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A Principled-Review of Studies in Computer-Based Pronuncation Instruction from 2015 to 2020

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Abstract

This paper reviewed computer-based pronunciation instruction research with a total of 15 research conducted all around the world to identify any overriding trends that might be useful to the concept in the context of the studies. Three topics are available in studies published primarily between 2015 and 2020. Analysis of the research has designated that most of the studies are conducted employing ASR-based tools. There are some advantages and disadvantages of CAPT but mostly has advantages, and results of the studies showed that in every study there is a positive effect of utilizing CAPT-based tools; simplicity of use, the utility of pronunciation training due to feedback given and adequate understanding of difficulties with pronunciation were advantages of CAPT based pronunciation instruction while there are some disadvantages such as lack of knowledge of usage, the transcription skills and convenience of the software. Also, the feedback was another concerned topic whether the feedback given by software is sufficient or whether peer or teacher feedback is required.

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Keywords: Pronunciation teaching and training; CAPT, ASR, SNSs, WEB 2.0 tools

Introduction

To communicate in a second language (L2), one needs to do more than simply memorize a new vocabulary list and a few grammar and syntax rules. The analysis reflected that competence in communicating in another language is related to the pronunciation standard

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of the speaker (Goh & Burns, 2012). Strong pronunciation is a key to efficient communication, comprehension and understanding, for both target language speakers and learners. In social and professional relationships, for career search and higher education success pronunciation plays a critical part (Yates, 2011). Because of how momentous pronunciation is, applied linguists and L2 experts are becoming increasingly interested in second language pronunciation (L2) (Isaacs & Trofimovich, 2016). Some scholars measure, affirm and stress the value of pronunciation and come up with the idea that no successful interaction occurs if the pronunciation of the non-native speaker slips under up to a point even though it has great grammar and vocabulary (Levis, 2018). Due to the auditory, emotional, psychomotor, and psychological components involved, pronunciation may be among the most challenging skills for learners to master in a foreign language (FL) (Levis, 2018). In view of the difficulty of FL, and although pronunciation plays a crucial role in oral communication (Brown, 1991), it is generally disregarded in FL courses as well as in research (Derwing & Munro, 2005). This, though, improved drastically in recent decades with several studies exploring numerous sides of FL pronunciation, their effect on perception, interpretation, accentedness and a wide variety of aspects including technology and WEB 2.0 tools.

The most consequential aspect of linguistic identity is thought to be pronunciation (Guiora, Beit-Hallahmi, Brannon, Dull, & Scovel, 1972). It is directly related to one's identity and the learner's and teacher's level of confidence in oneself. It affects not only the self-confidence of language teachers (Morley, 1998) but additionally their future work (Borg & Al-Busaidi). Furthermore, pronunciation plays a vital role in how communication is perceived by interlocutors (Lev-Ari & Keysar, 2010). It not only affects their ability to communicate effectively but has also been correlated with feelings of belonging (Gluszek, 2010), readiness for communication (Derwing, Munro, Foote, Waugh, & Fleming, 2014), phonetic improvement (Wang, Park, & Lee, 2006), and general language development (French, 2006). So far it has been identified empirically that the availability of specific phonetic instructions and guidance encourages various aspects of L2 pronunciation growth (Thomson & Derwing, 2015). However, the kind of guidance that will enable L2 students to produce new sounds most powerfully and productively remains to be addressed. More studies have identified effective techniques for teaching pronunciation both in and out of the school (Thomson & Derwing, 2015).

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Current students are immersed in interactive media-sharing technology, which encourages a variety of learning styles, in contrast to students of previous generations (McBride, 2009). The development of Web 2.0 tools and a range of electronic instruments led to the emergence of hybrid or blended learning (Goertler, 2011). In terms of language learning, blended or hybrid learning often refers to a situation where instruction takes place in a traditional classroom setting and is commonly enhanced or accompanied by computer- based or web-based exercises (Ducate, Lomicka, & Lord, 2012), embracing both virtual and actual interactions between the students and the teacher. Technology can assist FL learners in improving their pronunciation in several ways (Fouz-González, 2015). Rather than just updating outdated methods and executing the same tasks without technology, it should be used to genuinely boost learning; hence, choose activities that truly maximize the digital capabilities used (Setter & Jenkins, 2005). Research indicate how effective such resources could be for a specific group of students at a certain time period (Jamieson, Chapelle & Preiss, 2005).

The use of Computer-Assisted Pronunciation Training (CAPT) in EFL instruction has been proven to help students pronounce words more accurately. The CAPT programs are designed to provide learners with individual and multiple interactive pronunciation habits.

Several studies demonstrated that CAPT systems are successful. Despite the effectiveness of various CAPT systems, some students may find it demanding to employ them (Neri, Mich, Gerosa, & Giuliani, 2008; Wang & Young, 2015), this can restrict their ability to achieve academically to pre-planned activities (McCrocklin, Humaidan, & Edalatishams, 2019; McCrocklin, 2016 Neri et al., 2008).

Automatic voice recognition (ASR), a system that analyzes voice captured by the microphone and formulates an output, sometimes a written transcript, is part of the CAPT system which enables students to practice freely on any subject and anytime (Levis & Suvorov, 2014). ASR has recently been encouraged to introduce voice-to-text skills in Computer Assisted Language Learning (CALL) (Kim, 2006; Strik, Truong, Wet & Cucchiarini, 2009). The researchers suggest two uses for ASR in the context of pronunciation education (Holland, 1999; Mostow and Aist, 1999), evaluating oral production in students and teaching pronunciation in a foreign language. Many research studies have been materialized in the second or foreign language at the segmental level for CAPT-based ASR (Kim, 2006; Mostow and Aist, 1999; Levis, 2007; Penning de Vries et al., 2014). The idea has been put forth that EFL students can improve their success with the language by repeatedly learning in-class skills

(Thornton & Houser, 2005). Yet, many EFL learners do not always have the chance to access face-to-face contact in the classroom (Chang, Yan, & Tseng, 2012), so using an ASR-based CAPT in this situation is frequently a good choice. The viability of this technology in language teaching has been the subject of numerous research conducted by ASR (Neri, Cucchiarini, & Strik, 2006). By providing formative and prompt input that activates their meta-cognitive language learning processes, ASR-based CAPT can assist EFL teachers as well (Chen, Zhang, & Liu, 2014). The latest studies covered computer-assisted pronunciation (CAPT) instruction and ASR-based pronunciation training programs. CAPT programs usually direct students through self-training with a wide variety of speech samples and provide opportunities for production practice, often with students repeating words or responding to unique stimuli (Neri, et al., 2008). Using CAPT software for individual speech activities has been made possible by technological advancement independent of an instructor's supervision. CAPT programs that utilize techniques such as ASR and voice recognition provide students feedback to enhance their pronunciation of foreign languages and raise their knowledge of speech errors (Tsai, 2019). There are also distinct uses of ASR technologies, such as offering voice user interfaces, taking acts based on voice commands or performing speech-to-text. Common examples of ASR encompass Siri on iPhones, Google Assistant on Android devices, and Rosetta Stone's voice recognition. In the past ten years, interest has also been sparked by mobile gadgets like smartphones, media players, and language-learning camcorders (Kennedy and Levy, 2008).

Students can learn autonomously in these systems at anytime and anywhere while they are used in the classroom as an attraction for teachers and parents, these research display that mobile devices may be useful for studying languages as well. CAPT programs can also reduce the instructor's educational burden and allow the language instructor to be a facilitator and not the only resource to improve speech production, particularly in large classes (Tsai, 2019). In addition, their multimedia ability can allow students to learn more authentically by placing learning according to their linguistic and cultural patterns (Joseph & Uther, 2009).

An increasing number of diverse Web 2.0 resources, such as e-learning platforms, blogs, podcasts, wikis, and social networking sites (SNSs), are being used in foreign language teaching and learning. SNSs found their place in virtually everyone's everyday routine over the past decade. Users use them to interact with friends, read the blog posts or comments of the people they follow, locate work, publish plans and images, and more (Java, Song, Finin, & Tseng, 2007). Researchers revolved around the educational and in particular, language learning

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opportunities they offer because present learners use these resources wisely and because of their communication potential (Lamy & Zourou, 2013; Lomicka & Lord, 2016). SNSs expand the classroom's boundaries in terms of space and time. They promote contact with teachers and between students, both in and outside the classroom (Kassens-Noor, 2012). With the help of these resources, teachers and students can stay in touch after class has ended. For instance, if they have any questions or would like to share relevant details not discussed in the classroom. These networks provide a casual and not pressurized atmosphere, making learners These networks offer a pleasant, stress-free environment that helps learners (Promnitz-Hayashi, 2011) feel more at ease when speaking with classmates, teachers, or native speakers (Lin, Warschauer, & Blake, 2016). SNSs could increase social interaction in online or hybrid learning and provide students with a sense of immediacy that is lacking in other online learning platforms (Dunlap & Lowenthal, 2009). One of the main benefits of using SNSs for educational purposes is that students can access institutional learning platforms without going directly to them. As they constantly monitor the notifications of the people they follow, pupils will come into contact with the content given by teachers, creating opportunities for informal learning. The informality of SNSs is often appreciated by students, but others are afraid to discuss their personal life with their teachers and prefer to study apart from SNSs, where they reveal a lot of personal information (Harrison, 2013).

The current study is a principled review. It is based on research pronunciation instructions with various computer-mediated software. This survey focuses on 15 research papers, which were rigorously reviewed and published in the journals referred to between 2015 and 2020. The studies have been performed across a wide range of local and academic settings.

Method

Reviewing prior computer-assisted pronunciation instruction and evaluation studies in terms of research themes, research methodologies, instruments employed, and research findings is the primary goal of this work (see Table 1). In the second language or foreign language field in this context the leading journals in the English field were selected according to these criteria: The journals are indexed in the Social Sciences Citation Index (SSCI) or the Emerging Sciences Citation Index (ESCI) as well as in the scope of journals that research using technology in secondary and foreign language teaching. These five leading journals comprised in the scope of this review as a result of this categorization: CALICO Journal, Computer

Assisted Language Learning (CALL), British Journal of Educational Technology, Language Learning and Technology, and ReCALL (see Figure 1).

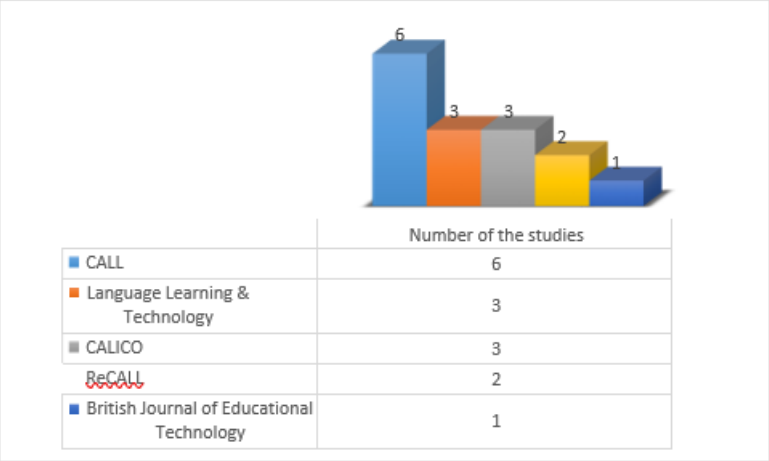

Figure 1. The number of the studies in each journal

Each of these issues was reviewed and the related studies were downloaded after the decisions were taken in the journals. Each article was then analyzed and the necessary data for each study was tabled. Three key sections of each article (abstracts, methods and results) were studied carefully during this process and other sections were also consulted if necessary.

The review contains 15 articles over the previous five years (2015-2020). In order to advance current research, older studies are also presented. The year 2018 has been left out of the following graph because there were no notable international studies published in that year.

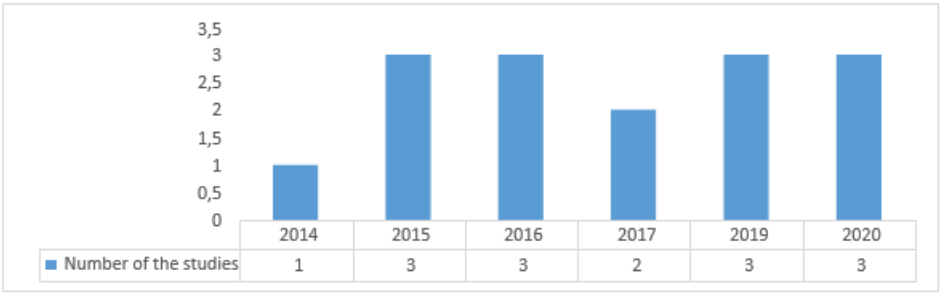

Figure 2. Years of publication

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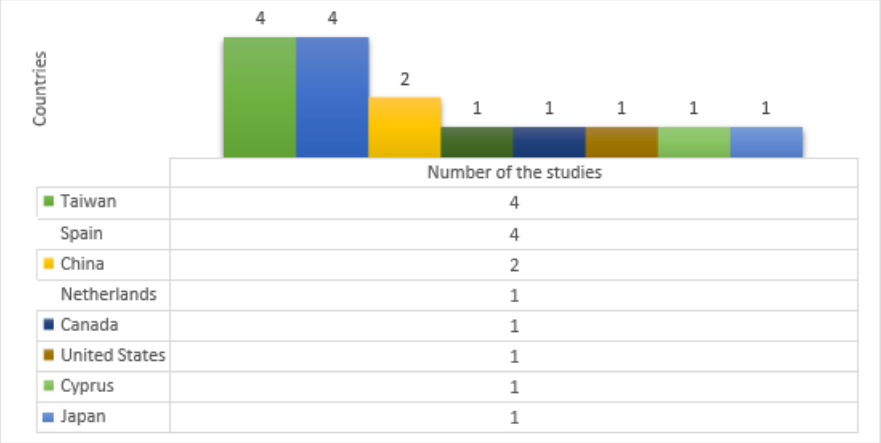

Figure 3. Context of the studies

Examining Figure 3, it can be concluded that the studies were mostly conducted in Taiwan and Spain between 2014 and 2020.

Table 1. *Topics and Context*

Source	Type of the Study	Focus	Context	Tools
Liwei Hsu (2015)	Quantitative	to investigate the connections between the components of perceptual learning strategies for EFL learners and adoption of technology.	341 EFL learners	ASR based app
Evers & Chen (2020)	Quasi- experimental	the effectiveness of adults using an automated speech recognition (ASR) system with peer feedback against individual practice.	64 adult learners	Speech notes
Cavus & İbrahim (2017)	Experimental	to determine whether using the created interactive mobile application may help English language learners increase their learning abilities such as vocabulary, pronunciation, listening, and comprehension without the help of an instructor.	37 young students	Near East University Childrens' Story Teller (NEU-CST)
Luo (2014)	Quasi- experimental	To investigate the effectiveness of a computer-assisted pronunciation training (CAPT) technique that incorporates oral reading and peer evaluation to improve pronunciation among Taiwanese English major students.	55 students	Goldwave (recording software) and Blackboard (Bb)
Doremalen, Boves, Colpaert, Cucchiarini & Strik (2016)	Mixed method, case study	to assess a version of an automatic speech recognition (ASR)-based approach for learning languages that gives feedback to Dutch language learners on a range of speech performance factors, such as pronunciation, morphology, and syntax.	Students and Teachers	DISCO project (ASR-based CALL system)

Gao & Hanna (2016)	Quasi- experimental	To look into how pronunciation performance of younger Chinese EFL students with lower-intermediate levels of proficiency is affected by instructional software and to examine the connections between learners' attitudes, motivation, and success.	60 Chinese-speaking students	New Oriental Pronunciatio n
McCrocklin (2019)	Qualitative study	to investigate student viewpoints, identify benefits and drawbacks of dictation software use, and come up with suggestions for the best ASR dictation tool.	16 advanced ESL participa nts	Windows Speech Recognition
Liakin, Cardoso & Liakina (2015)	Mixed method study	To use automatic voice recognition to look into how the L2 French vowel /y/ is learned in a mobile-assisted learning environment (ASR).	42 elementa ry French students	Nuance Dragon Dictation (Mobile ASR app)
Martin (2020)	Experimental study	to investigate how the pronunciation abilities of distant language learners change during their first semester of university language education with and without specific pronunciation training.	67 distance learners of German	innovative Cued Pronunciatio n Readings (iCPR)
Fouz- González (2019)	Experimental study	to investigate whether a podcast- based method might improve pronunciation of sounds that seem to have become fossilized among language learners.	47 native speakers of Spanish	Minute English podcast series by the BBC
Fouz- González (2017)	Quantitative study	To look into the possibility of using Twitter in conjunction with explicit instruction and technology to help EFL students pronounce the features that are frequently mispronounced. Owing to absence of type or specific instruction, insufficient exposure to the target language, challenging sound spelling, or a mix of these correspondences, relationship between learner interaction level and improved pronunciation, students' response to the approach taken, and use of social networking sites, among other factors (SNSs).	121 students enrolled in a Medicine ESP course	Twitter
Mompean & Fouz-González (2016)	Quantitative study	to see if Twitter might encourage online participation and can improve the pronunciation of a few phrases that EFL students frequently mispronounce.	16 natives Spanish EFL students	Twitter
Fouz- González (2020)	Experimental study	to investigate how the English File Pronunciation (EFP) software can aid learners of other languages in become better at pronouncing words.	52 EFL students of Spanish	English File Pronunciatio n app
Tsai (2019)	Qualitative study	to learn more about software users' perceptions of the mediated assistance system, how they find using it, how they feel about it, and most importantly, how peers can mediate students' pronunciation learning using MyET, a CAPT framework created in Taiwan.	60 junior college program students	MyET, a CAPT system designed in Taiwan

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Kıbıshı, Hırabayashı & Nakagawa (2015)	Mixed method study	To estimate the pronunciation and intelligibility scores of presentations made in English by Japanese speakers using offline techniques for Japanese English learners, and to look into the relationship between two scores (pronunciation proficiency and intelligibility) rated by native English teachers and various measures used to estimate a score.	5 English teachers	online real- time score estimation system

Results

In the sense of content analysis, the key subjects addressed internationally were pronunciation instruction through ASR-based tools, pronunciation instruction through SNSs tools and pronunciation instruction through other CAPT software tools in foreign language teaching settings.

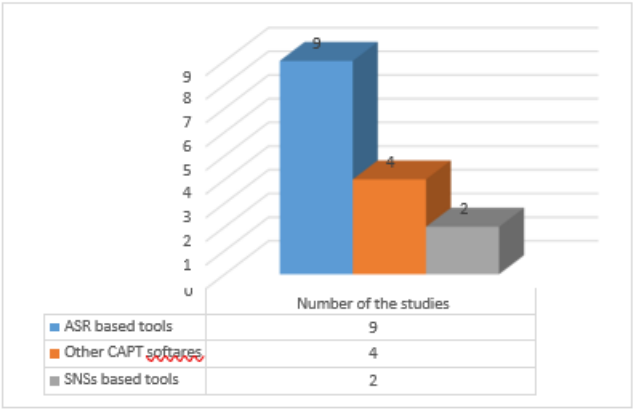

Figure 4. Topics of the studies

Pronunciation Instruction Through ASR-Based Tools

Any research on CALL's overall effectiveness is a valuable academic and practical contribution since it has become a prevalent tool in language teaching and learning that meets the needs of students who lack real-world experiences. A large number of studies have been classified in several contexts concerning teaching pronunciation with WEB 2.0 resources in this study 9 research out of 15 were related to teaching/instructing pronunciation through Automatic Speech Recognition (ASR) tools. ASR-based CAPT offers both speech- to-text and detailed input on enhanced pronunciation or additional practice. EFL students were recommended that they develop English by repeatedly practicing their learned skills in their classes (Thornton & Houser, 2005). However, many EFL students do not always have the possibility of in-class face-to-face contact (Chang, Yan, and Tseng, 2012). In this connection, the use of CAPT based on ASR is an alternative. In this review, New Oriental Pronunciation

(NOP), Windows Speech Recognition, Nuance Dragon Dictation (Mobile ASR app), MyET (a Taiwan-designed CAPT System), Online Real-time Score Examination System, Speech notes, Near East University Children's' Story Teller (NEU-CST) and DISCO (ASR-based CALL system) tools were used.

Gao and Hanna (2016) explored the efficacy of pronunciation teaching with instructional software (New Oriental Pronunciation) in the group of Chinese learners of English and the relationship between the attitudes of learners to pronunciation and pronunciation learning. Results revealed that the highest improvement in output was obtained by students receiving combined instruction (teacher and software instruction), who also demonstrated the greatest (positive) improvement in pronunciation. In line with these results, Tsai (2019) discussed how students feel about the computer's mediated assistance, difficulty and use attitudes, and how peers can help mediate students' pronunciation learning through MyET (a Taiwan-designed CAPT System) and discovered that technology mediation and human mediation can be complementary of each other and respectively have roles which cannot be replaced by each other. In support of this research, Evers and Chen (2020) focused on how adults' pronunciation performance varied with peer feedback and individual practice when using automatic speech recognition (ASR), speech notes, and discovered that using ASR with peer feedback was more satisfying. They also discovered that using ASR-based exercises with peer feedback is less adverse for students to use, and it is relatively simple to incorporate in a classroom.

Liakin, Cardoso and Liakina (2015) explored whether mobile device-based ASR pronunciation instructions will increase French /y/ development and perception within three groups of ASR group (they used ASR app in their mobile phones and no human interaction), non-ASR group (with a teacher providing feedback) and experimental group (teacher instructed but no feedback was given). The group that received training in an ASR-based environment had a significant improvement in /y/ output, according to the results. Similar to this, McCrocklin (2019) investigated student viewpoints, discussed the benefits and drawbacks of using digital dictation tools and came up with suggestions for the best ASR pronunciation program (Windows Speech Recognition) for pronunciation. Findings indicated that ASR's advantages included its simplicity, usefulness for pronunciation learning as a result of feedback provided, and adequate understanding of pronunciation issues.

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However, there were also drawbacks, embodying frustrating levels of acknowledgment, particularly on the first try, doubts about the software's transcription abilities, and an overall lack of convenience. Using automatic speech recognition (ASR), Doremalen, Boves, Colpaert, Cucchiarini, and Strik (2016) evaluated a model of a language learning program that provides feedback to Dutch language learners on several elements of speech output (pronunciation and syntax). They deduced from these ratings that subject matter experts, educators, and students are generally positive about the framework, found it helpful, and intend to apply it if they have the opportunity. According to Cavus and Ibrahim's (2017) investigation into the potential of using an already-existing interactive mobile application to improve vocabulary, pronunciation, listening comprehension, and other learning abilities in English language learners, students who received instruction operating the ASR tool outperformed the control group, especially in the area of pronunciation.

Kıbıshı, Hırabayashì and Nakagawa (2015) studied the pronunciation of Japanese speakers in English and their intelligibility with an online learning evaluation system (online real-time score examination system) for English pronunciation developed by the researchers and the relationship between two scores and results suggested that learners' pronunciation skill and intelligibility were enhanced by practising the introduced online system.

Contrary to the results of these studies, Hsu (2015) explored the structural connections between the models of perceptual learning and acceptance of technology among EFL learners and found out that there were no significant diversities according to learner styles and perceived usefulness and also suggested that learners may be more volunteer in practicing pronunciation face to face.

Pronunciation Instruction Through SNSs Tools

SNSs expand the classroom's physical and temporal limits. They encourage contact both in class and out of class between students or between teachers and students. In this review, Twitter as a CAPT software was exercised.

In the Spanish context, Mompean and González (2016) explored whether Twitter is capable of promoting online participation and whether it has a positive impact on the pronunciation of several words that EFL students commonly mispronounce. Results indicated that the Twitter-based training had a positive influence on the pronunciation of the target terms by the students. Furthermore, Fouz-González (2017) explored Twitter's pronunciation

guidance possibilities and explored the Twitter-based approach potential to help English Foreign Language learners (EFL) develop their pronunciation of segmental features and he found that the training with Twitter facilitated substantial changes in the pronunciation of the target characteristics of the learners and continued to develop over time.

Pronunciation Instruction Through Other CAPT Software Tools

Besides ASR and SNSs tools, there were some other computer-assisted tools used in studies. Innovative Cued Pronunciation Readings (iCPR), EFP (English File Pronunciation), Podcast and Goldwave are the tools used in these studies.

Martin (2020) discussed how competencies in distance language learning develop with and without targeted pronunciation training while students were taking their first semester of university language courses using iCPR, which consists of perception and development exercises with perceptual units typically coming before the production units. The findings specify that learners who received focused pronunciation instruction using a computer-assisted pronunciation training method fared much better than those who did not. Additionally, Fouz-González (2019) investigated the potential of using podcasts to help non- native speakers of a language improve the pronunciation of linguistic features that are frequently fossilized in their native tongue. He obtained that the training provided by the podcast had a positive impact on the participants' interpretation and production of the target sounds. Similarly to this, Fouz-González (2020) investigated how the EFP (English File Pronunciation) application could assist EFL students in apprehending and developing a variety of segmental features that typically tend to be fossilized in their interlanguage and found that the EFP training app significantly improved how learners interpret and develop objective characteristics. In order to improve pronunciation for major English-language students, Luo (2014) tested a CAPT technology in a Taiwanese context, incorporating oral reading and peer-reviewing. She discovered that the integration of the CAPT technique was superior to just in-class teaching in terms of lowering the pronunciation issues of the students.

Conclusion

The current pandemic with coronavirus reflected how important emerging technologies, including networking, entertainment and education, are in many aspects of life. Currently, the technical possibilities of language learning, in general, are undeniable. Technology provides the learner with an infinite choice of what, where and how. Continuing

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technical advancements are gradually increasing the reach of learning performance so learners can engage in meaningful dialogues or take part in real-world games that show their ability to make understandable speech rather than only recording single sentences or sounds.

This paper explores approaches to the analysis used in computer-assisted pronunciation training from 2015 to 2020. Analysis of the research has shown that, most of the studies conducted using ASR-based tools such as New Oriental Pronunciation (NOP), Windows Speech Recognition, Nuance Dragon Dictation (Mobile ASR app), MyET (a Taiwan-designed CAPT System), Online Real-time Score Examination System, Speech Notes and DISCO (ASR-based CALL system), secondly other CAPT based tools such as innovative Cued Pronunciation Readings (iCPR), EFP (English File Pronunciation), Podcast and Goldwave and Twitter as SNSs based CAPT tool. There are certain advantages and disadvantages listed in this review by CAPT. Examining studies, it is clear that computer- assisted pronunciation training primarily has benefits. Findings of the studies demonstrated that using CAPT-based tools had a positive impact on each study. The benefits of CAPT included ease of use, usefulness for learning pronunciation due to feedback provided, and a sufficient understanding of pronunciation issues. However, there are also a few minor drawbacks. Frustrating levels of acknowledgment, particularly in the first attempt, concerns about the transcription skills of the software, and lack of convenience were the disadvantages spotted in these studies.

Feedback is a concern too. The level of detail and accuracy of the input in the digital environment, whether segmental or suprasegmental, despite recent major improvements, remains a challenge. Some studies revealed that teacher and CAPT software feedback together or peer feedback supported by CAPT software have positive impacts on the learners. While some studies imply that the feedback provided by CAPT software alone has a favorable impact on pronunciation improvement, technology mediation and human mediation can support one another and each has functions that cannot be replaced by the other. Feedback must be accurate and reliable, whether automated or not and there remain limits in real-time, robust or easy to understand, despite ASR innovations. The partial associations between working memory and language performance were consistent with the weak influence of working memory on total language performance (Juffs & Harrington, 2011). As language performance is influenced by a variety of contextual and performative elements, the impacts of other performance variables such as strategy, context, and familiarity that may outweigh those of working memory should be incorporated into further research (McCutchen, 2000). There is evidence supporting the

positive effects of working memory on long-term language development (Kormos & Sáfár, 2008), so it would be beneficial to examine the effects of working memory on performance over an extended period of time or in conjunction with other production-related variables such as attitudes and strategies.

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