out the frequently mispronounced words, which were identified by the application, and could demonstrate how to pronounce them correctly in class. After learners have gained sufficient confidence in pronouncing the words before the class meets, they may more actively participate in a communicative task in the classroom.

The first limitation of this research is related to the tools used in data collection. A self-rating scale was used to measure the level of anxiety, so the participants' biases were unavoidable. To increase the validity and reliability of the research, objective indicators of anxiety, such as heart rate variability (HRV) and skin conductance, should be measured. The raters (listeners) were required to evaluate the participants' pronunciation performance based on comprehensibility and intelligibility. Acoustic analysis is an alternative way to evaluate pronunciation by determining the alteration of certain pronunciation features over a certain period. Further research should use experimental design to evaluate causal hypotheses. Perhaps, there could be four groups of participants, who receive different interventions as follows: no intervention, human-led training, computer-led training, and a combination of computer and human-led training.

The study results can be applied to create a framework for students to practice English pronunciation online or can be applied to design a hybrid, which has a combination of on-site and online practice and learning, and which offers a more autonomous and motivating learning atmosphere. This can be implemented as a guideline for designing activities to prevent and reduce EFL learners' anxiety, which could enhance their levels of confidence in English language learning and pronunciation.

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Appendix

The Rubric assessment for pronunciation

Score	Criteria
5	Very clear and easy to understand
4	Easily understood despite the detection of the influence of the mother tongue
3	Understandable to some extent
2	There are pronunciation problems requiring the full concentration of the listener.
1	There are serious pronunciation problems, and they cannot be understood.