

PEDAGOGICAL CONTENT KNOWLEDGE: A SYSTEMATIC REVIEW OF CHINESE LANGUAGE PRONUNCIATION TEACHING IN THE CFL CONTEXT

Abstract

The increasing attention on Chinese as a foreign language (CFL) pronunciation instruction gives us an opportunity to look into the current directions of teaching Chinese as a foreign language and the specific instructional pronunciation strategies employed by CFL teachers. This paper offers a review of empirical evidence on the use and impact of instructional pronunciation strategies in the CFL field from 1980 to 2019. Our findings reveal that: (1) controlled segmental-based strategies—such as comparative strategies, listening, and repeating strategies—are used widely and effectively to improve pronunciation of Chinese initials and finals; (2) suprasegmental-based strategies, especially computer-assisted strategies, largely improve CFL students' tone accuracy; and (3) the validity of assessments in quantitative studies needs to be further developed by including comparative groups, making tests before and after instructions, and involving discourse assessment contents.

Keywords: instructional pronunciation strategies (IPS); impact; Chinese as a foreign language (CFL)

1. Introduction

Benefiting from the rapid economic development in China, the teaching and learning of Chinese have commanded great attention in recent years. However, compared to other Chinese language skills (writing, reading, and listening), pronunciation has received limited attention (Jiang & Cohen, 2012). Hurtado & Estrada (2010) claimed that pronunciation should be regarded as one of the most important aspects of teaching in the second language (L2) context since it enables L2 speakers to communicate intelligibly with native speakers and directly presents their level of speaking ability (Morley, 1994; Müller, 2013). Improving pronunciation skills is an ongoing process, and having access to instructional pronunciation strategies allows teachers to improve students' pronunciation more effectively (Morley, 1991). Research has documented the benefits of pronunciation instruction in the field of second language acquisition in a wide range of languages, with a wide range of participants and instructional strategies. This applies to pronunciation instruction in Chinese as a foreign language (CFL), too. Even though a growing number of studies has claimed the effectiveness of specific instructional pronunciation strategies in the CFL field (Dong et al, 2019; Mok et al, 2018; Wiener, Chan, & Ito, 2020), more detailed and specific content with regard to pronunciation instructions is yet to be discovered. This includes the questions of what activities are being conducted before and in pronunciation teaching classes, and how language teaching theories, models, and strategies are being

integrated as pedagogical tools in CFL pronunciation instruction.

Scoping review, as a methodology to clearly present the research gap by concrete search items, has attracted increasing attention from different research fields, such as health (Archer, Fevrier-Thomas, Lokker, McKibbin, & Straus, 2011) and education (O’Flaherty & Phillips, 2015). To guarantee rigor in following this research approach, the methodology follows a prescribed a procedure that guarantees transparency and replicability. The present study builds on the procedure as prescribed by Arksey and O’Malley (2005). Their five-step review procedure starts from a clear conceptual and theoretical base. In the present case, this points at the need to analyze and discuss the literature related to CFL pronunciation instruction in higher education.

1.1. Theoretical framework

In the research on foreign language teaching before the 1980s, teaching methodologies were in the process of shifting from grammar translation to the audiolingual method and to communicative language teaching (Richards & Rodgers, 2014; Freeman, 2002). The relationship between teaching content and teaching processes, such as teaching activities, methods, and techniques, are in an unbalanced situation. Teaching processes are depending on and serve the teaching content. Later on, in the 1980s, inspired by the theory of “decision-making”, researchers in the field of foreign language teaching linked the concept of decision-making to pedagogical judgements, beliefs, and knowledge structures (Johnson & Ma, 1999). Shulman (1987) came up with the notion of “pedagogical content knowledge (PCK)” and argued that teachers’ knowledge derives from disciplined-based content and training-based pedagogy. Grossman (1990) believed that teachers should have both knowledge of subject-matter to select appropriate teaching topics and knowledge of students’ prior knowledge and proper strategies to formulate the content to be learned. Bukova-Güzel (2010) reviewed the research that had been conducted concerning PCK, and concluded that PCK comprises teacher knowledge of curriculum, knowledge of learners, and knowledge of instructional strategies and multiple representations. In the case of foreign language teaching, caused by the particular characteristics of language teaching class, the target language is regarded both as a subject matter and as a teaching tool in class. Moreover, in terms of oral language teaching, especially pronunciation teaching, the teaching content is determined by a curriculum that takes into account oral competences and heavily relies on specific instructional strategies that support oral communication (König et al., 2016).

1.2. Pronunciation instructions in the CFL context

Several pronunciation studies have investigated the importance of L2 pronunciation instruction

by observing L2 pronunciation instructors' strategies in the classroom (Saito, 2011, 2012) or laboratories (Pennington & Ellis, 2000). Instructional pronunciation strategies were divided into two categories according to the target pronunciation features (Burns, 2003): segmental-based instructions (e.g., initials and finals) and suprasegmental-based instructions (e.g., tones, intonation, and stress). Previous L2 pronunciation studies have revealed that segmental-based instructions were the major focus for pronunciation instructions, because segments may be explained with relative ease (Coniam, 2003). In the CFL context, the importance and effectiveness of pronunciation instructions have been increasingly emphasized and considered as a promising feature compared with other Chinese language features. Studies relating to CFL pronunciation instructions show that these strategies help students to feel more confident when speaking Chinese because they have better pronunciation, improve students' awareness of Chinese pronunciation features, and encourage students to be more active in class, when compared with traditional pronunciation teaching (Zhang, 2006; He, Wang & Wayland, 2016). In these instructions, a variety of strategies are used to teach Chinese pronunciation. For example, comparisons between two different languages, listening, and repetition are popular strategies in traditional Chinese pronunciation instructions, where students are trained in one aspect of Chinese pronunciation (Zhang, 2006). Computer-aided strategies are used to train CFL students intensively through direct visual or auditory stimuli and ensure that each student receives an equal amount of feedback (He, Wang & Wayland, 2016).

2. Previous literature reviews of L2 pronunciation instructions

Previous reviews of the literature on L2 pronunciation instruction have been diverse in both analytical approach and review focus.

Lee, Jang & Plonsky (2015) employed a meta-analysis approach to review 86 studies in order to explore the effectiveness of pronunciation instruction and the relationship between pronunciation instruction, different contexts, instruction types, and outcome measures. The within-group and between-group data showed medium to large positive effects through the implementation of pronunciation instructions, and further revealed that L2 learners of different proficiencies may benefit from pronunciation instructions. In addition, Lee, Jang & Plonsky found that laboratory-based pronunciation instruction may produce stronger effects than instructions in classrooms. However, in contradistinction with this finding, they also reported that technology- or computer-based pronunciation instructions were less effective than human-delivered instruction, and in particular that human teachers' provision of appropriate feedback on L2 learners' specific errors achieved positive outcomes.

Saito (2012) reviewed 15 studies in order to examine three independent variables (focus of instruction, type of instruction, and type of outcome measures) and reported significant overall improvement in all but two studies (arguably because instruction time was too short (just 15–30 minutes) in the first of the two studies that did not report marked improvement, while pre-

test scores were extraordinarily high in the second). Saito reported that five studies used segmental-based instruction, while seven used suprasegmental-based instruction. Of the six focus-on-form instruction studies, all showed improvements at either a control (six studies) or a spontaneous (two studies) level. Improvements were also presented in eight focus-on-forms studies measured at a control level, and the other three studies failed to show any improvements which measured at a spontaneous level. Likewise, both controlled constructed responses and free constructed responses improved.

Thomson & Derwing (2014) conducted a narrative review of 72 studies undertaken between 1982 and 2013, 82 percent of the 72 studies reported significant improvement. Native-like pronunciation, rather than intelligibility, was the goal for most of the studies, and the majority focused on segmental-based instruction. Reading-aloud tasks were the main assessment type that was used by eighty percent of the studies, and twenty percent of the studies measured the outcomes with spontaneous speech. Seventy-three percent of the studies assessed the outcomes in the form of reading certain words or sentences. Assessments which only aim at testing students' pronunciation (such as reading words or sentences, imitation) were categorized as form-oriented assessments. Assessments, like picture describing tasks or spontaneous speech, focusing on testing students' pronunciation and communication abilities were categorized as meaning-oriented assessments.

Some researchers, including Barrera (2004), Gilner (2008), and Pourhossein (2016), have reviewed the factors that may influence the effectiveness of pronunciation instructions. However, only Barrera (2004) has reviewed studies with specific instruction procedures and outcomes. He concludes that fluency-oriented training is more effective than individual segmental instructions, and that pronunciation instructors should adapt their strategies to substantial suprasegmental utterances in order to improve learner performance. Gilner (2008) and Pourhossein (2016) do not provide specific details of the pronunciation instructions that were used in each study.

Despite the focus on advantages in the review studies, a few drawbacks and gaps have been also unveiled. None of the existing reviews proposes any theoretical framework that could guide L2 pronunciation instruction. As for the pronunciation instruction in the CFL field, the situation is even worse. Indeed, thus far, there has been no comprehensive review of the wide range of instructional pronunciation strategies (IPS) that could be applied to map and improve the various aspects of Chinese pronunciation instructions. Hence, there is an urgent need for a comprehensive overview of the existing research on CFL pronunciation instruction as this will provide practical guidance for future related investigations. The present study, which is relevant to the development of IPS studies on Chinese pronunciation instruction, aims at providing a comprehensive framework specifically for CFL pronunciation instruction. We also hope that this scoping review will raise CFL researchers' awareness of the implementation of these strategies and draw further attention to pronunciation instruction.

3. Methodology

The starting point for this scoping review was to establish a research design that advised on the broad research questions to be addressed and the overall study protocol, including identification of key search terms and the databases to be searched.

3.1. Identifying the research questions

In order to explain the most crucial aspects of the instructional pronunciation strategies that are used in CFL studies and ensure that all of the important literature was included in our review, our research was guided by the following initial questions:

1. To what extent do scholars refer to research on L2 pronunciation instruction when they conduct research on CFL pronunciation instruction?
2. Which effective instructional pronunciation strategies are currently implemented in CFL classes?
3. What is the empirical evidence regarding the impact of implementing instructional pronunciation strategies?

3.2. Identifying relevant studies

Crucial definitions and key words are generated to search the literature relating to pronunciation learning and teaching as well as pronunciation strategies within higher education from multilingual CFL perspectives. The linked search items that were used to direct the search routes are outlined in Table 1.

Table 1. Key search items

“Pronunciation teaching” OR “instruct*” OR “theor*” OR “model”
“Undergraduate” OR “students” OR “university”
“CFL” OR “Chinese as a second language” OR “Mandarin” OR “Chinese”

Note: * Different types of morphology of this vocabulary.

A variety of sources were searched to gather the material that was needed to address our research questions. Databases are one of the most effective ways to acquire the full contents and abstracts of publications. References cited in publications are also useful for literature review, and help to ensure that all of the relevant studies are included. O’Flaherty & Phillips (2015) suggest that “educational subject headings” and “Boolean operators” may be utilized to refine literature searches. “Educational subject headings” are the subject headings that are used in education, while “Boolean operators” are simple words (and, or, not, and not) that are used

as conjunctions to combine or exclude certain search items and thereby produce more refined and informative results (Jonsson & Tarski, 1952).

In order to identify the resources as comprehensively as possible, criteria were formulated in terms of the time span and language of related publications. It is generally considered that CFL pronunciation studies emerged in the 1980s (Yang, 2008; Zhao, 2005), and earlier studies are neither systematic nor practical. Therefore, our scoping review covered the period from 1980 to 2019. A full list of “inclusion and exclusion criteria” (O’Flaherty & Phillips, 2015) is provided in Table 2.

Table 2. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Time period	1980 to 2019	Pre-1980 studies (no CFL instructional pronunciation studies).
Language	English and Chinese	Non-English and non-Chinese.
Type of article	<ul style="list-style-type: none"> Original research published in a peer-reviewed journal. Peer-reviewed and published masters’ theses. 	Studies without peer-review or unoriginal research.
Study focus	<ul style="list-style-type: none"> University students in higher education. Teachers teaching Chinese pronunciation in a CFL/CSL context. 	Students or teachers not in higher education contexts.
Literature focus	<ul style="list-style-type: none"> The main topic of the article relates to pronunciation instruction in a CFL/CSL context. 	Article partially discusses pronunciation instruction in a CFL/CSL context; personal comments.
Population and sample	<ul style="list-style-type: none"> Students enrolled in a formal undergraduate study. Teachers teaching Chinese pronunciation in a CFL/CSL context. 	Students not enrolled in a formal undergraduate program; teachers not teaching Chinese pronunciation in a CFL/CSL context.

The initial search began on February 13, 2018 in four electronic databases—CAJ (China Academic Journals via CNKI), Elsevier ScienceDirect, ProQuest, and Web of Science—to identify peer-reviewed publications. In view of guaranteeing the quality of this step, these databases were selected because they provide comprehensive – geographical - coverage of CFL instructional pronunciation strategies. In addition, references to studies discovered during the search process—which might generate new relevant publications—were taken into consideration. The whole search process was completed in June 2020. The database search procedure was carried out at least twice for each database to guarantee that publications were not missed given the time window in searching for the literature.

3.3. Study selection

A total of 549 articles were identified using the key search items. However, a large number of these were subsequently deemed irrelevant to our review, especially those relating to native-Chinese or inherited-Chinese students, high schools, and primary school Chinese pronunciation instruction. In addition, articles that discussed instructional pronunciation strategies in contexts other than teaching classrooms and labs, or outside of CFL/CSL classrooms, were excluded. Duplicated articles were removed, too. Only 22 articles remained following this filtering process; full-text versions of these were then obtained. During the process, a number of articles were identified on the basis of selected article references.

The process of article screening was based on Tricco et al.'s (2009) PRISMA framework to map systematic reviews and meta-analyses, as shown in Figure 1.

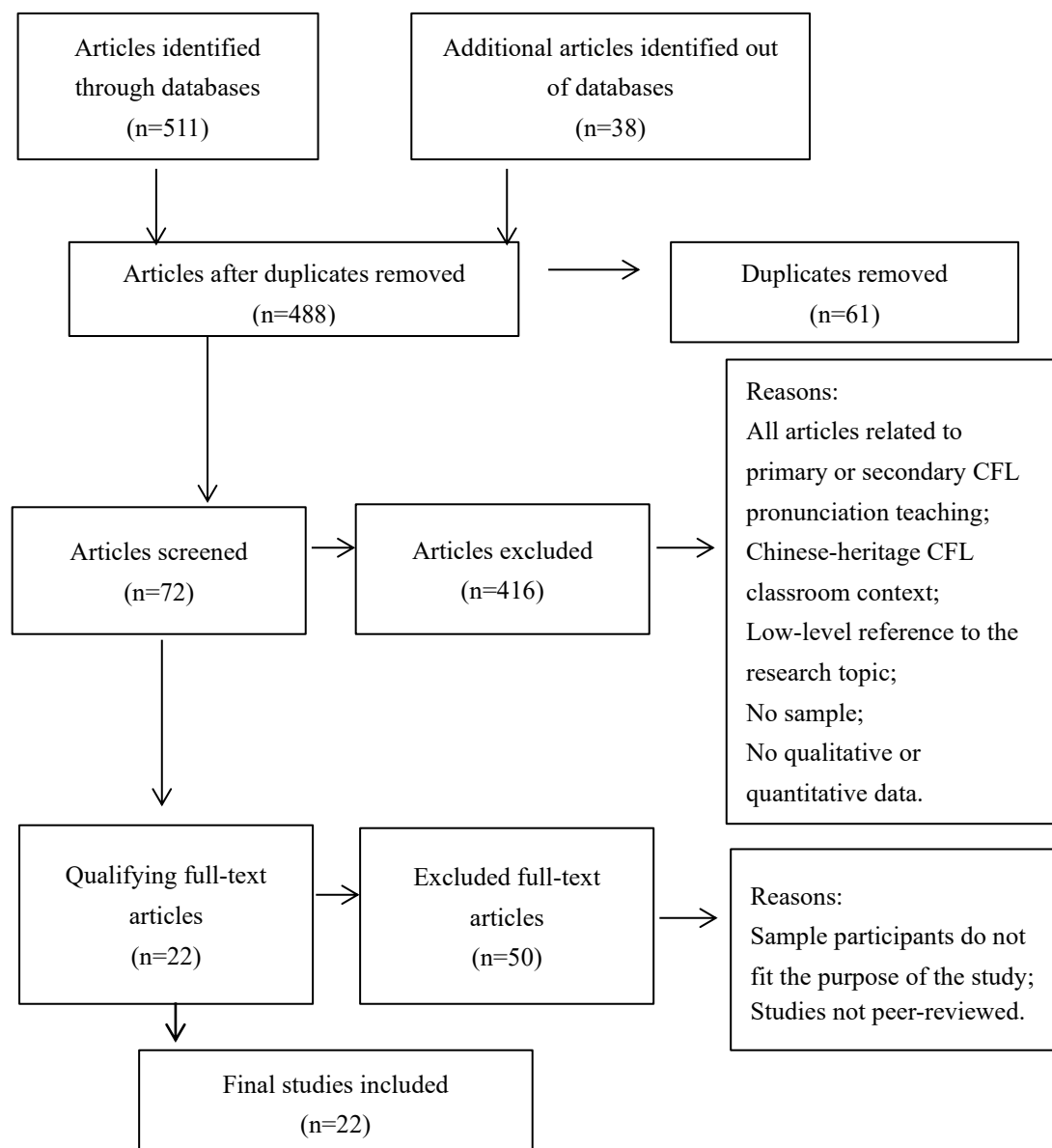


Figure 1. PRISMA flow diagram for article selection

3.4 Data charting

Arksey & O'Malley (2005) suggest that all of the relevant information contained within articles selected for review should be charted. In our review, this information includes: author, year of publication, location of study, research design, methodology, sample size, and a brief summary of each article's limitations and recommendations. Details are shown in Table 3.

Table 3. Included studies

Author	Year	Location	Intervention/in-class/pre-class	Research design/sample size	Outcomes
(1) Li	2013	Chinese	“Tongue twister” method so as to improve the fluency and accuracy of Korean CFL learners’ pronunciation. Pre-class: traditional teaching method In-class: active teaching activities including visual pictures to display the Chinese tones, presentation teaching, video teaching.	N=6, participants were BA3 bachelor Korean CFL learners. Five-class (7.5-hour) experiment with specific teaching steps connected to “tongue twister” practices. Three dictations to check the effect of a “tongue twister” at the beginning, middle, and late teaching period.	Grades on three dictations gradually improved. Successful for students and teachers. Limitations relating to the teacher’s organization: too many participants for one-to-one tutoring.
(2) Xia	2016	Chinese	Three-class pronunciation teaching designs related to Chinese vowels, consonants, and tones. In-class: role play, drill exercises, games, audio practice.	N=7 Three redesigned classes recorded. Participants were CFL adult beginners from different countries. Unit test and mid-semester test design.	Students spent more time practicing pronunciation in class and outside class, and were more active in the redesigned course. Students’ scores improved significantly. Limitations: small size samples, no feedback from students.
(3) Li	2011	Chinese	Four-month pronunciation training course on all aspects of Chinese pronunciation (80 hours teaching time). In-class: correction, drill exercises, reading.	N=22, participants were Korean CFL beginners. Qualitative measures were elicited through teacher’s observation.	Improved learning results and specific pronunciation teaching suggestions generated for teaching Korean CFL learners. Limitations: no feedback survey from students on the training course; teaching methods were traditional, and no teaching techniques were involved.
(4) Dalijia	2012	Chinese	Pronunciation training classes on for Mongolian CFL beginners. In-class: audio teaching, visual materials, imitation, games.	N=60, participants were Mongolian CFL undergraduate beginners. Qualitative pre-survey relating to students’ pronunciation learning and post-survey relating to teachers’ and students’ satisfaction.	Provided specific teaching design for Mongolian learners. High satisfaction response from students and teachers. Limitations: the strategies listed in the teaching design were specific to Mongolian learners as they were based on the differences between their native language pronunciation and Chinese; no innovative teaching strategies were suggested.
(5) An	2011	Chinese	Several instructional pronunciation strategies for Russian CFL learners. In-class: imitation of teachers’ pronunciations, reading, use of apps (Praat, Speech, or Mini-speech lab) to help students distinguish between their own pronunciation and the teacher’s pronunciation, use of body language, comparative teaching.	N=20+ Qualitative and quantitative data from an anonymous, open-ended questionnaire and three reading records.	Provided a few pronunciation teaching strategies for Russian CFL learners. However, no survey or training classes were carried out, so the effects of these strategies remain uncertain.
(6) Lei	2012	Chinese	Comparison between game-focus pronunciation	N=24.	Quantitative results: no obvious improvement in

			<p>teaching class and traditional pronunciation teaching class.</p> <p>Game-focus class: pronunciation spelling competition, tone distinguish competition.</p> <p>Traditional class: listening comprehension, reading.</p>	<p>Pre-survey and post-survey qualitative and quantitative data given.</p> <p>Post-tests of students from both classes recorded.</p> <p>Responses to a questionnaire (N=12) at commencement and completion of the redesigned class.</p>	<p>learning outcomes. More than half of the students considered the games helpful, but felt they should not be overused.</p>
(7) Zhong	2016	Chinese	<p>Experimental Chinese t3 teaching course with instructed strategies for Malagasy CFL beginners.</p> <p>Traditional class: first teach the full t3, then t3 sandhi, concentrating on all tones pronunciation; use gestures and games to enhance students' understanding.</p> <p>Experiment class: first briefly explain the full t3, then t3 sandhi, concentrating on t3 sandhi; use piano tunes to train students' t3 and t3 sandhi sense; utilize gestures and games.</p>	<p>N=20 (10 students in each class)</p> <p>Twenty pronunciation records, and another four from native Chinese speakers.</p> <p>"Praat" software used to compare and analyze CFL learners' pronunciation accuracy.</p>	<p>Quantitative results: no obvious improvement in monosyllabic t3 vocabularies. Improved grades in bi-syllabic t3 vocabularies.</p> <p>Limitations: not continuous teaching; no feedback from students.</p>
(8) Sen	2012	Chinese	<p>Special pronunciation training courses for Japanese CFL learners.</p> <p>In-class: compare the differences between Chinese and Japanese pronunciation; teach pronunciation based on each student's weaknesses; explain the correct pronunciation.</p>	<p>N=4.</p> <p>Qualitative and quantitative data collected, but only two students' compared data provided.</p>	<p>Quantitative data: two students' pronunciation accuracy improved significantly.</p> <p>Limitation: only appropriate for a small size class (less than five).</p>
(9) Wang et al.	2002	English	<p>Two-week perception training program based on Logan et al.'s (1991) high-variability procedure to help American CFL learners to produce the four Mandarin tones.</p> <p>In-class: four tones trained by the sequence of two words written in pinyin transcriptions and featuring different tone combinations. The tone combinations presented with increasing difficulty. Two alternative forced-choices talk which students needed response in 2s to identify the tones in the talk. Immediate feedback given after each stimulus.</p>	<p>N=16.</p> <p>Pre-test, post-test, and retention test conducted.</p> <p>Quantitative data analyzed by ANOVA.</p>	<p>Post-test showed significant improvement (21 percent) in the trainees' overall tone perception accuracy. Moreover, this improvement was retained six months after the training.</p>
(10) Zajdler & Chu	2019	English	<p>Longitudinal tone instruction training (34 weeks) for Polish CFL students to improve their Chinese tones.</p> <p>In-class activities: shadow-reading-like technique to teach the sequence of Chinese</p>	<p>N=11.</p> <p>Pre-test and post-test conducted.</p> <p>Quantitative data analyzed using a linear mixed-effect model.</p>	<p>The tonal contours of T1, T3, T4, and neutral tones (T0) improved significantly after 22 weeks of phonetic training. The end points of T1, T4, and T0 and the start points of T4 and T0 also improved. So, all Chinese tones improved</p>

(11) Zhang	2012	English	<p>vowels with tones, segmental and suprasegmental phonetic units, morphemes/lexemes, and phrases and sentences.</p> <p>Experimental study (30 hours) to investigate the effectiveness of active techniques to instruct students on the differences between male and female speakers in a control group and an experimental group in the range of their fundamental frequency (F₀).</p> <p>Experimental group: 8 male and 4 female Australian CFL beginners.</p> <p>Control group: 5 male and 5 female Australian CFL beginners.</p> <p>Instruction: use humming, clapping to rhythms of the language, movement, and gestures to enhance perception of rhythmic patterns based on a “somatically enhanced approach.” Sptool were used to present listening stimuli.</p>	<p>N=22.</p> <p>Pre-test and post-test conducted.</p> <p>Quantitative data provided. Tonal productions of both groups analyzed by Praat. T-Test and ANOVA used to analyze variables (the mean, SD, minimum, maximum, and range) involved in the study.</p> <p>Qualitative data provided information on students’ learning strategies and their opinions of the intervention.</p>	<p>significantly, with the exception of T2.</p> <p>Limitation: no control group for comparison.</p> <p>The voice quality of male subjects in the experimental group was similar to that of native speakers after the training. Both female and male subjects in the experimental group spoke Mandarin at a higher average mean F₀.</p> <p>Limitations: small number of student participants.</p>
(12) Liu	2014	Chinese	<p>Training course for Thai CFL BA1 students to acquire correct initial pronunciations (6.5 hours teaching time). Experiment group and control group were divided to test the results.</p> <p>Instructional teaching design provided.</p> <p>In-class: differences between Chinese and Thai pronunciation explained, gestures and pronunciation map utilized to teach and imitate teacher’s pronunciation, “paper-blowing” strategy to teach aspirated initials and unaspirated initials, “tongue twister” to practice pair initials, peer correction to mitigate pressure on the students.</p>	<p>N=18.</p> <p>Pre-test and post-test conducted.</p> <p>Quantitative data with Likert scale questions (N=9) to get students’ evaluations.</p> <p>Open-question questionnaire (N=8) to get teachers’ perceptions of Chinese initials error correction.</p>	<p>Generally positive student response to the course. All of the instructional strategies were deemed helpful, but the focus should be on certain initials.</p>
(13) Wang	2017	Chinese	<p>Eight-week pronunciation peer correction program for CFL learners. Two groups (experimental and control) established to identify differences in students’ pronunciation.</p> <p>Experimental group used the strategy of “teacher correction + peer correction”; control group only teacher correction.</p> <p>Pre-class: explain the rules and methods of peer correction.</p> <p>In-class: one student reads a given text, others</p>	<p>N=18 (experimental group), N=17 (control group).</p> <p>Pre-test and post-test data provided.</p> <p>Recordings of all tests on both classes.</p> <p>Qualitative and quantitative data (N=18) from questionnaires and interviews with experimental group students after the program.</p>	<p>All students’ grades increased, but those in the experimental group displayed more improvement than those in the control group.</p> <p>There was positive feedback from the students about peer correction.</p> <p>Limitations: effective peer correction relies on students’ personal characteristics; no analysis of specific peer correction strategies that might be more effective.</p>

(14) Wu & Miller	2007	English	<p>offer corrections on the pronunciation of initials, finals, tones, stress, and intonation, then peer correction in the second half of each class. When different opinions arise, teacher's help may be sought.</p> <p>Two instructional peer correction designs given.</p> <p>Tutoring package comprising 100 Chinese characters for a CFL learner to improve his pronunciation. The tutoring content consisted of two panels, each with 50 characters (5 groups of 10 characters).</p> <p>Pre-tutoring: presentation of a character and five seconds for pronunciation.</p> <p>Tutoring: use of gestures, showing the shape of lips and tongue for correct pronunciation, repetition until correct pronunciation achieved.</p> <p>Post-tutoring: evaluate the effect of the tutoring.</p>	<p>N=1.</p> <p>Qualitative data given.</p> <p>Records on each session. No session number stated.</p>	<p>Grades continuously improved throughout tutoring.</p> <p>Provides empirical evidence for tutoring Chinese pronunciation not only for characters but also for tones, initials, and finals.</p> <p>Limitation: very small sample size.</p>
(15) Wang	2012	English	<p>Chinese tone tutoring program comprising 48 phrases and 15 sentences read by four native Chinese speakers on Chinese tones.</p> <p>Training group: seven US CFL beginners (mean age 20), six sessions (total six hours).</p> <p>Control group: five US CFL beginners (mean age 20) who just take the pre-test and the post-test.</p> <p>Pre-test: read a list of phrases and ten sentences.</p> <p>Training: records from the training stimuli, pitch contour shown on a computer screen to let students compare and check.</p> <p>Post-test: repeat the pre-test after the training program has finished.</p>	<p>N=12.</p> <p>Pre-test and post-test conducted.</p> <p>Open-ended questionnaire to get evaluations from training group students.</p> <p>Quantitative data given.</p>	<p>The two groups' grades were similar in the pre-test, but significant differences were evident in post-test. All seven trainees expressed support for the tone training they had received and requested more in the future.</p> <p>Limitations: small sample size; short-term training; no assessment of students' overall pronunciation improvement as the program focused exclusively on tones.</p>
(16) He et al.	2016	English	<p>Comparison of pitch direction-focused method and pitch height-focused method for teaching Chinese t3 (three-month instruction period).</p> <p>Experimental group: 12 intermediate US CFL learners receive the pitch height-focused method.</p> <p>Control group: 12 intermediate Canadian CFL learners receive the pitch direction-focused method.</p> <p>Training: experimental group focus on pitch</p>	<p>N=24.</p> <p>Three tests (one per month) conducted throughout the instruction period. Each test consisted of 33 stimuli provided with Pinyin and characters.</p>	<p>Quantitative results showed the pitch height-focused teaching method worked well for tone production. Students' grades improved significantly after training with this method.</p> <p>Limitation: reading speech, rather than spontaneous speech, was tested.</p>

(17) Liao et al.	2014	English	<p>height, control group on pitch direction.</p> <p>Introduction of an adapted computer-assisted pronunciation training (CAPT) program for CFL learners to detect phoneme and tone errors in order to improve pronunciation.</p> <p>Pre-training: each student reads 1900 syllables.</p> <p>Training: students are asked to repeat after the pronunciation demonstration provided by the computer. If a student's pronunciation is incorrect, they are asked to pronounce again until the pronunciation is verified. Pronunciation errors and feedback are presented on the screen.</p>	<p>N=8.</p> <p>Quantitative data given by Likert five-scale questionnaire completed by six professional and pre-service Chinese teachers.</p>	<p>Quantitative data demonstrated highly accurate identification of students' pronunciation errors. The validation of the program was verified. Corrective feedback provided by the computer based on students' errors seemed reliable. Limitations: no student survey; limited samples of pronunciation errors.</p>
(18) Liu	2014	English	<p>Investigation of students' and teachers' perceptions of tone pedagogies employed by CFL teachers in a US CFL class.</p> <p>In class: repetition, error correction, speaking with the teacher, listening to audio recordings, vowel hyperarticulation, hand gesture techniques.</p>	<p>N=3 (instructors).</p> <p>A total of 69 students participated in the observation classes, and 10 completed online interviews.</p> <p>Qualitative data collected by recording students' and teachers' responses after class observations.</p>	<p>Overall student satisfaction with the tone pedagogies. Most effective tone pedagogies (from students' and teachers' perspectives) identified.</p> <p>Limitations: small sample size; no attempt to measure the effectiveness of the employed tone pedagogies.</p>
(19) McGinnis	1997	English	<p>Two-year investigation into the relative efficacy of tone spelling (Pinyin) and diacritics (Gwoyeu Romatzyh) in Chinese pronunciation teaching.</p> <p>Two groups of English-speaking CFL students were taught these two teaching methods separately in different academic years.</p> <p>Instructional staff remained constant during the two-year teaching period.</p> <p>Students' conversations were recorded in a regular training class. Eight native Chinese speakers then assessed the recordings.</p>	<p>N=91.</p> <p>Qualitative data collected from the assessors.</p>	<p>Significant tone production accuracy found by using Pinyin.</p>
(20) Wu & Miller	2012	English	<p>Introduction of a 12-session pronunciation and translation tutoring package for US CFL beginners in pairs.</p> <p>Pre-training: tutors' own teaching methods.</p> <p>In-training: ten cards used as teaching materials, comprising Chinese characters on the front and their Pinyin and English translations on the back. Specific steps followed in each session: present ten cards, review the cards, test the cards, free conversation.</p>	<p>N=6 (students), N=4 (tutors).</p> <p>Qualitative data in the form of the author's and another native Chinese-speaker's assessment of the students' pronunciation on the session recordings.</p> <p>Quantitative survey of students' evaluations.</p>	<p>Students' pronunciation and translation accuracy improved significantly during program (from 51 to 94 percent). Follow-up showed students continued to achieve high pronunciation grades (average 88 percent). Highly positive responses among students and tutors.</p> <p>Limitations: extra training provided by tutors after the sessions, which cast doubt on the effectiveness of the package itself</p>

(21) Beutner	2001	English	<p>An over 15-week experiment to instruct US CFL learners' tone production by using Computer Assisted Interactive Feedback (CAIF) as supplementary support.</p> <p>Twenty-seven undergraduate CFL students participated in the weekly supplementary CAIF instruction. Students received immediate interactive aural and visual feedback from the provided software - Smart Start Chinese. Pronunciation-score criterion was used in four identical sessions to measure how accurately a student could pronounce a set of 32 syllables involving the four tones.</p>	<p>Data collected included videotaped CAIF sessions, recorded interviews, and an anonymous final evaluation.</p>	<p>An improvement in group accuracy of 40% was noted. Nearly all students' tone pronunciation improved significantly, and especially the lowest quartile experienced greatest improvement.</p> <p>Strong support and acceptance of CAIF was found from the qualitative measures.</p>
(22) Wang	2008	English	<p>Comparison between two experimental training Chinese tone learning methods and a traditional teaching and learning method in the CALL (computer-assisted language learning) context. Group A received perceptual training with auditory input. Group AV received perceptual and production training with both auditory and visual input. A control group received no additional training.</p> <p>Pre- tests: all participants from the three groups took perceptual tests. The two experimental groups also took a production test.</p> <p>Post-test: all three groups repeated their respective pre-training tests.</p>	<p>N=26 (10 in perceptual training, 8 in perceptual and production training, 10 in the control group).</p> <p>Quantitative data collected.</p>	<p>Both experimental groups improved significantly (Group A by 17 percent, Group AV by 13 percent) in perception accuracy of Chinese tones when compared with the control group. They also both improved in production accuracy, but in this case, there was no significant difference between the two groups.</p>

4. Findings

This scoping review analyzed 22 articles. Ten of these studies focused on pronunciation training for English-speaking CFL learners (10 and 14–22), three on different language-background CFL learners (2, 6, and 13), one on the genders of CFL learners (11), and the remaining eight on Korean (1 and 3), Thai (12), Mongolian (4), Russian (5), Japanese (8), Malagasy (7), and Polish (9) CFL learners. In terms of specific aspects of pronunciation, 13 studies concentrated on general pronunciation training, 10 on tones training, and 1 on initials training. All 22 studies reported assessed the strategies' effectiveness with reference to quantitative and/or qualitative data.

4.1. Observations concerning the empirical studies on the pronunciation teaching of CFL

4.1.1. Citations

Table 4. Citation overview of the 22 selected studies

Study	C-CSLP/CFLP	C-E/O	C-Ir	E-CSLP/CFLP	E-E/O	E-Ir	O-CFLP
Study 1	24	X	4	X	X	X	X
Study 2	57	1	X	X	X	X	X
Study 3	31	X	X	X	X	X	X
Study 4	24	X	3	X	X	X	X
Study 5	15	x	x	x	x	x	13
Study 6	39	1	2	x	1	x	x
Study 7	24	3	3	x	2	x	x
Study 8	22	x	2	x	x	x	8
Study 9	2	x	5	10	24	x	x
Study 10	1	x	x	11	11	1	1
Study 11	x	x	x	1	15	5	x
Study 12	29	4	x	x	1	x	x
Study 13	17	21	x	x	27	x	x
Study 14	x	x	x	1	x	2	x
Study 15	x	x	x	8	24	x	x
Study 16	1	x	x	18	1	x	x
Study 17	x	x	x	27	18	8	x
Study 18	x	x	x	75	59	71	x
Study 19	x	x	x	14	2	x	x
Study 20	x	x	x	7	x	5	x
Study 21	x	x	x	8	57	23	x
Study 22	x	x	x	6	20	x	x
Total	286	30	19	186	262	115	22

C-CSLP/CFLP=Chinese language publication on CSL/CFL research.

C-E/O=Chinese language publication on English or other languages education research.

C-Ir=Chinese language publication irrelevant to language education research.

E-CSLP/CFLP=English language publication on CSL/CFL research.

E-E/O= English language publication on English or other languages education research.

E-Ir= English language publication irrelevant to language education research.

O-CFLP=Other language publications on CFL research.

Citations are regarded as a formal representation of previously published studies that is relevant to the citing authors' research output. By analyzing the citations, pronunciation instructors could get a clear view of the scope (Leimu & Koricheva, 2005) and to what extent the selected reviewed studies are connected to L2 pronunciation instruction and CFL/CSL pronunciation instruction. Web of Science (WoS) was used to investigate whether cited articles were cited in English language publications related to L2 pronunciation instruction, and China's version of the Web of Science (CNKI) was used to check articles cited in Chinese language publications. Table 4 provides an overview of the citations in the selected empirical studies. The 22 studies have 920 citations, including 335 Chinese language studies, 563 English language studies and 22 other language studies related to Chinese as a second language (CSL)/CFL research. Among the 335 Chinese language studies, 286 studies are related to CSL/CFL research, 30 studies are related to English or other languages education research, and 19 Chinese language studies are irrelevant for language educational research. In terms of the 563 English language studies, 186 studies are on CSL/CFL research, 262 are on English or other language education research, and 115 studies are irrelevant for language educational research. Based on the statistics above, we have noticed that, within the CSL/CFL research domain, Chinese language studies are cited more than English language studies, suggesting that CFL/CSL researchers referred more to other relevant Chinese language CFL/CSL publications. We also noticed that CFL/CSL English articles cited more English CFL/CSL publications than Chinese language publications, and Chinese CFL/CSL articles cited more Chinese CFL/CSL than English publications. This situation might be caused by the fact that the majority of CFL/CSL researchers have Chinese nationality, and it is relatively convenient for them to access CNKI, as compared to databases with English publications. By contrast, CFL/CSL researchers from other countries will have easier access to English language publications. This division of the research communities has had an unfortunate effect on the progress of CFL/CSL pronunciation instruction research in a global perspective, and is a problem which needs to be addressed in the future. Valuing English or other language educational research, English language studies are cited a bit more frequently than Chinese language studies. In addition, more English language studies which are unrelated to language educational research are cited compared to Chinese language studies, mainly focused on statistical analysis methodologies, and instructional designs.

4.1.2 Theories and concepts

The analysis on the theories and concepts in teaching CFL/CSL pronunciation of the 22 studies showed that most of the studies (11 out of 22) attempted to introduce, integrate or supplement existed research theories and concepts related to CFL pronunciation teaching into their research.

“Tongue twister” strategy (1) was conducted to instruct CFL students’ pronunciation based on second language acquisition theory and “monitor hypothesis” proposed by Krashen (1977). The concept and theoretical base of “game-focused” strategy (6) used in CFL classes was explained and classified, but the outcome for CFL students’ pronunciation is not very obvious. This proves that the proper way to integrate this strategy in CFL class still needs to be further developed. The concept of “Somatically-Enhanced Approach” (11) was first proposed to instruct Australian CFL students in Chinese prosody. Based on the theories of “body movement” from Highwater (cited in Moore & Yamamoto, 2011), Swain’s (1993) “output hypothesis”, and Gibson’s (1978) “language perception and production” interaction relationship, SEA helped CFL students to master the correct tones and the rules of pronunciation stress, pauses, and intonations. “Peer correction” strategy (13) was drawn from Hendrickson’s (1978) “error correction theory” to test the effectiveness of CFL students’ Chinese pronunciation and it was confirmed by students’ positive feedback and improved scores. Three studies (17, 21, 22) were conducted using the framework of computer-assisted pronunciation teaching theory to instruct CFL students in Chinese tones. One study (18) proposed her own conceptual framework to instruct American CFL students in tones, and the framework included four sections: perceptions, teacher-student dynamic, idiosyncrasies, and experiences in language learning. As we can see from the findings, the majority of the reviewed studies (13 out of 23) are lack of substantial theoretical support.

4.2. Which of the various instructional pronunciation strategies were most effective?

4.2.1. Pre-class strategies

Pre-class preparations are regarded as warm-ups for instructional pronunciation classes. Many of the studies in the scoping review reported the implementation of these pre-class strategies to help CFL students prepare for their upcoming training programs. They included:

- Breathing control and vocal training for “tongue-twister” general pronunciation training (1).
- Mouth-opening exercises, double-lip exercises, tongue exercises, and nasal resonance exercises for Chinese vowels and consonants training (1 and 2).
- Surveys that gathered data on student demographics (5, 6, 7, 8, 13, 14, 15, 17, and 18), their perceptions of Chinese pronunciation learning and rules (8 and 11), and any specific difficulties they had experienced when trying to master pronunciation, as well as teachers’ instructional strategies (8) and what they considered the most effective instructional strategies (5 and 6).
- Pre-tests, which were used as a basis of comparison with the students after instruction (5, 9, 10, 11, 12, 13, 14, 15, 17, 20, and 22).

- An introduction that explained the rules and steps of the program (13).
- Training for CFL teachers to determine the strategies they should adopt during instruction (20).

As is clear from this list, many of the studies utilized pre-training surveys (5–8, 13–15, and 17–18) and/or tests (5, 9–15, 17, 20, and 23). However, we noticed that there was little empirical validation of these pre-training surveys or tests in the reviewed studies. A validated pre-training survey or test allows researchers to compare the results with a post-training survey or test in order to assess the effectiveness of the pronunciation instruction (Li, 2013). Therefore, future researchers may wish to explore the validation of pre-surveys and pre-tests with regard to various aspects of Chinese pronunciation instruction. We also noticed that some CFL teachers organized pre-training articulation exercises in order to mitigate students' anxiety and increase the effectiveness of their "tongue-twisting" strategies (1 and 2). Pre-training sessions were also organized to explain the details of the upcoming program (13), while another study reported that CFL teachers received training prior to embarking on computer-aided pronunciation instruction (20). However, seven of the studies did not conduct any pre-program strategies. Burns (2006) insists that appropriate pre-training strategies improve ESL students' learning outcomes, raise their awareness of particular techniques and training methods, enhance their engagement during the subsequent in-class instruction period, and create a benchmark for comparison with post-instruction evaluations. This also applies to CFL pronunciation instruction programs. Pronunciation instructor training concerning the specific strategy and familiarity with students' misconceptions and mistakes (Grossman, 1990) are also required in order to make pronunciation instructions successful. In the review studies, a few instructors claimed that the reason for choosing the instruction content was that they noticed their students' weakness of learning certain Chinese pronunciation aspects, based on their teaching experiences and teaching observations (4, 5, 7, 8, 10, 11, 12). But it is unknown to what extent CFL teachers or instructors are able to well-understand students' misconceptions and mistakes. Therefore, there is a need for CFL pronunciation instruction researchers to assess CFL pronunciation instructors' preparedness.

4.2.2. *In-class pedagogical strategies*

We employed Burns's (2003) distinction between segmental-based and suprasegmental-based instructional pronunciation strategies to summarize CFL teachers' effective in-class programs (see Table 5).

Table 5. Summary of CFL teachers' effective instructional pronunciation strategies

Code	Summary	Reviewed studies
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Segmental-based strategies

1. Comparative strategies	Teachers give instructions on Chinese vowels and consonants based on similar pronunciations in CFL students' native language.	1, 2, 3, 4, 5, 8, 12
2. Listening and repeating	Students listen to and repeat the given material.	1, 3, 10, 12, 14, 18
3. Visual-aid production activity	With the aid of pictures or videos, students imitate related Chinese vowels and consonants.	1, 4, 18
4. Articular lingual map	Students are shown the correct articulations of each Chinese vowel and consonant.	2, 5, 12
5. Physical production strategy	Accompanied by a specific physical movement (e.g. blowing paper or a candle, nodding), students read target words, focusing on specific aspects of pronunciation that have been previously identified.	2, 5, 12, 14, 18
6. Tongue-twisting	Students read a set of selected sentences, focusing on specific aspects of pronunciation that have been previously identified.	1, 12
7. Checking activity	Teacher checks students' performance and offers feedback on previous pronunciation activities.	3, 5, 8, 13, 14, 20
8. Repetition drill strategy	Students repeat target initials or consonants.	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 18
9. Audio-aid production strategy (listening discrimination activity)	Students make a choice based on what they hear.	2, 6, 10
10. Game	Students engage in a language activity that has specific goals for segments, rules, and levels of competition difficulties.	1, 4, 6, 10

Suprasegmental-based strategies

11. Five-degree notation strategy	Present the different pitches of four Chinese tones. The teacher explains the particular pitch of the training tone to students in order to enhance students' awareness of the tone range.	1, 2
12. Mobile-aided production strategy	Use smartphone apps to present the pitches of Chinese tones.	5, 7
13. Game	Students engage in a language activity that has specific goals for suprasegments, rules, and levels of competition difficulties.	1, 4, 7, 10
14. Computer-aided strategy	Teachers use computer software to present stimuli, then ask students to repeat the words or sentences they have heard, focusing on specific Chinese tones.	7, 9, 10, 11, 15, 16, 17, 20, 21, 22
15. Physical production strategy	Accompanied by a specific physical movement (e.g. a gesture), students read target words.	5, 7, 11, 15, 18
16. Checking activity	Students or teachers check speakers' performance and give feedback on speakers' general pronunciation during a previous pronunciation activity.	9, 10, 13, 14, 20

We noticed that segmental instruction was an important element in all of the instructions under review. Comparative strategies (1, 2, 3, 4, 5, 8, and 12), listening and repeating (1, 3, 10, 12, 14, and 18), checking activity (3, 5, 8, 13, 14, and 20), and repetition drill strategy (1–8, 10,

12, and 18) were the most common segmental-based strategies, and all achieved positive outcomes. Influenced by the Chinese segments' features, some pronunciation instructors favored "articular lingual map" and "physical production strategy" to teach the difference between aspirated and unaspirated initials (2 and 12) and Chinese alveolo-palatal phonemes¹ / tɕ /, / tɕʰ /, / ɕ / (5). Collectively, the repertoire of strategies included blowing candles or sheets of paper, nodding, or moving hands in different directions. For other special Chinese segments, such as alveolars /ts/, /tsʰ/, /s/ and retroflexes / tʂ /, / tʂʰ /, / ʂ /, / ʐ /, instructors used "tongue-twisting" to help students distinguish between the different articulations (1 and 12).

Among the studies that employed suprasegmental-based strategies, the focus was usually on tones and tone sandhi. Tone pitches were taught effectively through the use of "five-degree notation" (1 and 2), "mobile-aided production strategy" (5 and 7), and/or "physical production strategy" (5, 7, 11, 15, and 18). However, of all the suprasegmental-based strategies, "computer-aided pronunciation strategy" was clearly dominant in the teaching of CFL tones. The laboratory setting enabled each student to repeat words and phrases then listen to their own recordings (7, 9, 10, 15-17, and 20-22). Software such as Sptool was also used to analyze the students' speech production and allowed them to see a visible representation of the differences between their own pronunciation and that of native speakers (11). This helped the students to access information that cannot be adequately expressed with words.

As revealed above, segmental-based strategies and tonal strategies dominated the instruction provided in most of the studies. This could be explained by two reasons: the particular characteristics of Chinese – the tonal features are one of the most difficult aspects for CFL learners to acquire; and the main participants of the pronunciation instructions are CFL beginners. *Accuracy* is the main focus for CFL beginners' pronunciation, rather than fluency. Considering the fact that there is no settled curriculum for pronunciation teaching in CFL class, pronunciation teachers mainly follow the pronunciation allocations in CFL textbooks as their preferred pronunciation teaching sequence (Lin, 2010), that is initials – finals – tones – pinyin – pinyin spelling elaboration – texts - exercises. CFL pronunciation instructors concentrate on improving students' segments and tones in the beginning phase. Measuring segments and tones are also easier than analyzing intonation and sentence-level stress by using pitch contour, pitch rating, or error counts (Kissling, 2013). Students' initial errors are dependent on the influence of their native language, which means different language background students might make different initial errors. This demands teachers to become familiar with students' native language so as to clearly explain the errors students make and choose proper segment strategies to instruct them.

Another important finding was that controlled strategies were used much more frequently than interactive strategies (such as games and role-play). For example, several teachers employed a "game" strategy that was limited to instructing selected words or sentences (1 and

¹ Initials sounds are represented in International Phonetic Alphabets (IPA).

6). Such techniques had little or no positive impact on students' grades. No free pronunciation strategies (e.g. presentations or spontaneous talk), which aim to enhance students' communicative abilities, were mentioned in the reviewed studies. Research has shown that most CFL teachers are influenced by traditional ESL teaching approaches and certain controlled activities when teaching Chinese segments, and there is evidence that these techniques have a significant positive impact on students' phonological development (Pan & Liu, 2017). However, advocates of communicative teaching criticize traditional pronunciation approaches on the grounds that controlled activities may limit learners' pronunciation comprehensibility in authentic conversations (Baker, 2014). Over recent years, there has been increasing support for communicative activities that involve dynamic interaction to enable learners to use the target language automatically. In our review, although several studies employed interactive strategies, their use was limited and the outcomes were not significant.

We also noticed that very few studies were aimed at intermediate (1 and 9) or advanced CFL students, rather than beginners (2–7, 10–16, and 19–22). It seems that CFL researchers assume that there are two dimensions to Chinese pronunciation teaching (Liu, 2012): first, that Chinese segments should be prioritized and all aspects of Chinese pronunciation should be taught at the start of the learning period; and, second, that all aspects of Chinese pronunciation should be taught throughout the whole learning period (Cheng, 2008). Obviously, in the reviewed studies, CFL beginners were the main recipients of Chinese pronunciation instruction. Therefore, it is difficult to say which instructional pronunciation strategies would be most effective in helping advanced CFL learners to improve their stress and intonation. Research has shown that these shortcomings in these areas are linked to several factors: intermediate and advanced CFL textbooks contain few pronunciation exercises; there is little clear guidance on the different aspects of Chinese pronunciation at the various CFL student levels; and there is a lack of continuity in pronunciation instruction in CFL textbooks (Zhou, 2006); oral fluency becomes the main focus for advanced CFL learners; less numbers of intermediate and advanced CFL students for quantitative studies.

Compared with traditional classroom teaching, computer-assisted pronunciation training (CAPT) achieved highly positive outcomes by providing a private, stress-free environment that enabled students to have visual input and offered pronunciation feedback (Neri et al., 2002). Seven of the studies in our sample utilized computer-assisted instruction to improve Chinese tones and tone sandhi. Stimuli recorded by native-Chinese speakers were presented to the students, who were asked to listen carefully and imitate what they heard in order to improve their tone production (9, 15, 16, and 21). Pitch direction-focused and pitch height-focused strategies were used to instruct Chinese t3 and tone sandhi (16). Software, such as Kay Elemetric's Sona Speech II (15 and 22), an adaptive pronunciation training software (17), enabled students to make visual comparisons between their own production and the stimuli, which helped them to identify any discrepancies between the two pitch contours and reproduce

the correct pronunciations. Personal devices, such as mobile phones, iPads, or iPods, are proved to significantly improve L2 students' general pronunciation by using tracing or shadowing strategies, and to be highly valued by L2 students for their availability to adapt to their personal needs (Foote, 2015; Martinsen et al., 2017). However, we noticed the absence of other aspects of Chinese pronunciation in these computer-assisted strategies, which suggests that more attention should be paid to improving CFL students' suprasegments through the use of CAPT.

4.3 What is the empirical evidence for the impact of instructional pronunciation strategies?

Most of the studies in our sample (1, 5-13, 15-17, and 20-22) collected quantitative data in the form of surveys or tests. Post-test results of the instructions generally increased following the instructional period. Additionally, a number of studies (1-5, 8, 12-14, and 18-20) gathered qualitative feedback in the form of questionnaires, interviews, or free text surveys. These suggested active engagements with interactive instructional strategies increased student satisfaction.

The quantitative data indicated that “tongue-twisting” strategies helped students to improve their awareness of sentence stress and intonation (1 and 7); “pronunciation comparative” strategies increased the accuracy of students' aspirated and unaspirated initials, supra-dentals /t/, /tʰ/, /n/, /l/, Alveolo-palatal phonemes /tɛ/, /tɛʰ/, /ɛ/, and the velars /k/, /kʰ/, /x/ (1, 5 and 8); and checking activities improved academic performance (5, 8-10, 13 and 20). Only one study (6) reported no significant improvement in students' test results.

Only eight of the studies that collected quantitative data conducted the pronunciation intervention with both a control group and an experimental group (6, 7, 11-13, 15, 16, and 22). Seven of the eight studies showed improved scores by comparing the pre-tests and post-tests (7, 11-13, 15, 16 and 22).

Six of the studies used acoustic devices to measure results, while eight employed human listeners. The remaining articles provided no information on how the students' pronunciation was assessed. Among the studies that used human appraisal, two assessed specific aspects of pronunciation (13 and 20), while five assessed overall pronunciation (6, 8, 10, 14, and 19). In the studies that utilized acoustic devices (7, 9, 11, 15, 16, 21 and 22), all of the teachers measured one specific aspect of Chinese pronunciation – tones.

Some studies use the same stimuli for pre-tests and post-tests, while others choose different stimuli. In our review, seven studies (5, 6, 8-12, 15, 17, and 20-22) used the same stimuli for pre-tests and post-tests in order to evaluate the intervention's effect (Henderson, 2008). Two studies (1 and 13) used different stimuli in the tests. One study (16) used the same stimuli in the pre-test, during instruction, and in the post-test. Thomson & Derwing (2014) suggest that the same stimuli should not be used during the instruction itself as this might limit pronunciation outcomes. Another limitation regarding student assessment was that some of the

studies failed to implement either a pre-test (7, 10, and 11) or a post-test (8).

Qualitative feedback from questionnaires and surveys suggested that the instructional strategies increased awareness of the characteristics of each phoneme and the accuracy of the phonemes (4 and 14), student engagement (11, 21), and learning motivation (19). One important observation is that few of the studies built on validated instruments to map, for example, perception. In light of significant improvements in ESL pronunciation evaluation instruments (see, e.g., Baker, 2014; Macdonald, 2002; Sifakis & Sougari, 2005; Walker, 2005), there is an urgent need for CFL researchers to engage in such validation studies. This also introduces the need to increase sample sizes in order to validate instruments.

In summary, the qualitative and quantitative data suggest that instructional pronunciation strategies have a generally positive impact in the form of better grades, more active student engagement, and so on. That said, the low validity of the questionnaires and the limited types of assessment that were used in the studies cast some doubt on the reliability and validity of the research results. In addition, few of the studies undertook long-term Chinese pronunciation instruction or implemented interval testing.

5. Discussion

This systematic scoping review presented important insights into research relating to pronunciation instructions implemented in the CFL context. In our discussion, we will thoroughly investigate the difficulties and challenges of pronunciation instructions in the CFL context.

5.1. *Lack of theoretical framework*

Based on Shulman's (1987, 1988) PCK theory, to make a CFL pronunciation instruction successful, a framework that was developed based on pronunciation instruction procedures and the specific features of the selected Chinese pronunciation aspect are vital. For CFL pronunciation instructors, this needs a nuanced understanding of Chinese phonology, instructional strategies, assessments, curriculum, and media that CFL pronunciation instructions need to include. Although some studies have followed established theories or concepts, such as Krashen's (1977) "monitor hypothesis", Hendrickson's (1978) "error correction", CAPT theory, etc., the elaborations and framework of these studies are not fully conducted to guide the whole instruction procedures. In addition, the theories and concepts used by CFL instructors are developed for English language teaching but not Chinese as a foreign language teaching, and attributed to the particularities of Chinese pronunciation, these theories and concepts might not completely fit for pronunciation instructions in the CFL context.

5.2. Segmental-based and tonal instructions as the dominant focal points

Strategies for instructing Chinese initials, finals, and tones were widely conducted by CFL pronunciation instructors and most of them received positive outcomes. Comparative strategies, listening and repeating, checking activity, and repetition drill strategy make up the majority as compared to the other segmental-based strategies, since they are easy to conduct and can be generally applied. Pitch-contour and pitch register strategies are relatively widely used by CFL instructors because of the characteristics of Chinese tones which can be verbally described by pitch contour (level, rising, falling) and pitch register (high, low, mid). In class, word combinations or signal words are the main training materials for instructors to train students' segments and tones. However, research has also shown that tonal errors mainly occur in sentences or in combinations of words, not in isolated syllables (Guo & Tao, 2008). Moreover, CFL students learn oral Chinese as a medium of communication, and spontaneous speaking is involved from the beginning-level CFL class to the advanced-level class. To help students better express themselves effectively in communication, intonation and sentence-level stress training needs to be carried out. However, strategies for improving CFL learners' intonation and sentence-level stress are rather rarely encountered in CFL pronunciation instruction studies, which directly affects the language teachers' approach to their teaching strategies.

5.3. Lack of interactive strategies

In addition to a broader Chinese pronunciation instruction focus, more communicative strategies should also be conducted for improving CFL students' pronunciation comprehensibility, especially for intermediate and advanced CFL students, interactive strategies on practicing suprasegments (in terms of Chinese, stress, intonation, and rhythm). Celce, Brinton, and Goodwin (1996) suggested that the teaching of suprasegments is the most efficient way of achieving fluency. Fluency is oriented for intermediate and advanced language learners because it's strongly related to native speakers' perception of intelligibility. Hahn's (2004) research indicated related evidence of fluency supremacy, promoting the teaching of suprasegment aspects. In our review, although several studies employed interactive strategies for instructing Chinese prosody, their use was limited and the outcomes were not significant. This suggests that CFL teachers should identify efficient pronunciation exercises and implement interactive strategies to instruct intermediate and advanced students' stress and intonation and thereby enhance their comprehensibility and intelligibility (Zhang, 2006).

5.4. Assessments features of CFL pronunciation instructions

Except for the above components of the PCK framework, knowledge of assessments also

plays a crucial role in guiding teachers' instructions. There is a discussion related to the assessment reliability of pronunciation instructions. Researchers are concerned that individual differences in scoring pronunciation assessments may have a disproportional influence or bias concerning the assessment, which subsequently causes fairness issues. Seven studies in our review used acoustic devices to measure tones. Hou & Li (2006) measured CFL students' tone pronunciation with PRAAT software, which evaluates whether tones remain steady. However, human pronunciation is inherently unstable, and the software identifies some errors that humans are unable to detect. Moreover, in real-life conversations, people tend to tolerate slight pronunciation mistakes as long as these do not undermine comprehensibility (Zielinski, 2008). When using human assessment, it is important to validate inter-rater reliability when multiple listeners are involved (Wang, 2003).

There is also another discussion on whether the assessment of an instruction should include a control group or not. Researchers, who consider not to include a control group, believe all learners may want to receive instruction, and those who were divided into the control group may receive an unsatisfactory outcome, thus raise an ethical dilemma (Thomson, 2011). While Thomson & Derwing (2014) suggest that results obtained without a control group should be considered unreliable. Students may improve without any training simply by continuing to receive regular L2 teaching. However, there is no evidence of significant improvement in a short period of time in the absence of intervention (Munro & Derwing, 2008). Therefore, we also consider that future research into pronunciation training should involve both an experimental group and a control group, as it is only by comparing the two groups' progress that an accurate assessment of a strategy's effectiveness may be made.

Two main methods were used to assess students' pronunciation: reading out individual words (5, 7, 9, 10, 14, 16, 19, 21, and 22) and reading out whole sentences (1, 14, 15, 17, and 20). Reading-aloud assessments ensure that target pronunciation features are thoroughly evaluated. However, such assessments fail to identify CFL students who have acquired comprehensible pronunciation yet lack grammar and vocabulary retrieval. Moreover, research has shown that reading-aloud exercises may not lead to more spontaneous speech (Thomson & Derwing, 2014). By contrast, picture descriptions, presentations, or pair conversations on a given topic not only enable accurate assessment of pronunciation in terms of phonology but also allow teachers to check students' intelligibility and/or comprehensibility in speech production (Munro & Derwing, 1995). Hence, CFL teachers should focus on such exercises during pronunciation assessment.

6. Theoretical and pedagogical implications

The foregoing discussion suggests that acquiring intelligible Chinese pronunciation requires a robust framework in the context of a communicative teaching approach.

Based on Shulman's (1987) PCK framework, it is evident that curriculum, including pre-class preparations, play an important role in helping students to engage fully with the instruction. Students seem to favor strategies that are closely related to specific Chinese pronunciation instructions. By using pre-class strategies, students' conceptualization and motivation are stimulated in advance of the phonological encoding procedure. In addition to pre-class surveys regarding the students' motivation and anxiety, explicit pre-class strategies, such as explanations of rules and interactive relaxation techniques, are conducive to in-class training.

Our review revealed that the segmental-based and suprasegmental-based strategies imposed on CFL students during conducted pronunciation instruction can be conceptualized following Shulman's (2012) PCK framework. CFL teachers stimulate students' segment (vowels and consonants) representations by showing the "articulatory lingual map" (2 and 12), and their tone representations with the "five-degree notation" strategy (1 and 2). After all of these phonological representations were completed, the related phonological assembly (i.e. the complete syllable) was presented. CFL learners then received feedback from the teacher, or computers, or peers which had proved to be effective. The assessments used in the studies to evaluate CFL learners' pronunciation were mainly from experts, however, students' self-assessment can also be a considerable evaluation method (Lappin-Fortin & Rye, 2014).

Empirical evidence is essential to gauge the impact of Chinese pronunciation instruction on CFL students' pronunciation and overall communication. CFL teachers and students should also be encouraged to utilize technology when practicing pronunciation. Explicit guidelines are required in order for CFL teachers to assess and provide useful feedback regarding students' pronunciation. Teachers' pronunciation knowledge base and teaching approach base should both be widened to facilitate more professional and interactive instruction.

This review has identified a number of gaps in the literature that need to be addressed in the interest of a more effective implementation of Chinese pronunciation instruction. For instance, at present, there is an unsystematic and inexplicit content focus due to the lack of an up-to-date conceptual framework that would enable proper coordination of pre-class and in-class instructional pronunciation strategies. Currently, almost all Chinese pronunciation instruction research in the CFL field is conducted within the L2 acquisition framework. However, due to the unique characteristics of Chinese pronunciation (such as tones, tone sandhi, aspirated initials, etc.), there is an urgent need to develop a conceptual framework for CFL pronunciation researchers and educators to follow in their pronunciation instruction or teaching.

7. Limitations and directions for future research

In the previous sections, we have discussed the theoretical and pedagogical implications of our scoping review. In this section, our aim is to analyze the limitations of this study and offer suggestions for future CFL instructional pronunciation strategies research.

This review may not have identified every Chinese pronunciation instruction strategy, despite our best efforts to be as comprehensive as possible. We used ten search items to search related and peer-reviewed articles, but additional search items may have generated further results. Moreover, there are other bibliographic databases in addition to the four we searched, and these may have yielded more articles on Chinese pronunciation instruction in the CFL field. In addition, while we have reviewed all of the Chinese and English papers we could find, we are aware of a number of articles that have been published in other languages. Finally, of course, there may be many unpublished studies.

There is considerable scope for development of this research area. First, more work could be done on teachers' use of different instructional pronunciation strategies in different educational contexts (Chen, 2011). Second, participant demographics (e.g. language background, age, etc.) in Chinese pronunciation instruction classrooms could be explored to make the subject more generalizable to new learners (Marx, 2002; Moyer, 2013). But, we have to take into account that less research is available involving advanced CFL learners. The instructional needs of the latter might differ from novice and intermediate level CFL learners. Pronunciation strategy research should respect this diversity. Third, perceptual training could be incorporated within pronunciation instruction (Bradlow et al., 1997). Furthermore, an exploration of the nature of assessment (e.g. speaking tasks, evaluation of pronunciation, etc.) during and after Chinese pronunciation instruction may provide new insights into the effectiveness of the various strategies (Derwing & Munro, 2015). Finally, researchers should make full use of technology to advance the development of Chinese pronunciation instruction.

8. Conclusions

This work should be viewed as a pioneering attempt to synthesize a set of CFL pronunciation instruction studies, rather than an all-inclusive review. Its significance rests on the fact that it provides a scoping analysis of the discipline/field of implemented instructional pronunciation strategies and the impact of those strategies. In addition, it sheds light on three prevailing problems in the Chinese pronunciation instruction process. We have found that: a) very few studies are grounded in theoretical assumptions; b) interactive strategies and certain aspects of Chinese pronunciation research are rather limited; and c) educational evaluation is currently inadequate. Finally, in addition to identifying a number of critical gaps in the literature, this study has made some constructive suggestions regarding the future direction of CFL pronunciation instruction research.

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