

The Design and Evaluation of Intelligent Computer-Assisted Language Learning Tools for Beginner Learners of Mandarin Chinese

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A thesis submitted for the degree
of Doctor of Philosophy

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Abstract

The present research aims to design and evaluate two Intelligent Computer-Assisted Language Learning (iCALL) prototypes to assist the teaching and learning of spoken Chinese in the Irish post-primary context.

The research adopts a three-phase mixed-method design. The first phase involves a needs analysis for both teachers and students to ascertain their needs and challenges in teaching and learning spoken Chinese, as well as their attitude towards iCALL implementation. The second phase develops two iCALL prototypes based on the findings of the needs analysis, and the third phase trials and evaluates both prototypes against the intended design.

The first phase of the research identified three main challenges in teaching spoken Chinese, which are: (i) the difficulty of Mandarin phonological acquisition, particularly regarding the tones, (ii) insufficient and inappropriate teaching and learning materials, and (iii) the lack of opportunities to practice and use the language outside of class hours.

In the evaluation of the two iCALL prototypes, the findings indicate that in the context of assisting teachers, the positive impacts are mainly reflected in five areas, including (i) technological experience, (ii) in-class teaching, (iii) student engagement, (iv) formative assessment, and (v) teacher training. In the context of assisting learners, the positive impacts are more evident in four areas: (i) Mandarin tone acquisition, (ii) learner autonomy, (iii) language confidence, and (iv) self-assessment.

In terms of its contribution to the field of Teaching Chinese as a Foreign Language (TCFL), the present research is the first to analyze and address the needs of beginner-level post-primary students learning spoken Chinese in Ireland. As a cross-discipline research project, it brings together educational pedagogy and technology and further implements the iCALL study in the context of TCFL.

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Table of Contents

Chapter 1 Introduction	1
1.1 Development in teaching and learning Mandarin Chinese in Ireland	1
1.2 CALL and iCALL in the context of Irish post-primary TCFL	2
1.3 Aims and Rationales	4
1.4 Research questions	6
1.5 Structure of the Thesis	7
1.6 Definition of key terminology	8
1.7 Summary	13
Chapter 2 Literature Review	14
2.1 Overview	14
2.2 Learner Context	16
2.2.1 Mandarin Chinese Curriculum Design in Irish Post-primary Context	16
2.2.2 Challenges in teaching Chinese as a foreign language	19
2.2.3 Challenges in learning Chinese as a foreign language	20
2.3 Theory	22
2.3.1 Second Language Acquisition theories in CALL.....	22
2.3.2 The acquisition of spoken Chinese	26
2.3.3 Technology-mediated spoken Chinese acquisition	30
2.3.4 The acquisition of Mandarin Chinese tones	34
2.3.5 Technology-mediated tone acquisition	38
2.4 Action	40
2.4.1 The development in teaching spoken Chinese	41
2.4.2 Communicative Language Teaching.....	43
2.4.3 Teaching and assessment materials for spoken Chinese	44
2.4.4 Issues in teaching spoken Chinese in Ireland	46
2.5 Technology	47
2.5.1 Automatic Speech Recognition.....	48
2.5.2 Speech Visualisation technology	51
2.5.3 Gamification technique.....	56
2.5.4 Virtual World.....	59
2.5.5 Artificial Intelligence.....	66
2.5.6 Spoken Dialogue System	67
2.6 Evaluation	70
2.6.1 Needs analysis	70
2.6.2 CALL, iCALL and TELL	72
2.6.3 The Wizard of OZ method.....	74
2.6.4 Previous research on the evaluation of CALL and iCALL	75
2.7 Summary	84
Chapter 3 Research Design	86
3.1 Overview	86
3.2 Research questions	86
3.3 Considerations for the research design	87
3.3.1 Disciplinary considerations.....	87
3.3.2 Ethical considerations	89
3.3.3 Practical considerations	90
3.3.4 Overview of research design.....	91
3.4 Phase one: Needs analysis	92
3.4.1 Needs analysis for teachers	92
3.4.1.1 Semi-structured interview design	93
3.4.1.2 Participant identification.....	94
3.4.1.3 Data collection.....	95

3.4.1.4 Methods for qualitative data analysis.....	96
3.4.2 Needs analysis for students.....	97
3.4.2.1 Error analysis design.....	97
3.4.2.2 Participants identification.....	99
3.4.2.3 Data collection.....	100
3.4.2.4 Methods for data analysis.....	100
3.5 Phase two: Develop the iCALL tools.....	101
3.5.1 The first iCALL tool - ViewTones.....	101
3.5.1.1 Overview of ViewTones.....	101
3.5.1.2 Development of ViewTones.....	107
3.5.2 The second iCALL tool - Trip2China.....	112
3.5.2.1 Overview of Trip2China.....	112
3.5.2.2 Development of Trip2China.....	114
3.5.3 The implementation of the Wizard of Oz method.....	118
3.6 Phase three: Evaluate the iCALL tools.....	120
3.6.1 Teacher evaluation.....	120
3.6.1.1 Semi-structured interview design.....	120
3.6.1.2 Teacher participants' identification.....	121
3.6.1.3 Interview administration.....	121
3.6.1.4 Methods for data analysis.....	121
3.6.2 Student evaluation.....	122
3.6.2.1 Experiment and questionnaire design.....	122
3.6.2.2 Student participants' identification.....	124
3.6.2.3 Experiment and questionnaire administration.....	125
3.6.2.4 Methods for data analysis.....	126
3.7 Summary.....	127
Chapter 4 Result of the needs analysis.....	128
4.1 Overview.....	128
4.2 Results of Teacher Needs analysis.....	128
4.2.1 Participants.....	129
4.2.2 Challenges identified in teaching and learning spoken Chinese.....	131
4.2.3 The extent to which TCFL incorporates technology in Irish schools.....	135
4.2.4 The willingness of teachers towards iCALL for TCFL.....	137
4.3 Results of student's needs analysis.....	139
4.3.1 Participants and experimental set-up.....	140
4.3.2 The participants' reporting of challenges in learning spoken Chinese.....	140
4.3.3 Analysis of participants' Mandarin tones production.....	141
4.4 Summary.....	144
Chapter 5 Findings of the iCALL evaluation.....	146
5.1 Overview.....	146
5.2 Reliability and Validity.....	146
5.3 Results: Teacher interviews.....	148
5.3.1 Participants.....	148
5.3.2 Teachers' experience with CALL to date.....	150
5.3.3 Existing challenges in the teaching/ learning/assessing of spoken Chinese.....	153
5.3.3.1 Challenges in teaching spoken Chinese.....	153
5.3.3.2 Challenges in learning spoken Chinese: teacher perspective.....	158
5.3.3.3 Challenges in assessing spoken Chinese: teacher perspective.....	162
5.3.4 Treatment: implementation of the iCALL tools.....	164
5.3.5 Teachers' feedback on the iCALL tools.....	165
5.3.5.1 Impact of the iCALL tools on teaching spoken Chinese: Teacher perspective.....	165
5.3.5.2 Impact of the iCALL tools on learning spoken Chinese: Teacher perspective.....	168
5.3.5.3 Impact of the iCALL tools on assessing spoken Chinese: Teacher perspective.....	171
5.3.5.4 Limitations and insights for future development of the iCALL tools: Teacher perspective.....	173

5.4 Results: Students	175
5.4.1 Participants	175
5.4.2 Findings of the pre-test questionnaire	178
5.4.2.1 Impact of language learning experiences.....	179
5.4.2.2 Impact of Chinese language competence.....	180
5.4.3 Findings of the pre-test and post-test comparison	182
5.4.3.1 General comparisons	182
5.4.3.2 Impact of language learning experiences.....	184
5.4.3.3 Impact of game experiences.....	188
5.4.4 Findings of the error analysis.....	189
5.4.5 Findings of the post-test evaluation-Experimental Group.....	193
5.5 Summary	195
Chapter 6 Summary of Findings and Discussion	197
6.1 Overview	197
6.2 Summary and discussion of key findings	197
6.2.1 Challenges for teachers in teaching spoken Chinese.....	197
6.2.2 Challenges for students in learning spoken Chinese	198
6.2.3 The design of two iCALL tools to address the challenges	200
6.2.4 The impact of the iCALL tools in assisting teachers.....	201
6.2.5 The impact of the iCALL tools in assisting learners	202
6.3 Summary of contribution	204
6.4 Limitation and future direction of the research	206
Conclusion	208
References	212
Appendix	229
Appendix A Consent form for teachers	229
Appendix B Semi-structured interview (teacher needs analysis)	230
Appendix C Consent form for parents	231
Appendix D Recording items for students (needs analysis).....	232
Appendix E Semi-structured interview (teacher evaluation).....	233
Appendix F Interview transcriptions (teacher needs analysis)	234
Transcript of Audio Interview 01 (CZ-N-M-M).....	235
Transcript of Audio Interview 02 (SF-N-M).....	238
Transcript of Audio Interview 03 (QW-N-M).....	240
Transcript of Audio Interview 04 (FG-N-M)	243
Transcript of Audio Interview 05 (YJ-N-M).....	245
Transcript of Audio Interview 06 (XX-N-M).....	247
Transcript of Audio Interview 07 (YZ-N-M)	251
Transcript of Audio Interview 08 (YF-N-M)	254
Transcript of Audio Interview 09 (MC-N-E)	256
Transcript of Audio Interview 10 (TW-N-E)	258
Transcript of Audio Interview 11 (MF-N-E).....	261
Transcript of Audio Interview 12 (RG-N-E).....	263
Appendix G Interview transcriptions (teacher evaluation).....	265
Transcript of Audio Interview 01 (MC-E-E).....	266
Transcript of Audio Interview 02 (SC-E-E).....	271
Transcript of Audio Interview 03 (MS-E-E)	276
Transcript of Audio Interview 04 (CT-E-M).....	280
Transcript of Audio Interview 05 (HS-E-M).....	284
Transcript of Audio Interview 06 (WX-E-M)	288
Appendix H Pre-test and post-test questionnaires (student evaluation)	292
Appendix I Student evaluation questionnaire	294

List of Figures

Figure 1 Example of the Chinese phonetic system.....	10
Figure 2 The Five-Level Tone Mark.....	10
Figure 3 ICALL in the context of the current study	11
Figure 4 Xu (1999)'s framework of spoken Chinese acquisition and communication	26
Figure 5 Screenshot of <i>ViewTones</i> (in the game).....	102
Figure 6 Screenshot of <i>ViewTones</i> (four tones).....	103
Figure 7 Screenshot of <i>ViewTones</i> (third tone practice).....	104
Figure 8 Screenshot of <i>ViewTones</i> (difficulty).....	106
Figure 9 Screen Shot of Don't Stop Eighth Note	107
Figure 10 Screen Shot of <i>Super Mario Jump</i>	108
Figure 11 Screen Shot of <i>ViewTones</i> (tone indicators)	111
Figure 12 Screen Shot of <i>Trip2China</i> (first scenario)	112
Figure 13 Screen Shot of <i>Trip2China</i> (Mei)	113
Figure 14 Screen Shot of <i>Second Life</i>	114
Figure 15 Screen Shot of <i>PandoraBots</i> platform	114
Figure 16 The backstage of <i>FaceRig</i>	116
Figure 17 The <i>Voice Changer</i>	116
Figure 18 Sample characters in <i>Trip2China</i> using <i>Voice Changer</i>	117
Figure 19 Mispronunciation rates for all participants.....	142
Figure 20 Mispronunciation rates of heritage and non-heritage speakers	142
Figure 21 Mispronunciation rates of single-syllable words.....	143
Figure 22 Mispronunciation rates of disyllable words	143
Figure 23: Example of Praat report to the students of Control group A	177
Figure 24: Example of feedback to the students of Control group B.....	178
Figure 25 Patterns in pre-test results	181
Figure 26 Pre-test and post-test changes between groups	184
Figure 27 Impact of language learning experiences (Mean differences)	187
Figure 28 Pre-test error rates: Stage 1	190
Figure 29 Post-test error rates: Stage 2	191
Figure 30 The error reduction rate between Stages 1 & 2 (fig. 28 &29)	192
Figure 31 Challenges addressed by iCALL tools.....	200

List of Tables

Table 1 Sample of Oral and Aural learning outcomes in LC Chinese specification	18
Table 2 Overview of Assessment for LC Mandarin Chinese	18
Table 3 Chapelle's (2001) criteria for judgemental analysis of CALL	80
Table 4 Chapelle's (2001) criteria for empirical evaluation of CALL	81
Table 5 Leakey's (2011:81) additional six principles	82
Table 6 Criteria for iCALL evaluation in the current research	84
Table 7 Structure of the research design	92
Table 8 Student evaluation of the iCALL tools	122
Table 9 Syllables used for the controlled experiment	123
Table 10 Demographic information of the teacher interviewees (needs analysis)	129
Table 11 Demographic information of teacher interviewees (evaluation)	148
Table 12 Demographic information of student participants	176
Table 13 Influence of experiences in learning Asian languages	180
Table 14 Paired wise comparisons between groups	183
Table 15 Language learning experiences in the experimental group	186
Table 16 Mean differences of participants with no Asian language learning experiences	188
Table 17 Impact of game experiences in iCALL implementation	189
Table 18 Descriptive data of post-test evaluation for ViewTones	193
Table 19 Descriptive data of post-test evaluation for Trip2China	194
Table 20 Challenges in teaching spoken Chinese	198
Table 21 Challenges in learning spoken Chinese	199

Chapter 1 Introduction

1.1 Development in teaching and learning Mandarin Chinese in Ireland

According to the Irish census (CSO, 2017), Chinese nationality has become one of the major immigrant groups in Ireland, with a population of circa ten thousand by the end of 2016. In the meantime, with the extensive communication and collaboration between Ireland and China, particularly under the influence of Brexit (Barrett et al., 2015), the demands for teaching and learning Chinese as a foreign language (TCFL) have also grown rapidly due to the interest of local and international students in Ireland.

TCFL in Ireland began in 1986 when a Chinese community school was established to help teach heritage languages to children of immigrant Chinese businesspeople (Chen & Cao, 2014). Cantonese was first introduced as the main language studied until the 1990s, while Mandarin Chinese gradually become more mainstream in recent years among Chinese community schools (Zhang & Wang, 2018). In comparison, the history of TCFL as a curriculum in the Irish education system is relatively short, with only a little bit more than a decade in both higher education and post-primary education contexts.

In higher education, the first credit-bearing degree programme which involved Chinese language education was founded at University College Dublin in 2006 as a double major undergraduate degree combining commerce and Chinese studies (Wu, 2017). The design of a minor subject in Chinese studies was the main method for developing Chinese language education in the higher education system (UCD CI, 2016). In 2018, there were eight Irish universities and higher education institutions offer Chinese language studies as the sole or part of the degree (Zhang & Wang, 2018: 37). The introduction of TCFL in post-primary education began at a similar time.

In post-primary education, Chinese language education was first introduced to Irish post-primary schools as an extracurricular subject. Two Confucius Institutes, the Chinese cultural institute funded by the Chinese Ministry of Education, were established respectively at University College Dublin and University College Cork in 2006. With the support of these two institutes, schools in Dublin and Cork regions first began to offer

Chinese language and culture courses in 2006 (UCD CI, 2012). With the initial awareness-raising, the Irish government began to implement Mandarin Chinese into the post-primary curriculum.

In 2012, the Irish National Council for Curriculum and Assessment (NCCA) launched the Transition Year (TY) Unit of Chinese Culture and Language Studies, which was the first step of Chinese language education entering the Irish post-primary system (NCCA, 2012a). Built on the popularity of the TY module, the NCCA launched the Junior Cycle (JC) Short Course in Chinese Language and Culture subsequently, which represented that Chinese language education has officially become part of the post-primary school curriculum (NCCA, 2016). In 2017, the Languages Connect foreign language strategy in education was published (DES, 2017). Based on the strategy, Mandarin Chinese was introduced as a Leaving Certificate (LC) curriculum subject in 2020 and the first LC exam took place in 2022.

Chinese language education in Ireland is expected to be further developed across educational levels due to such positive support from the learners, educators, and policymakers in Ireland. However, some challenges and complexities need to be addressed, especially at the post-primary level, which will be further discussed in Section 2.2.2 and Section 2.2.3.

1.2 CALL and iCALL in the context of Irish post-primary TCFL

Over the years, there have been various ways to conceptualise the field, and several acronyms have been employed at different times. However, the term Computer-Assisted Language Learning (CALL) seems to be the most widely accepted (Hubbard, 2021). In his work, Hubbard (ibid) outlined the history of CALL in five distinct periods from the 1960s to the present day. The development of CALL evolved in parallel with the innovation and implementation of computer science in the field of education, alongside the gradual widespread use of computers and other digital devices in daily life.

During the 2010s, CALL further advanced in tandem with the proliferation of smart mobile devices and applications, the rapid expansion of streaming media and computer-mediated communication (CMC), ubiquitous computing, gamification, and increasing

normalization (Bax, 2003). The COVID-19 pandemic accelerated the shift towards widespread emergency online teaching, making applications like Zoom and others a part of the daily lives of millions of language learners and their instructors. Understanding available technologies and their effective use became increasingly essential for both language teachers and learners.

Doughty (1987) explained the interconnection between Second Language Acquisition (SLA) theory and CALL by discussing Krashen's monitor theory (Gregg, 1984), the information processing theory (Simon, 1978), and the interaction theory (Gallaway & Richards, 1994). She pointed out that using computers to deliver instruction and collect data opens the possibility for more precision and control in data collection, while educational theories still need to play a central role in designing CALL research that will ultimately inform practice.

Some early research adopted the social constructivist approach as the theoretical foundation for CALL research. Labour (2001) examined how different learning styles interact and impact learners' activities in a CALL environment to help teachers better evaluate the use of network-based multimedia authoring tools. The use of technology for telecollaboration has also driven the expansion of a theoretical framework drawing on sociocultural theory (Belz and Thorne, 2006; Lantolf, 2000). Belz and Thorne (2006) highlighted that telecollaborative pedagogies engage a broader set of issues than those raised by CALL for classes or individuals. Such pedagogies aim to develop intercultural competence through telecollaborative projects with people from other cultures, raising issues of intercultural tensions, negotiation of language and identity, as well as social and institutional contributions and constraints. With these dynamic and broad-based theories coming into play in conducting CALL research, SLA theories need to encompass the learner, teacher, language, technology, and institution, as well as how power relations intersect in ways that are both within and beyond the control of the teacher.

Intelligent Computer-Assisted Language Learning (iCALL) is a subfield of CALL that 'applies concepts, techniques, algorithms, and technologies from artificial intelligence (AI) to CALL' (Gamper & Knapp, 2002). ICALL is a highly interdisciplinary field of research that draws on various disciplines in applied linguistics and computing (Levy, 1997, p.49). ICALL systems offer a wide variety of interactions, both tutorial and non-

tutorial. The latter can be broadly categorized as dialogue systems and language tools (Heift, et al., 2015). In the context of the current research, the dialogue system is the primary approach adopted to create the iCALL tools, and the research follows the five stages of design for iCALL teaching programmes mentioned by Colpaert (2006), which include analysis, design, development, implementation, and evaluation.

The study on using CALL to facilitate TCFL in an Irish context began with a research project conducted at the tertiary level. Li et al. (2018) carried out a three-year diachronic research project to analyze the application of digital methods in TCFL. It piloted, analyzed, and summarized the effects of different approaches to CALL based on the language proficiencies of the target learners. The research focused on the teaching and learning of Chinese reading and writing skills, but, to date, no research has addressed the implementation of CALL and iCALL in facilitating spoken Chinese acquisition in the Irish context.

To address this gap, the current research views iCALL as an interdisciplinary subject that allows language acquisition theories to be integrated and realized through educational technologies. It proposes and evaluates two iCALL tools for assisting the teaching and learning of spoken Chinese. These tools implement various CALL and iCALL theories and technologies, including (i) a voice-control game for learning Mandarin tones, which combines gamification and speech visualization technologies, and (ii) a Spoken Dialogue System with a Virtual World interface for students to conduct oral practice and receive instant feedback provided by integrated technologies, such as Automatic Speech Recognition (ASR), Natural Language Understanding (NLU), Dialogue Management (DM), Natural Language Generation (NLG), and Text-to-Speech (TTS). Relevant key terminology will be further explained in Section 1.6, and relevant literature will be reviewed in Section 2.5.

1.3 Aims and Rationales

The present research aims to develop and evaluate an iCALL tool that can be utilised to facilitate the teaching and learning of spoken Chinese for beginner learners in Irish post-primary education.

To achieve this aim, the following objectives have been identified. The rationale for each is outlined below.

- 1) To conduct a needs analysis among post-primary students and teachers of TCFL and identify their context-specific needs about teaching and learning spoken Chinese and the willingness to use iCALL tools
- 2) To develop a prototype of an interactive gamified tone visualisation tool for Chinese pronunciation to help improve learners' perception and production of Mandarin tones
- 3) To develop a prototype Chinese spoken dialogue system that aims to provide an immersive language learning context for learners. Learners will be able to engage with a virtual interlocutor using authentic spoken Chinese and will receive instant feedback on their production
- 4) To evaluate the effectiveness of the two iCALL tools (2 and 3) in facilitating the teaching of spoken Chinese
- 5) To evaluate the effectiveness of the two iCALL tools (2 and 3) in facilitating the learning of spoken Chinese
- 6) To evaluate the effectiveness of the two iCALL tools (2 and 3) in facilitating the assessment of spoken Chinese

Rationale

- 1) To date, there has been no research on spoken TCFL in the context of Irish post-primary education. There is also a dearth of research on the use of iCALL tools in the Irish post-primary context. A context-specific analysis is necessary to determine the specific needs of Irish post-primary teachers and learners set against the backdrop of the wider fields of TCFL and iCALL. The literature review (see Sections 2.2.2 and 2.2.3) gives an overview of these fields.
- 2) The rationale for developing the tool for Mandarin tone acquisition is to offer an alternative methodology to the traditional imitation and repetition exercises most used in spoken TCFL instruction and to explore its effectiveness. Where learners

do not have ready access to native-speaker teachers to provide models of the tones, as is the case for most Irish post-primary students learning Chinese at the ab initio level, access to a visualisation tool that gives instant feedback may prove a valuable complement to classroom activities.

- 3) The rationale for developing a virtual interactive language partner is to address the inevitable lack of exposure Irish learners have to the target language. The tool aims to provide guidance and support for learners both to practice their spoken Chinese and to assess and reflect on their learning. This low-anxiety setting has proven effective in other language contexts (See Section 2.4.4) and an investigation in the Irish post-primary context is needed.

4-6) Since the context of TCFL in Ireland is very new and the digital tools have not previously been used in this context, an initial investigation into the effectiveness of the two new iCALL tools being developed as part of the current research is necessary for Irish teaching, learning, and assessment contexts.

1.4 Research questions

Given the above aim and objectives, four research questions have been identified:

1. What are the challenges for teachers in teaching spoken Chinese in the context of Irish post-primary education?
2. What are the challenges for learners in learning spoken Chinese in the context of Irish post-primary education?
3. To what extent can iCALL tools aid teachers in teaching and assessing learners' spoken Chinese in the Irish post-primary context?
4. To what extent can iCALL tools aid beginner learners in learning and assessing their spoken Chinese in the Irish post-primary context?

The above research questions will be further discussed in chapter 6.

1.5 Structure of the Thesis

This thesis is divided into 6 chapters, and they are outlined below.

Chapter 2 provides a review of the existing literature in the field of Chinese language education and technology relevant to the present research. It covers four main research areas. The first part reviews the background of the learners and the Chinese curriculum, as well as the challenges identified by previous research in the teaching and learning of TCFL. The second area delves into the theories embedded in the current study. It examines acquisition theories in CALL, with a focus on social constructivism, Sociocultural Theory, and SLA interactionist theory. This section also reviews the common acquisition theories used to support CALL research, particularly in spoken Chinese acquisition and Mandarin tones acquisition, and their adaptation in the technology-mediated context.

The third area focuses on teaching pedagogy and methodology, reviewing the historical development of spoken Chinese pedagogy, communicative approaches, task-based language teaching, material development for teaching and assessing spoken Chinese, as well as current issues in teaching spoken Chinese. The fourth area concentrates on technology, primarily in iCALL. This section reviews the key technologies and the evaluation criteria concerning the present research, including automatic speech recognition, speech visualisation, gamification, virtual worlds, artificial intelligence, and spoken dialogue systems. The final part reviews previous works on the evaluation of CALL and iCALL and proposes the evaluation criteria for the current study.

Chapter 3 outlines the design of the current research project. It begins by reviewing the research questions, proposing hypotheses, and explaining considerations from the perspectives of research discipline, ethics, and practical feasibility. The chapter then outlines the design of this three-phase mixed-method research project. The first phase involves a needs analysis for both teachers and students, initially ascertaining their needs and challenges in teaching and learning spoken Chinese and their attitudes towards iCALL implementation. Based on the findings of the first phase, the second phase involves the development of two iCALL tool prototypes aimed at addressing some of these challenges. The third phase administers the tools and evaluates their impacts. The

chapter provides a general overview of the research design, the identification of research participants, data collection methods and instruments for the first and third phases, and introduces each iCALL prototype and its development process in the second phase.

Chapter 4 reports the results of the first phase of the research, the needs analysis. For the teacher needs analysis, it presents the backgrounds of the participants, challenges identified in teaching and learning, the status of technology implementation, and teacher attitudes towards iCALL implementation. For the student needs analysis, it first presents demographic information of participants, followed by findings regarding students' perceptions and identified challenges in learning spoken Chinese and Mandarin tones.

Chapter 5 reports the findings of the third phase of the research, the iCALL evaluation. For the evaluation by teachers, it provides information about participants and research administration, followed by findings of existing challenges identified by teachers in teaching and assessing spoken Chinese, as well as their insights on the challenges for their students in learning spoken Chinese. It then reports findings of their evaluation of the iCALL tools, covering both their positive impacts and limitations. For the evaluation by students, after outlining demographic information of participants, it presents survey results regarding the potential impacts of language learning experiences, Chinese language competence, and ICT background of students on their performance using the iCALL tools. It then discusses the results of the experiment and error analysis, followed by the results of the student questionnaire about the functionality of the iCALL tools, considering both their concrete effects and students' perceptions of the tools.

Chapter 6 is the final and summary chapter of the thesis. It begins by summarising and discussing the key research findings in the context of the four research questions about the challenges and needs of teachers and learners and the evaluation of the iCALL tools from their perspectives. After that, it presents the contribution of the current research project, its limitations, and insights for future directions.

1.6 Definition of key terminology

Phonetic language and logographic language: In linguistics, a phonetic language refers to a language in which the written symbols closely correspond to the spoken sounds of

the language (Crystal & Alan, 2023). This means that the pronunciation of words can be predicted based on the written representation, and vice versa. A logographic language is a writing system in which each character or symbol represents a word, morpheme, or meaningful unit, rather than representing individual sounds or phonemes (DeFrancis, 1989). Mandarin Chinese, notably written using Chinese characters, is a prominent example of a logographic language.

Mandarin tones: For phonetic languages, the pitch is the instrument to distinguish lexical items. It is often measured and expressed by the fundamental frequency (f_0) as the rate of vibration of the vocal cords during voice production (Elliott, 1991: 180-181). In the context of Mandarin Chinese, Pike (1964: 3) described Mandarin Chinese as a ‘language having a lexically significant, contrastive, but relative pitch on each syllable’. Gandour (1978) identified tone as ‘the particular way in which pitch is utilised’. Mandarin Chinese is a syllable-tone language, and each stressed syllable in Mandarin Chinese has a lexical tone. Learners need to acquire Mandarin Chinese tones from the outset as it is essential to distinguish the meanings of the words.

Pinyin: which means ‘spell sound’, is the phonetic system of Mandarin Chinese written in the Latin script. It is used to Romanise Chinese characters into a spelling form and is widely used by both native Chinese and CFL learners. Pinyin includes three components, namely the initials, finals and tones. Initials refer to the initial consonant sounds in a syllable. Finals are the vowel and any following sound in a syllable that comes after the initial. The tone marker is a useful visual reminder, particularly for non-native speakers, as the tones can be difficult to grasp. In today’s digital age, learners need to become familiar with pinyin. The majority of Chinese people, for example, use pinyin input to type Chinese on a computer. There are 21 initials along with 39 finals and 4 contrastive tones in Mandarin Chinese. See an example of a character and its pinyin below (see Figure 1)

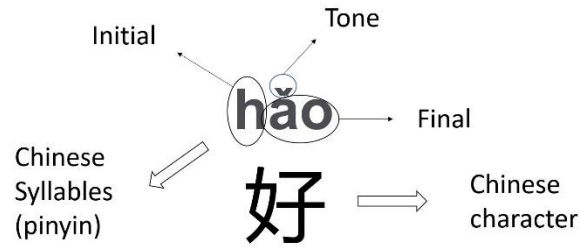


Figure 1 Example of the Chinese phonetic system

Contrastive tones: Tone 1 is a high-level tone, Tone 2 is a high-rising tone, Tone 3 is a low dipping tone, and Tone 4 is a high-falling tone. (Chao, 1968). See Figure 2 as an example.

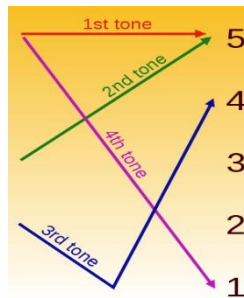


Figure 2 The Five-Level Tone Mark

Tone marks: Teachers and scholars use tone makers ‘ˊ’, ‘ˊˊ’, ‘ˇ’ and ‘ˋ’ to represent the four tones respectively. The following examples are widely used to illustrate the use of tones.

- Tone 1 mā ‘mother’ (high-level tone)
- Tone 2 má ‘hemp’ (high rising tone)
- Tone 3 mǎ ‘horse’ (low dipping tone)
- Tone 4 mà ‘to scold’ (high falling tone)

Intelligent Computer-Assisted Language Learning (iCALL): ICALL is a combination of design with educational pedagogy, technology and artificial intelligence to provide personalised and adaptive language learning experiences (Amaral & Meurers,

2011). In the context of the current study, the focus is on the integration of a Spoken Dialog System with the assistance of artificial intelligence in supporting Mandarin language acquisition (see Figure 3).

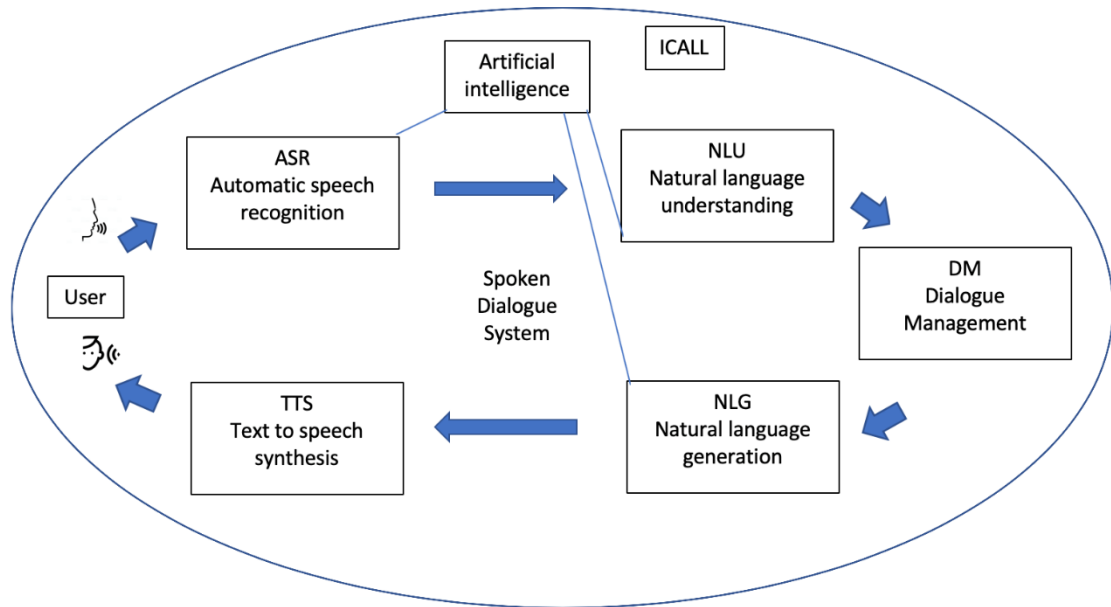


Figure 3 ICALL in the context of the current study

Spoken Dialog System (SDS): A spoken dialogue system is a computer system able to converse with a human by voice. In the present research, the second tool is an SDS with the interface of a Virtual World for students to conduct oral practice and gain instant feedback provided by the integrated technologies of Automatic Speech Recognition (ASR), Natural Language Understanding (NLU), Dialogue Management (DM), Natural language Generation (NLG) and Text-to-Speech (TTS).

Automatic Speech Recognition (ASR): Speech recognition is an interdisciplinary subfield of computer science and computational linguistics that develops methodologies and technologies that enable the recognition and translation of spoken language into text by computers with the main benefit of searchability. It is also known as automatic speech recognition (ASR), computer speech recognition or speech-to-text (STT). It incorporates knowledge and research in the computer science, linguistics and computer engineering fields.

Natural Language Understanding (NLU): NLU is the process of constructing natural language outputs from non-linguistic inputs. One of the central goals of NLU is to investigate how computer programs can be made to produce high-quality, expressive, uncomplicated, and natural language text from computer-internal sophisticated representations of information. (Reiter & Dale, 1997)

Dialogue Management (DM): Dialogue management controls the whole dialogue process, and its design directly affects the performance of the dialogue system. Dialogue management mainly includes two tasks: (1) Dialogue state tracking; (2) Dialogue policy learning. Dialogue state tracking determines the current user target based on multiple rounds of conversations between the system and the user. Dialogue state tracking provides the basis for later decisions. Dialogue policy selection selects an executable action based on the results of the dialogue state tracking. The goal is to complete the task in a short conversation as possible. (Bibauw, et al., 2019)

Natural Language Generation (NLG): Natural Language Generation (NLG) systems generate texts in English (or other human languages, such as French) from computer-accessible data. NLG systems are (currently) most often used to help human authors write routine documents, including business letters and weather reports. They also have been used as interactive explanation tools which communicate information in an understandable way to non-expert users, especially in software engineering and medical contexts. (Reiter & Dale, 1997)

Text-to-Speech (TTS): Text to Speech is the “synthetic” (computer) generation of speech, the process of converting written text into speech. As such it complements other language technologies such as speech recognition, which aims to convert speech into text, and machine translation which converts writing or speech in one language into writing or speech in another (Taylor, 2009). It has long been a colloquial research topic in the field of artificial intelligence. (Ren et al., 2019)

Virtual World (VW): Virtual world is a shared, simulated space which is inhabited and shaped by its inhabitants who are represented as avatars. These avatars mediate our experience of this space as we move, interact with objects, and interact with others, with whom we construct a shared understanding of the world at that time. (Girvan, 2018)

1.7 Summary

This chapter has introduced the present research project. It began by outlining the background of the research describing (i) Mandarin Chinese language education in Ireland and (ii) intelligent Computer-Assisted Language Learning. The aim, objectives and rationale of the research were stated, and the research questions were outlined. Some key terminology relevant to the current research was presented in Section 1.6.

Chapter 2 presents a literature review structured under the headings ‘Theory’, ‘Technology’, ‘Action’ and ‘Learners’.

Chapter 2 Literature Review

2.1 Overview

This chapter reviews research relevant to the present research project. As an interdisciplinary project (see Section 1.2), it is important to first establish the framework of the literature review. Matthews (1993) and Chapelle (1997) identified that theories in the field of linguistics and Second Language Acquisition (SLA) were the two main disciplines that informed and were informed by iCALL.

The dissertation structure adopts the Theory Action Technology Learner context (TATL) framework proposed by Ní Chiaráin and Ní Chasaide (2015) as the guideline for the development and evaluation of the two iCALL tools. The TATL framework is an essential tool for steering CALL development. It combines four vital elements, requiring consideration both before and during development:

- (i) **Pedagogical Theory:** The foundation, where educational theory drives the development process.
- (ii) **Learning Tasks:** Derived from theory, it specifies meaningful language learning activities.
- (iii) **Technological Provision:** Concerned with selecting and integrating the right tech tools.
- (iv) **Learner Context:** Recognising cultural diversity and individual cognitive styles.

This framework ensures a holistic approach, aligning CALL development with effective pedagogy, making tasks relevant, leveraging appropriate technology, and adapting resources to diverse learner backgrounds. As a result, the review of the literature in this chapter follows the same structure. According to this framework, four major disciplines of academic literature should be reviewed to prepare for the present research project.

- (i) **Theory** - Chinese language acquisition theories
- (ii) **Action** - Spoken Chinese teaching pedagogy and methodology
- (iii) **Technology** - Relevant educational technologies and ICT
- (iv) **Learner** - Learner background, learning context, needs and challenges

To provide a clear context for the research from a reader's standpoint, this chapter first reviews literature relevant to the learner context. However, as mentioned in the previous chapter, there is still not much research on Irish students learning Chinese. Therefore, the present research needs to rely more on the results of its own needs analysis to inform the design and evaluation of the iCALL tools in this respect (see Section 2.2 and Section 3.4).

The second part of this chapter reviews Chinese language acquisition theories. It reviews (i) acquisition theories and CALL and (ii) theories of spoken Chinese acquisition in general and (iii) previous research on using technology to assist spoken Chinese acquisition, and (iv) Mandarin tone acquisition in the context of a technology-mediated environment (see Section 2.3).

The third part of this chapter reviews action, mainly in the pedagogy and methodology for teaching spoken Chinese. It begins with a historical review of the development in teaching spoken Chinese, followed by a discussion on the Communicative Approach of Language Teaching. Towards the end of this part, the material development for teaching and assessing spoken Chinese is reviewed and some current issues on teaching spoken Chinese are also presented (see Section 2.4).

The fourth part of this chapter reviews relevant educational technologies and the methods to evaluate such technologies. In the beginning, six key technologies are reviewed, which are the virtual world, artificial intelligence, automatic speech recognition, spoken dialogue system, speech visualisation technology and gamification (see Section 2.5).

Towards the end of this chapter, different definitions, and approaches of CALL and iCALL evaluation are reviewed. The evaluation criteria for the current research outcome (see Section 3.5 Phase two: Develop the iCALL tools) are also presented at the end of Section 2.6.

2.2 Learner Context

This section reviews the context of learning Mandarin Chinese in Irish post-primary schools from three perspectives of curriculum design, challenges in teaching and challenges in learning Chinese as a foreign language.

2.2.1 Mandarin Chinese Curriculum Design in Irish Post-primary Context

Chinese is a migrant language in Ireland. Looking back at the development of Chinese language education at the post-primary level in Ireland, it began as a heritage and community education that was delivered by complementary and vocational schools outside of the Irish curriculum in the 1980s (Chen & Cao, 2014). Then, Chinese language classes were seen in Irish schools as supported by the Confucius Institutes as early as 2006 (Zhang & Wang, 2018). The Chinese curriculum was first introduced into the Transition Year in 2012 (NCCA, 2012b), then into the Junior Cycle as a short course (NCCA, 2016) and as a Leaving Certificate (LC) subject in 2020 (NCCA, 2019).

According to the reports of the two Confucius Institutes in Ireland in 2016 (UCC CI, 2016; UCD CI, 2016), there were about twelve thousand post-primary students in over 150 schools in Ireland studying Chinese through the Junior Cycle short course and the taster Transition Year Chinese programmes (old TY Chinese). Despite more than a decade of history in introducing Chinese into schools, the language teaching and learning components in the Junior Cycle and old TY Chinese are peripheral, with a range of about 10%-30% of the subject content. There were also no clear requirements on the qualification of the teachers for teaching these programmes.

At the time of the research, new bridging programmes of TY Chinese (New TY Chinese) towards the LC Mandarin Chinese curriculum and the LC Mandarin Chinese curriculum have also emerged in some schools. The language teaching and learning components in the new TY Chinese are about 90% of the subject content. According to the 2020 annual report of Post-Primary Languages Ireland (PPLI, 2021), about nine hundred students were studying the Chinese language in these 'new' TY programmes, and an additional 35 students sit in the fifth-year LC Chinese class. There was also a qualification required by the state for teaching the LC programme, which is in line with the requirements for

modern foreign language teachers in post-primary schools. In comparison, these TY and LC programmes focus primarily on the study of the language, and the teaching and learning context would be ideal for the current research project.

The curriculum specification for the JC short course and the TY Chinese programme was created earlier using the content-based approach (NCCA, 2012b, 2016), while the LC Mandarin Chinese specification was developed later using a learning outcome-based approach and aligned broadly with the Common European Framework of Reference for Languages (CEFR), at the level of pre-A1 to A1 (NCCA, 2019). There are two inter-related and inter-dependent strands for the LC Mandarin Chinese specification, namely, the Communicative Language Competence (CLC) and Plurilingual and Pluricultural Competence (PPC). Below are some examples of the oral and aural competence aimed as the outcome of the LC Chinese curriculum (see Table 1).

In terms of assessment, the state exam has ordinary and higher levels. In both levels, a significant weight has been given to testing the spoken Chinese competence. At both ordinary and higher levels, the speaking and listening components count for 60% of the overall scoring (see Table 2). The ordinary level assesses speaking and listening skills with equal importance while the higher level focuses slightly more on reflecting the competence of oral production.

With the great emphasis on spoken Chinese in the curriculum design and the challenges identified in previous research (see Section 2.2.2 and 2.2.3), the current research project established a focus on assisting and improving the teaching and learning of spoken Chinese at the post-primary level in Ireland (see Section 1.3 the aims and rationales of the study).

Table 1 Sample of Oral and Aural learning outcomes in LC Chinese specification

Reception	CLC3. Identify and gather specific information from a range of short, simple oral, written and multi-modal texts expressed in everyday language for a particular purpose, especially if there is visual support.
	CLC6. Understand short and simple descriptions of places, events, personal experiences, feelings and perspectives, expressed in very simple everyday language.
Interaction	CLC9. Use short, very simple expressions and phrases to initiate and close simple face-to-face conversations, asking for clarifications as appropriate.
	CLC10. Ask and answer simple questions, exchange ideas, express emotions and information on familiar topics in everyday situations.
Production	CLC11. Convey their message clearly enough to be understood with generally clear pronunciation (e.g. tones), intonation, stress and rhythm.
	CLC16. Develop a range of creative texts on subjects of personal interest (e.g. songs, poems, drama, stories) using very simple language, in spoken, written and digital formats.
Mediation	CLC17. Convey, in writing or orally, using very simple language the main points involved in clear, simple texts on subjects that are familiar and of personal interest.
	CLC22. Respond (in writing and orally) to short, simple creative oral, written and digital texts about everyday topics, using very simple language to explain how it made them feel.
Plurilingual competence	PPC3. Apply communication and compensation strategies when communication is impaired (such as by using synonyms, gestures, translanguaging etc.) and thereby avoid misunderstandings.
	PPC7. Compare and contrast the target languages they already know or have studied, taking account of features such as tonality or logographic writing system, to support their comprehension of oral, written and digital texts.
Pluricultural competence	PPC13. Interpret aspects of cultures and communities in everyday living, social conventions, interpersonal relations, evolving values and beliefs through engagement with a range of short, very simple oral, written and digital texts.
	PPC16. Demonstrate an awareness of and use appropriate verbal and non-verbal social conventions when interacting with others.

Table 2 Overview of Assessment for LC Mandarin Chinese

Assessment Component	Modes of Communication	Ordinary Level	Higher Level
Oral Exam	Speaking	30%	35%
Written Exam	Listening	30%	25%
	Reading	25%	20%
	Writing	15%	20%

2.2.2 Challenges in teaching Chinese as a foreign language

In recent years, there has been an increasing number of studies concerning TCFL in Ireland, with most of them being conducted in the context of higher education. Despite differences in educational contexts, some of these studies could shed light on the current research. For example, Zhang, Osborne, Shao & Lin (2020) mentioned the issue of the classroom language that TCFL in Irish higher education predominantly used English. The translanguaging approach was suggested to encourage more exposure to the target language and to change the monolingual approach in providing instruction and feedback.

There were only a handful of studies that investigated TCFL in an Irish post-primary educational context in the past decade (Ji, 2015; Ruddock, 2010; Wang, 2015; Zhang & Wang, 2018). Among them, two major challenges were identified: the lack of qualified teachers and the peripatetic nature of Chinese language education in the Irish post-primary system at the time of the research. These two challenges, as perceived by the researcher, have contributed to the motivation for conducting the present research project.

To provide insights for establishing and developing Chinese language education in Irish post-primary schools, Ruddock (2010) systematically reviewed the development and issues of Chinese language education in three English-speaking countries: Australia, the UK, and the US. She reported that the main issue for its development in these countries was the lack of qualified teachers. Native Chinese teachers found it difficult to utilize suitable teaching and learning methods to assist learners' comprehension of the language. Non-native Chinese teachers appeared to lack proficient language skills to demonstrate appropriate methods for language learning and usage (ibid: 14). Ruddock also reviewed the development of Chinese language education in Japan as a non-English speaking context in comparison with the development of Japanese language education in Ireland. The main challenge identified in TCFL was the peripatetic nature of Chinese courses in Japan, which was similar to the situation of Japanese and Chinese courses in Ireland at the time of the investigation. It was reported to affect learners' mentality and commitment as well as teachers' self-recognition and enthusiasm in teaching.

With the change of time, some of the above issues were resolved by the development of policy and educational support, while others remain evident as identified and reported in

the study of Zhang and Wang (2018). They reported that the uptake of Chinese language courses was relatively low due to several complexities in TCFL in an Irish context. One of the major obstacles in teaching was the shortage of qualified teachers who possess equivalent qualifications required to teach in various Irish educational contexts (ibid: 40). The popularity of the TY Chinese module was largely determined and supported by the teaching resources published along with the course (NCCA, 2012b). This has helped teachers with limited capacity in both language competence and teaching methodology to initiate teaching, but it also creates a reluctant mindset for them to take full ownership of teaching. As a result, there is an extremely limited number of Irish and native Chinese teachers who could teach independently beyond the TY Chinese module. This has partially been reflected in the number of schools initiating the JC short course Chinese and the method of teaching. For example, with insufficient training in the target language as well as pedagogy, some teachers were found to overuse English in their Chinese classrooms (Carson, Jiang, Zhou, & Egan, 2020).

2.2.3 Challenges in learning Chinese as a foreign language

The difficulties of CFL learning are also partially rooted in the characteristics of the Chinese language. The major linguistic challenges identified were the acquisition of Chinese characters (Osborne, Zhang & Adamson, 2022), Mandarin phonetic acquisition (Lu & Song, 2017), and the indefinite usage of grammatical rules (Li, Zhang, Xie, Wang, & Wang, 2018). Among all the key challenges, the present research focuses on challenges in teaching and learning spoken Chinese.

Putting themselves in the shoes of young Irish Chinese learners, they would initially tend to have not much confidence in their efficacy due to the perceived difficulty in learning the language (Wang, 2015). They can mainly demonstrate and reflect on their competence and learning progress in the classroom, where some may feel more vulnerable if not fully prepared. From a socio-cultural perspective, English plays a dominant role in communication for both Irish and heritage Chinese speakers (Zhang, Osborne, Shao & Lin, 2020). It has contributed greatly to a lack of Chinese language exposure for the learners, as they rarely have opportunities to practice and use Chinese to improve oral and aural competencies outside of the class.

The negative perceptions at a personal level (low confidence) and a societal level (English dominance) can occupy beginner learners' mindsets and lead to a state of demotivation (Zhang & Wang, 2016: 149). Therefore, a relatively private space for practice and self-evaluation would be a great help in maintaining and improving Chinese learners' confidence, especially at the early stage of learning. With the absence of the language environment in the physical world, the present research looks at the potential in the virtual world.

There was an increasing amount of research in the past decade about the implementation of information communication technology (ICT) in TCFL, and many have reported that computer-assisted language learning (CALL) is effective for CFL learning from the perspective of learning outcomes as well as learners' wellbeing (Jiang & Ramsay, 2005; Lai, 2017; Lai, Luo, Zhang, Huang, & Rozelle, 2015; Lam et al., 2001; Lam, Pun, Leung, Tse, & Ki, 1993; Wu & Molnár, 2018). A great number of software and applications were developed and are continuously being developed for TCFL. ICT was also increasingly being represented in CFL teaching and learning materials, which also had a positive impact on reviewing and shifting the pedagogy and approach to be more relevant to the teaching and learning context at present (Zhang & Leahy, 2021).

In the meantime, many of these ICT products do not have a clear educational pedagogy to support learning and acquisition, and more have failed to tackle the real challenges in specific learning contexts (Liu, Zhou, & Lu, 2019). In terms of applications for spoken Chinese, imitation and repetition are still the dominant methods to acquire Mandarin pronunciation, while a significant shortage is seen in providing clear and meaningful guidance and feedback for the perception and production of Mandarin pronunciation.

The other major challenge identified was that learners of Chinese as a foreign language (CFL) in Ireland have little or no exposure to a Chinese language environment. This has caused the learners to lack the opportunity to use and communicate in the language outside of the designated class hours. Wang (2015) mentioned that Chinese language education in Irish schools was still at the stage of focusing primarily, and often predominantly, on interest and awareness-raising. As the classes are peripatetic (see Section 2.2.1), there are limited contact hours in schools ranging from typically 40 minutes to 80 minutes weekly. There is often no homework nor guidance for continuous

learning outside of class hours. In conjunction with the teaching quality and the absence of a Chinese language environment, it is extremely difficult for dedicated students to make meaningful progress in learning.

The major challenges in the teaching and learning of CFL were also identified and reported consistently in other TCFL contexts around the world (Zhang & Li, 2010), while conventional methods appeared to be insignificant in making positive changes. Therefore, the current research would like to propose an intelligent Computer-Assisted Language Learning (iCALL) solution to help address these challenges and to assist the TCFL in the context of Irish post-primary education.

2.3 Theory

This section briefly reviews relevant SLA theories in CALL, some theories in spoken Chinese acquisition and Mandarin tone acquisition, and reviews are made in both conventional teaching and learning settings as well as the technology-mediated new learning settings.

2.3.1 Second Language Acquisition theories in CALL

Trends in theory and practice heavily impact the Second Language Acquisition (SLA) area (Ziegler, N., & González-Lloret, M., 2022). When it comes to the relationship between acquisition theories and CALL, Chapelle (2010) pointed out that theoretical approaches are essential in developing and evaluating CALL artefacts and materials. At the time, Chapelle (ibid.) summarized the theoretical approaches that CALL research concerned into four general categories: cognitive linguistics, psycholinguistics, learning theories, and sociocultural theories. Building on this foundation, Akayoğlu (2019) reviewed the publication of CALL between 1997 and 2018 and identified three theoretical frameworks that were popular among the CALL literature and have good potential to be adopted by future research. These three frameworks are Social Constructivism, Sociocultural Theory, and SLA Interactionist Theory.

Closely associated with Bandura's (2001) Social Cognitive Theory, which sees learners as social agents, Social Constructivism emphasizes the importance of evaluating learning

in context. Learners are seen as members of society, and knowledge is viewed as a human product. Meaningful learning occurs when individuals engage in social activities. Seeing CALL as an extended social activity, many CALL researchers have chosen Social Constructivism as the theoretical framework for their research, especially for those with a focus on learners' traits (e.g., learner autonomy, motivation) as well as the social context (e.g., online learning environment).

Social Constructivism

Parmaxi & Zaphiris (2017) reviewed 41 empirical studies between 2009 and 2013 published in top-ranking CALL journals and reported that social constructivism was the most popular SLA theory framework adopted by CALL researchers. In the context of TEFL, Abbasi (2022) mentioned that social constructivism is still the common theoretical foundation for research and the design of teaching and learning products. According to Wang (2020), social constructivism is also one of the most influential SLA theories among Chinese scholars in the past decade (Gu & Zhu, 2002; Liu, 2013; Wang, 2012), especially in research that investigates project-based language learning.

In the field of CALL, Labour (2001) adopted Social Constructivism as the theoretical foundation for his research on the typology of different CALL-based interactivity and authoring tools. The theory helped him match individual learning styles with different factors in the social and learning context, such as online learner engagement, online data and events organisation. To understand the reasons behind students' willingness to engage with online blogging, Social Constructivism helped Wang, Lin & Liao (2012) conceptualise the potential antecedents on a personal level (e.g., personality traits, self-efficacy, and innovative tendency). They collected data from 358 college students in Taiwan and reported that personalities such as extraversion, agreeableness, conscientiousness, as well as the tendency of personal innovation, contribute more towards the enjoyment of online blogging and engagement for educational purposes.

Thang & Bidmeshki (2010) also used the Social Constructivism framework to guide the design and interpretation of their study. The research is about Malaysian undergraduate students' online English learning experience and its impact on their development of reading skills, learning autonomy, and motivation. It is reported that the online course

they investigated contributed significantly to the increase in reading skills and motivation. However, as affected by the social context (that many learners do not wish for full learning autonomy), the positive impact on learner autonomy was less prominent.

Sociocultural Theory

In the Sociocultural Theory of Vygotsky and Cole (1978), communication is a social and intercultural activity, typically involving a more novice partner and a more experienced partner. Under this theoretical framework, the process of communication is a form of collaboration as well as a learning activity on both sides (Lantolf, 2000). Su and Zou (2020) investigated the interactions between language learners and the sociocultural learning context. After reviewing the relevant theory constructs, they reported that the Sociocultural theory and Social Constructivism were the most suitable for explaining such interactions.

Technology plays a role in facilitating telecollaboration, and the efficiency of collaboration is often affected by the intercultural awareness and competence of different parties involved (Swain, Kinnear & Steinman, 2015). Zeiss & Isabelli-García (2005) investigated the effect of Computer-Mediated Communication (CMC) on language learners' attitudes and perception of the target culture and intercultural competence. The research conducted an experiment about CMC between several groups of American and Mexican language students and reported that CMC is effective in increasing intercultural awareness among participating learners about more current events.

In addition to investigating the impact of CALL on intercultural activity, researchers have also been using intercultural activities to examine the effect of CALL methods. Wu (2018) conducted a naturalistic study among Chinese and American students using an intercultural exchange and reflective task to test the effectiveness of an asynchronous CMC model. It is reported that the intercultural activity helped discover the dynamics of the alignment process in language use and content agreement, which was overlooked by traditional analysis that focused primarily on the linguistic perspective.

SLA Interactionist Theory

Even in the early stages of acquisition research, researchers such as Wagner-Gough & Hatch (1975) noted that interactionally modified input helps with comprehension in comparison with pre-modified input, even with reduced linguistic complexity. The interactionist perspective in SLA primarily concerns the learning environment. Specifically, research that adopts the Interaction Theory often focuses on how learners use their linguistic environment to construct their knowledge of the target language and guide language use.

To investigate whether Interactionist Theory applies to CALL research, Fuente (2003) compared the receptive and productive measures used by Spanish learners in both CMC and face-to-face interactions. For the same purpose, Chapelle (2006) tasked students of German at the Open University to mind map their skills in conducting everyday life roles as well as being an online language learner and to explore any transferrable skills in these scenarios. Both studies confirmed the appropriateness of adopting the SLA Interactionist Theory for CALL research, as results show that learners utilise their linguistic knowledge and skills in ‘conventional’ contexts to recreate and cope with learning and communication in CMC and CALL scenarios.

In the context of TCFL, a number of studies have shown that learners could actively develop their own linguistic and communication competencies through authentic communicative tasks, particularly with native speakers and even in an online virtual environment (Luo & Gao, 2022; Tseng, Sun & Lan, 2020). In the context of the current research, insights are drawn from previous research about

- (i) the importance of creating and evaluating the virtual learning environment and the immersive experience of learners as a suitable learning context demanded by the Social Constructivism theory
- (ii) designing and investigating the role of an AI as a more experienced communication partner and its effect on learners’ development of linguistic and sociocultural awareness based on the Sociocultural Theory

- (iii) conducting a needs analysis and being mindful of the impact of learners' existing linguistic repertoire or language learning experiences when doing content design for the iCALL artefacts, as indicated by the SLA Interactionist Theory.

2.3.2 The acquisition of spoken Chinese

A few early researchers in TCFL have already mentioned that learners' spoken language acquisition and development of learning strategy require the guidance of the teachers (Li, 1996). As a result, Chinese acquisition theory has been one of the main areas with heavy interest from Chinese scholars in both domestic and international contexts.

The early research of Xu (1999) interviewed 60 CFL learners from diverse language and socio-cultural backgrounds and summarised common strategies in spoken Chinese acquisition and common communicative strategies for encouraging Chinese oral production. Some of these strategies may seem to be out of date and no longer valid in the current era, but many are still effective. The framework is summarised in Figure 4.

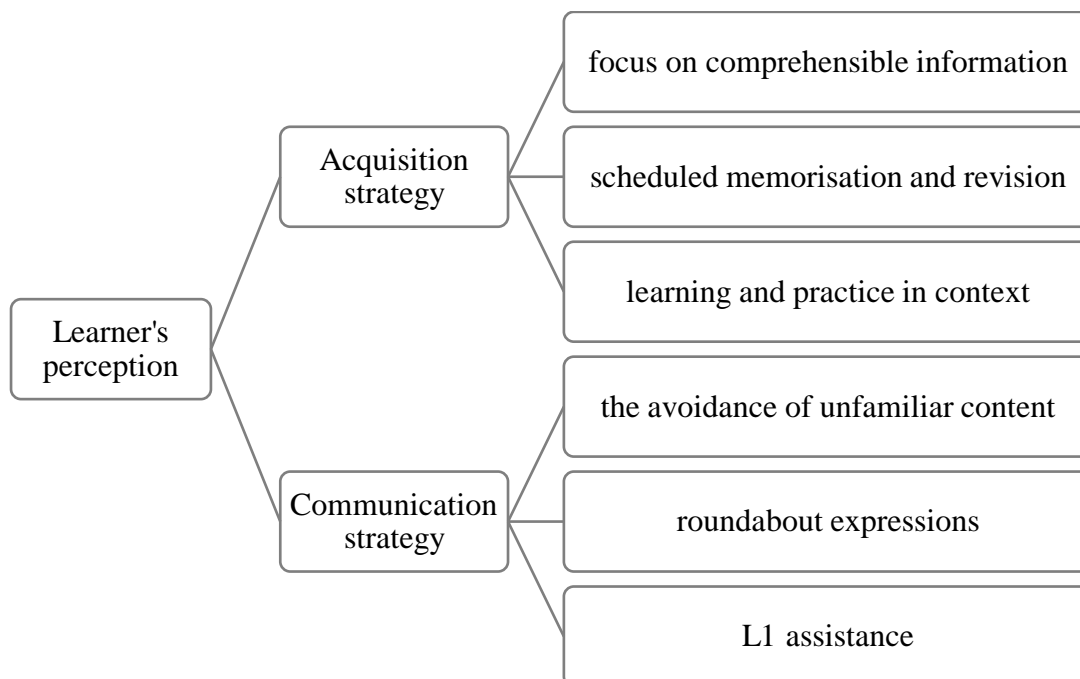


Figure 4 Xu (1999)'s framework of spoken Chinese acquisition and communication

In Xu's framework (Figure 4), learners' perception dominates the strategies used in acquiring the language and their communication. The Acquisition Strategy within this

framework concentrates on enhancing language learning by emphasising key principles. It revolves around the pursuit of comprehensible information, enabling learners to grasp Mandarin in a manner that makes sense to them. Scheduled memorisation and revision form essential components, facilitating long-term retention. Furthermore, learning and practising the language in context fosters a deeper understanding of Mandarin's intricacies. This strategy underscores the importance of structured, systematic learning that combines linguistic knowledge with practical application.

The 'focusing on comprehensible information' requires a certain degree of tolerance for any unfamiliar content in the process of acquisition. Due to potentially insufficient language input outside of class hours, it is essential to carry out scheduled memorisation and revision of learning content, and such practice is best arranged in context, for example, the memorisation and revision of lexical items could be carried out ideally in sentences with given communicative scenarios.

On the other hand, the Communication Strategy recognises the significance of effective language usage. Learners employing this strategy aim to communicate in Mandarin with fluency and clarity. To achieve this, they avoid unfamiliar or overly complex content, opting for a straightforward approach. Additionally, they employ roundabout expressions to convey their ideas subtly and effectively. While striving to maintain a Mandarin-only environment, learners also minimize reliance on their native language (L1), promoting immersive language use.

The communication strategy is best used to achieve maximum effect in language use while not necessarily the most beneficial for acquisition. For example, too much use of the mother tongue is not always helpful in learning. Xu (ibid.) also marked purposefully that, on top of these two types of strategies, it was learners' perception of the differences between Chinese and their mother tongue which would determine the use of all these strategies.

Among the recent research in the field of spoken Chinese, Zhang (2016) sourced the results of Japanese CFL learners' HSKK tests (the official spoken Chinese proficiency test for non-native speakers) and investigated the learning strategies that learners adopted in conjunction with their performance of different speaking skills. Based on the findings,

he proposed some guidelines for balancing teaching to improve language learning outcomes while cultivating effective learning strategies. The focus of learning should be on the fluency and coherence of spoken production at the beginning, instead of focusing predominantly on the accuracy of pronunciation. The minimum training units should be communicative, and the main content for training and practice should be dialogues and monologues instead of words and expressions. Instruction and feedback on phonological practices should be comprehensive and approachable, instead of relying heavily on plain demonstrations of pronunciation.

From the early stages of research in the field of Chinese acquisition, scholars have explored the concept of 'theory in context.' However, few investigations have delved into the interplay between context and strategy. TCFL research used to demonstrate a tendency to primarily focus on validating the effectiveness of specific strategies, with little attention given to the contextual aspects. This pattern started to shift in the early 2000s as the notion of the 'student-centred' classroom gained prominence in TCFL. Researchers began to examine and discuss acquisition theories in conjunction with considering students' backgrounds and the learning context.

Some of these studies looked at the impact of language exposure in the target language environment on learners' acquisition strategy (Li, 2007; Li, 2015; Ye & Tan, 2015), while others began to flag the issue of conventional learning methods being ineffective in an overseas learning context due to the lack of language exposure. For example, Wu (2008) mentioned that self-evaluation and self-correction were proven to be effective methods in learning spoken Chinese for foreign students learning in China, while such measures did not emerge as effective in his research among overseas Italian Chinese learners. Multiple factors would determine the effect of such strategies, such as the personality of the student and whether the communication target is a native speaker or not, echoing Xu's (1999) research that beneath the surface, language confidence seems to be one of the determining forces for effective acquisition at the early stage of learning.

Li & Tong (2019) drew a similar conclusion to Xu (1999) on the importance and influence of language confidence in Mandarin acquisition. They conducted a study on using E-flashcards in comparison with using paperback flashcards in learning Chinese vocabulary and reported that the use of E-flashcards, which incorporate multimedia

inputs (e.g., visual, verbal, audio), improves the effect of language acquisition, while learners' change to a more positive learning attitude was a more evident influence closely associated with their increased language confidence through the use of the E-flashcards.

Apart from deliberately cultivating learners' strategies in learning, another direction for resolving issues regarding learners' ineffective learning strategy in TCFL was the immersion education model, which is more commonly used in the American context. Liang (2014) reviewed the development of immersive Chinese language education in America. She acquired data from the Mandarin Immersion Parents Council and identified that among all the schools offering language immersion courses for Mandarin Chinese, more than 60% were applying a half-immersion model (using 50% target language and 50% English for the immersion), and about 23% of schools were using a full immersion model (using more than 90% of the target language for the immersion). She conducted qualitative interviews to investigate the improvement in communicative capability and the effectiveness of learners' learning strategies among schools with different immersion models. Findings showed that learners in full-immersion schools not only excelled in spoken production in comparison with learners in half-immersion and no-immersion schools, but they also appeared to develop more effective learning strategies.

Liang (2014) examined the impact of full immersion experiences on learners' strategies, attributing the benefit to a reduction in negative native language transfer. In contrast, Guo (2015) suggested that this advantage was linked to a shift in learners' language learning approach, moving from explicit to more implicit learning. Implicit learning in language education, as explained by Reber (1967: 855), involves learners focusing more on the content of communication, while the acquisition of phonological and linguistic components occurs subconsciously.

This implicit approach can be particularly effective in acquiring spoken Chinese because, despite differences in phonology and grammar between Chinese and learners' native languages, the content of communication often shares more similarities. However, implementing an immersion model, while proven to be highly effective (Sindoni, 2014), comes with substantial costs for establishment and maintenance, making it less feasible in many teaching and learning scenarios. Consequently, some research has explored the use of educational technology to create real-life or virtual immersion experiences for

TCFL, which will be further discussed in Section 2.3.3. In the context of TCFL, it is very much influenced by the Communicative Language Teaching (Ji, 2011; Jia, 2005; Liu, Ye, & Wei, 2018).

2.3.3 Technology-mediated spoken Chinese acquisition

As mentioned earlier, when the issues in the physical world cannot be solved in conventional ways, scholars began to look at alternative solutions with the assistance of ICT and educational technology. In the past two decades, a decent amount of research has been conducted in the field of Computer-Aided Pronunciation (CAP) and Computer-Aided Instruction (CAI). Pennington (1999) discussed the potential and limitations of CAP in learning L2 pronunciation. Regarding the potential, CAP could provide authoritative and highly salient feedback for individual learners (ibid: 429). It helps learners build confidence when improving their spoken language competence and sustain their motivation and effort to practice pronunciation during the critical period, in the context of infancy and early childhood. Pennington pointed out that the use of technology in pronunciation acquisition is relatively behind in comparison with its application in other areas of language learning and acquisition, and limitations were evident (ibid: 431). For example, many CAP software lacked a baseline in terms of standard pronunciation of the target language.

Neri, Cucchiarini, Strik, and Boves (2002) mentioned more of the advantages of Computer-Aided Pronunciation Training (CAPT). They examined the relationship between pedagogy and technology in CAPT software and reported that the main benefit of the use of CAPT is the creation of an immersive and less stressful learning environment. Learners in a CAPT environment could practice at their own pace and have access to nearly unlimited virtual language input while receiving tailored and instant feedback during and after the CAPT, as supported by ASR.

To investigate the effect of CAPT on learners with varied pronunciation levels, Hincks (2003) conducted an empirical study and recruited two groups of middle-aged learners with various language backgrounds. The students were admitted to the course based on a placement test. Results of the placement test showed that participants possessed a varying level of skills in English ranging from advanced beginner to upper-intermediate. A copy

of the program Talk to Me from Auralog was offered to the experimental group of students (n=11). It was used as a supplement 200-hour course in technical English, and participants were encouraged to practise on their home computers. The control group of students (n=15) did not use the programme, and the development of the two groups was compared. Chapelle's (2001) six criteria for CALL assessment (further discussed in Section 2.6.4) were implemented to evaluate the programme. The results of the study showed that the CAPT benefited the learners who began the course with a strong foreign accent rather than those who began with better pronunciation.

Looking back on the development of technology-mediated language acquisition, Eskenazi (2009) systematically reviewed research from Spoken Language Technology for Language Education (SLTLE). According to her review, Automatic Speech Recognition (ASR) was one of the most popular language-learning and assessment technologies in the 1990s. After that, the research attention was directed more to the Natural Language Processing (NLP) and Spoken Dialogue System (SDS) for the next decade (ibid: 833). Moore (2017) summarized the evolution track of spoken language technology in the field of second language (L2) studies. According to Moore (ibid:3), the evolution was through a focus on researching six key concepts or tools including (i) Command and Control Systems, (ii) Dictation Systems, (iii) Interactive Voice Response (IVR) Systems, (iv) voice-Enabled Personal Assistants, (v) Embodied Conversational Agents (ECAs) and (vi) Autonomous Social Agents (robots).

About the application of technological tools in language learning, Lu (2018) conducted a study on using NLP to facilitate the learning of English for non-native speakers. In this model, NLP technology was used to build a dialogue system that enables learners to interact with conversational agents in a meaningful and coherent manner. The findings of the research suggested that such an approach was effective in increasing learners' exposure to the target language as well as improving their learning motivation.

Another well-known tool for language acquisition as defined by VanLehn (2011) is the Intelligent Tutoring System (ITS). It is a computer-based educational technology that leverages AI and machine learning to provide personalised, adaptive, and interactive instruction to students. The primary goal of an ITS is to enhance the learning experience by tailoring instruction to the individual needs and abilities of each learner. It has begun

to be commonly adopted in various types of language education. At the moment, Human-Robot Interaction (HRI) is the main technological concept in realising the SDS for language educational purposes, that robot or AI perform language tasks or interactions with the learners, while the process and the robot are all under the supervision of the teachers as human beings. (Sheridan, 2016: 526).

Other than directly assisting the learning of languages, another great advantage of educational technology is to create an immersive environment and experiences for language education (see Section 2.3.2). Regarding creating real-life immersion, Sindoni (2014) investigated the function of using online interaction to treat both spoken and written discourses of language learners and users. She reported that this type of interaction could be conducted and perceived in unprecedented manners, which was particularly evident in reducing learners' anxiety and raising their motivation for communication.

Regarding virtual immersion, Morton and Jack (2005) studied how to use a self-access learning package named SPELL (Spoken Electronic Language Learning) to facilitate learners in learning the target language in a virtual immersive environment with virtual agents (see Section 2.5.4 Virtual World). They noted that the virtual agents excelled in engaging the learners through negotiated interactions as they were tireless and could provide immediate and relevant feedback in the format of animated interactions. However, Ribeiro et al. (2016) mentioned that the effect of human-machine interaction was also highly dependent on the range and difficulty of the language used by both the learners and the machine. Therefore, it was important to identify the appropriate level of learners' proficiency when establishing and configuring the corpus of the SDS (see Section 2.5.6 Spoken Dialogue System).

In the context of TCFL, research on technology-mediated spoken language acquisition remained scarce and in narrow varieties before the 2000s. Much of the research focused exclusively on either the technological or educational perspective of the TCFL. There were insufficient empirical studies to bridge the gap between these two perspectives. Since the 2000s, there was a significant surge of research interest in the potential of technology-mediated language acquisition.

Some researchers were using visualisation (see Section 2.5.2 Speech Visualisation Technology) to help tone and intonation perception and production (Chan, 2003; Hirata, 2004; Levis & Pickering, 2004; Luo & Yang, 2022). Some use ICT to create virtual learning platforms for online or blended learning models and claimed that the implementation of ICT tools can boost collaboration and peer learning (Chen, 2007; Lai, 2017). To make it more accessible for the learners, Tan (2018) reviewed several Mobile-Assisted Language Learning (MALL) tools that were used between 2016 and 2018 in TCFL. The evaluation was made from four general perspectives in terms of the content, function, interface and operation of the applications. It was reported that mainstream tools were used as references for learning, such as the digital dictionary or grammatical Wikipedia. The tools for teaching and learning were relatively fewer and were made more towards taster experiences rather than systematic language studies, which were not particularly useful for learning beyond the entry-level. There were attempts for gamified tools for learning spoken Chinese, though the balance of entertaining and effective learning proved to be difficult to maintain. Jeon et al. (2017) conducted a research project also on gamification. They use gamification to encourage learner autonomy and reported that the mechanic of the game can assist learners to establish effective and tailored learning strategies (see Section 2.5.3 Gamification Technology).

Another focus of MALL in TCFL referred to the use of social media applications in assisting the learning of spoken Chinese. WeChat is a mobile application for online messaging and a popular social media platform in mainland China. Some studies have discussed the functions and advantages of using WeChat in assisting CFL learning (Ji & He, 2020; Jin, 2018; Jiang & Li, 2018; Liu, 2013). Ji & He (2020) summarised the advantages and issues of using WeChat. Regarding the benefits, learners could use fragment time for study and digital media allowed more efficient content search. Timely and personalised feedback could be provided through text or multimedia messaging, while the social media platform provides opportunities for establishing learner communities. Regarding the issues, there were still limited resources for TCFL from a learner perspective, and the existing resources were mainly designed for learners in a Chinese domestic context. Learning content was often lacking interactive elements, and the purpose of learning content may contain recessive advertisements for promoting WeChat accounts instead of providing tangible resources and guidance for the learners.

Regarding the integration of technology with learning materials, The Great Wall Chinese textbooks and associated learning software, designed for CFL learners, gained significant popularity (Ma, 2005). Sun (2015) conducted a comparison between The Great Wall Chinese and Rosetta Stone software, highlighting that the former emphasized phonological study and was more suitable for TCFL within a domestic context. In contrast, the latter offered a robust platform for simulated communication practice, catering to the needs of overseas CFL learners.

In another study, Tai & Wei (2021) explored the use of iPads as a multimedia digital platform to facilitate and enhance translanguaging in a Chinese-English classroom. They found that utilizing iPads enabled teachers to leverage additional semiotic features and spatial resources for content instruction. This approach provided a more flexible environment for both teachers and students, supporting a translanguaging approach and enhancing the learning experience by offering richer content output.

The researcher of the present research also conducted a collaborative project analysing the integration of CALL in Chinese teaching and learning in the context of Irish higher education (Li, Zhang, Xie, Wang, & Wang, 2018). Effective methods were identified for CFL learners at various learning stages. For beginner learners, the use of Computer-Mediated Communication (CMC) and pinyin input software could help increase learners' phonological perception and production along with their writing production (Chen, 2020). For more experienced learners, the use of digital materials and online multimedia learning content could increase learners' tolerance of unfamiliar auditory input and learning confidence as well as more exposure to the Chinese language outside of the designated class hours (Li, Zhang, Xie, Wang, & Wang, 2018).

The next few sections discuss the development of some popular methodologies in teaching and learning spoken Chinese, with a focus on Mandarin Chinese tones acquisition (see Section 2.3.4 and Section 2.3.5).

2.3.4 The acquisition of Mandarin Chinese tones

Mandarin Chinese, renowned for its tonal nature, presents a unique linguistic challenge with its system of tonal variations. The four phonemic tones in Mandarin are often symbolised as High-Level (Tone 1), Mid-Rising (Tone 2), Low-Dipping (Tone 3), and

High-Falling (Tone 4). The meaning of each syllable varies according to its associated lexical tone (Yip, 1995).

Due to the characteristic of Mandarin Chinese being a tonal language, the challenges and difficulty in Mandarin lexical tones acquisition for CFL learners have been consistently drawing the attention of Chinese educators and researchers since the early stage of TCFL. Extensive research has been conducted analysing the feature of Mandarin tones from the perspectives of phonological studies (Duanmu, 1990; Gårding, Kratochvil, Svantesson, & Zhang, 1986; Zhang, 1988), which has laid a solid foundation for the later investigations in tones acquisition.

One of the most striking phenomena in Mandarin phonology is tone sandhi, a process where the tonal contour of a syllable changes depending on the context in which it occurs (Zhang & Lai, 2010). Understanding the acquisition of Mandarin Chinese tone sandhi is crucial for both linguists and language learners.

The presence of tone sandhi in Mandarin means that the phonetic realisation of these tones changes when certain tones appear consecutively in connected speech (Guo et al., 2022). The most well-known form of tone sandhi in Mandarin is the third tone sandhi, where a third tone (low-dipping) changes to a second tone (mid-rising) when followed by another third tone. This process is a reflection of how Mandarin speakers employ context to facilitate efficient communication.

The acquisition of Mandarin Chinese tone sandhi has been a topic of interest for scholars studying child language development. Research has shown that children acquire tone sandhi patterns as early as three years of age. A study by Zhu & Dodd (2000) demonstrated that Mandarin-speaking children as young as three exhibit sensitivity to tone sandhi patterns in their production. This suggests that tone sandhi is not merely a feature of adult speech but is ingrained in the language acquisition process from an early age.

In the context of adult education, one of the significant research projects in the field of tone acquisition refers to Elliott (1991), who specifically explored the relationship between the perception and production of Mandarin Chinese tones. The research targeted

33 CFL learners from the University of Hawaii with various language backgrounds, and their learning context lacked consistent exposure to the Chinese language environment. The research findings indicated that for non-native speakers, the production of tones was more difficult than perception. Among the four lexical tones, learners considered that Tone 2 and Tone 3 were the most difficult to reproduce. Elliott (*ibid.*) also reported that learners' errors in both tone perception and production were vulnerable to fossilization. Learners' awareness of these errors did not necessarily increase along with their extensive experiences in learning Chinese. Therefore, it was essential to increase learners' capacity to access their pronunciation, not only from a communicative perspective but also on a 'micro' phonological level, so that timely self-evaluation and corrections could be applied to achieve a better result in tone acquisition.

Guo and Tao (2008) reviewed previous research regarding the acquisition order of tones among American Chinese learners. They conducted a longitudinal study to examine American learners' development of Mandarin tone production. They tracked the developmental process of students' tone production based on near-natural speeches of 16 participants who were unaware of the research project; the results showed that tone 1 and tone 4 are produced with the greatest accuracy, while tone 3 is the most problematic one. The result of the study was in line with Elliott (1991) that tone 2 and tone 3 were the most difficult tones for learners to acquire.

Leather (1990) reported that after the perceptual training of identifying words with the same pronunciation but different tones, learners' accuracy in producing the words with different tones improved significantly. Similarly, learners could also perceive differences in lexical tones more effectively through training in tone production. It is also worth noting that Leather (*ibid.*) mentioned the two types of training demonstrated a similar effect in increasing either learners' tone perception or production, and it was suggested that one-way practice would be sufficient to ensure the parallel growth of learners' phonological skills in these two perspectives. The above findings were also in line with previous research in L2 learning, as auditory training of L2 segmental properties could modify the perceptual system of adult L2 learners (Logan, Lively, & Pisoni, 1991; Pisoni, Aslin, Perey, & Hennessy, 1982).

Wang conducted a series of studies to investigate the specific effects of perceptual training on learners' perception of tones (Wang, Jongman, & Sereno, 2003; Wang, Sereno, & Jongman, 2006; Wang, Spence, Jongman, & Sereno, 1999). It began with an exploratory study that examined American learners' change of capacity in identifying the differences in tones as the result of auditory training (Wang et al., 1999). The improvement was reported to be significant and transferable to new communicative contexts and other phonological domains in Mandarin Chinese. The effect of training also appeared to be persistent, with learners' performance in a post-test after six months of the initial training showing almost no reduction in the accuracy of tone perception. Moreover, learners' perception of pitch height was identified to be more resistant to improvement in comparison with pitch contour. Similar findings were also identified by Wang et al. (2003), that learners' improvements in the perception of pitch height and pitch contour were not improved simultaneously. In addition, they reported that the effect of perception training regarding the contrasts of Mandarin Chinese tones could be transferred to production.

Based on the above findings, Wang et al. (2006) explored the difficulties for CFL learners in improving the perception and production of tones. They first identified the differences in tone acquisition between native and non-native speakers. For native speakers, the tonal pattern was integrated into the verbal acquisition of each meaningful word. While for non-native speakers, especially those with a non-tonal language background, it was detached from the verbal acquisition of words and was recognized more as non-verbal information. It was mentioned that intensive training in either tone perception or production could lead to a change in learners' hemispheric processing and cortical representations more similar to native speakers.

In terms of more recent research on the challenges in tone acquisition, Hao (2012) examined L2 tone acquisition, with a focus on the differences between learners from tonal and non-tonal backgrounds. Hao (ibid.) conducted an experiment that included English-speaking and Cantonese-speaking learners to assess their ability to perceive and produce Mandarin tones. Surprisingly, the results did not show a significant advantage for Cantonese learners, who have experience with a tonal language. Both groups encountered difficulties in distinguishing certain Mandarin tones, especially T2 and T3. Notably,

learners were more successful in mimicking tones than in identifying or reading them, emphasising the challenge of associating pitch contours with tonal labels.

Bryfonski & Ma (2020) examined the impact of explicit versus implicit corrective feedback on Mandarin tone perception and production in beginner learners. Two groups of adult learners participated in a 14-week course, with one receiving more implicit feedback and the other more explicit feedback. Results showed that the implicit feedback group demonstrated greater improvement in tone production ($d = .75$) compared to the explicit feedback group. Both learners and the instructor favoured recasts as a feedback method. Tone perception did not yield statistically significant differences.

Jin (2019) delved into the acquisition of five Chinese tone sandhi by English-speaking learners of Chinese. The study involved 53 American college students with various Chinese proficiency levels. The findings unveiled distinct acquisition patterns across different sandhi processes and learner levels. Several factors influence L2 learners' acquisition of these tone sandhis, including instructional methods, phonetic motivations, the learning process, inherent linguistic factors, and interference from English intonation.

The results of the above study emphasised the importance of teaching tone sandhi rules explicitly and from the early stages of learning. Regular, real-time speaking speed is recommended in class to allow students to grasp natural tone sandhi applications and coarticulations in speech. Additionally, a brief contrastive analysis between English intonation and Chinese tones can benefit learners in avoiding transfer errors. Continuous, long-term training and teacher analysis of students' speech are crucial for effective tone sandhi acquisition. These recommendations contribute to the development of effective pedagogical strategies for L2 Chinese learners.

2.3.5 Technology-mediated tone acquisition

Researchers in the field of TCFL gradually realised the limitation of conventional methods in assisting the learning of Mandarin tones. Often the instruction and feedback of tone production were realised by approaches of concretization (e.g., using hand gestures, body movement, etc.), while they may still present as being abstract to learners.

Therefore, as soon as the concept of technology-mediated language learning reached the field of TCFL, scholars began to research its implementation in tones acquisition.

Early attempts in this direction were made more from the perspective of transferring the professional linguistic and phonological knowledge of researchers in assisting tone acquisition. Chun (1989) as an early researcher in this direction advocated that new technology should be used to help Chinese language learners to improve their perception and production of tones and intonations. Chen (1992) investigated that used a computer and a digital signal processor (DSP) to record and analyse the fundamental frequency (f₀) of tones in Mandarin Chinese. The pitches and sound waves of the two learners were compared first by showing each learner's phonological graph on one side of the screen and then by overlapping their pitch contours with the standard pronunciation. Through this comparison, both learners could observe the pattern of tone errors in a direct manner, and consistent comparisons provided direct feedback which guided the learners to work towards the standard tone production.

Such an approach was found to be effective in other contexts of L2 learning as well. For example, Hirata (2004) conducted a study to assess the efficacy of using f₀ contours as visual feedback to native English learners acquiring Japanese pitch. The findings suggested that the learners' perception and production of Japanese pitch were improved by using a training system which integrated this visualisation process.

With foreign language education shifting more towards a communicative approach, the focus of implementing modern educational technology also changed to its facilitation of content delivery and conducting learning activities. Among the many directions, speech-visualisation technology was a widespread approach in both the teaching and research of L2 education, especially regarding the acquisition of intonation (Levis & Pickering, 2004). James (1979) noted that visualisation could have a significant effect on improving the intonation of L2 learners, which was supported by Bot (1980, 1983) that audio-visual feedback was more effective in comparison with single-element feedback for the learning of intonation.

In the field of TCFL, Chan (2003) designed a Computer Aided Learning System for Chinese Phonetics (CALCP) to help learners study and practise Chinese phonetics. The

CALCP utilised different formats of information in content delivery. The standard pronunciation of tones was displayed by a combination of static and dynamic pictures and audio files of the tones. The tone production process was demonstrated by animations and videos. Besides, exercises and quizzes were followed after the demonstration for practice and self-assessment. The learners could also record their pronunciation with the built-in application and playback or further compare their recording with the pronunciation standard. This model was widely adopted by many later technological tools in assisting the learning of phonetics in Mandarin Chinese.

However, it is important to strengthen that at the current stage of research, CALL is still better placed in an assisting role for Mandarin phonetic acquisition, and teachers need to take a leading role in the teaching and learning process. As reported by Sunaoka & Sugie (2022), in the context of emergency remote teaching due to the COVID impact in Japanese universities, relying solely on technology for the instruction and feedback of Mandarin phonetic studies, especially the Mandarin tones, was proven to be less effective. Sunaoka & Sugie's (ibid.) discovery was mainly about the deficiency in the shift of pedagogy to incorporate online teaching and learning, while Zahradnikova (2022) mentioned that the effectiveness of CALCAP was also determined by students' attention, anxiety, and contentment with the learning process, which could not be presumed based on studies of the conventional face-to-face classroom. These challenges along with the new opportunities presented require further studies in the field of CALL.

2.4 Action

This section briefly reviews the development in teaching spoken Chinese, followed by a discussion of Communicative Language Teaching. As the creation of the iCALL tools for the current research project would also require material development, the next part of this section reviews the teaching and assessing materials for spoken Chinese. To factor in and with good intention to address some current issues in teaching spoken Chinese, these issues are also reviewed at the end of this section.

2.4.1 The development in teaching spoken Chinese

According to Zhou (2010), research on teaching spoken skills in the field of CFL studies emerged in the 1980s. Before then, TCFL was mainly carried out in a domestic context and was dominated by comprehensive courses, those in which learners acquire different language and communicative skills based on one set of teaching and learning materials (Liu, 2001). Such courses were suitable and met the needs of learners at that time, as the majority of CFL learners were to become scholars of Chinese literature or sociocultural studies. As a result, TCFL was often weighted more on reading and writing skills in comparison with listening and speaking skills (Zhao, 1979).

With the increasing globalisation and the opening up of China, there has been a growing interest in spoken Chinese in the Western world, leading to more opportunities for cultural exchange and language learning. This shift in focus and approach to teaching Chinese reflects the evolving landscape of language education in response to changing global dynamics and communication needs.

Beginning in the late 1980s, individual courses with a focus on training different language skills were established in TCFL, and research on teaching and learning spoken Chinese was followed as well as other different perspectives on language skills (Zhou, 2010). According to Wang (1999), spoken Chinese courses became popular in elementary-level TCFL courses. These spoken Chinese courses aimed to cultivate both language skills and communicative competencies of the learners, while the teaching of pronunciation and lexical tones in Chinese were the essential linguistic components of these courses. This shift in teaching and learning purposes was caused by the change in learners' needs, that communicative competence became more practical and in need. Learners' perception of a proficient language user was also changed from being skilful in reading and comprehending written Chinese more to the demonstration of aural and oral skills.

After the development of TCFL was extended to the overseas context, some of the well-established methods for TCFL in a domestic context appeared to be less effective. Li (2009: 7) summarised the main context of TCFL into five categories, namely (i) teaching Chinese as the first and native language, (ii) teaching Chinese as the second and native language, (iii) teaching Mandarin Chinese to ethnic minority groups as a shared

communicative language, (iv) teaching Chinese as a second language to learners from a greater China region or under the influence of Chinese character culture and (v) teaching Chinese as a general second or foreign language. He pointed out that some of the issues regarding the teaching pedagogy lay in the insufficient study of the development and communicative Chinese language standards in different contexts. In other words, the attention of researchers should be directed to pursue appropriate teaching approaches in context instead of developing universal standards and pedagogy for TCFL.

In line with Li (*ibid*)'s study, Fang, Zheng, and Chen (2016: 424) stated that the cause of ineffective pedagogy was rooted in differences between the teaching contexts, such as the language policy, education system, teaching and learning environment, learners' background and motivation, etc. For teaching spoken Chinese in an overseas context, they emphasised the importance for teachers to be aware of the intercultural nature of the teaching process, that learners' perception and production skills are tightly associated with their intercultural communication competence. In the meantime, they recommend including findings of comparative studies about Chinese and learners' native language in the teaching and learning process to help promote the positive transfer of the mother tongue while also reducing the chances of negative transfer effect.

Noriko and Tian (2013) reviewed the issues in teaching spoken Chinese in Japan from the perspectives of the learner, the teacher, the language, and the learning context. For the learners, the main problem was the insufficient opportunities to practice spoken Chinese outside of the designated class hours. For the teachers, it was reported that the target language was rarely used, which further contributes to learners' lack of exposure to the Chinese language environment. For the language, the negative transfer of the Japanese language was reflected in learners using the pronunciation of Kanji (an adopted Chinese character in the Japanese writing system) to pronounce Chinese. For the learning context, the Japanese educational system appeared to have not recruited enough experts in spoken Chinese teaching and assessment (see Section 2.2.2).

Li (2018) conducted a mixed-method study that targeted the teaching of spoken Chinese in American post-primary schools and reported various issues from the perspectives of the learner, the teacher, the teaching pedagogy, and the teaching material. In general, she noted that the lack of learning motivation was the primary issue. Learners complained

that there were insufficient opportunities to practise and use spoken Chinese beyond the designated class hours, which has led to a negative perception of the benefit and necessity of learning the language.

Another similar study by Chen and Zhu (2018) was carried out among students in American higher education. They also reported that the main issue in teaching spoken Chinese was learners' insufficient exposure to the Chinese language environment and mentioned that the Situational Language Teaching (SLT) approach was particularly effective in improving learners' immersive experiences in the target language and culture. It also appeared to have an impact on the process of learners' spoken language acquisition. Instead of applying the learning content in practice, learners simultaneously observe and mimic the communicative scenarios, and acquire language components and cultural understandings throughout the process. At the same time, they also mentioned that the implementation of CALL was potentially another effective direction in realizing or improving learners' immersive experiences through the SLT pedagogy.

There were a few research investigations into Chinese teaching and learning in the Irish context during the past decade (Ji, 2015; Ruddock, 2010; Wang, 2015; Zhang & Wang, 2018), which were briefly discussed previously (see Section 1.2). While studies about teaching spoken Chinese have yet to emerge in the Irish context.

2.4.2 Communicative Language Teaching

Communicative Language Teaching (CLT) or the Communicative Approach was considered a functional approach that uses language functions and ideas as a guide to foster communicative competence in a specific social context (Larsen-Freeman, 2004: 606). The CLT theory was first introduced in the Teaching English as a Foreign Language (TEFL) in China in the 1970s and was applied to the field of TCFL in the following decade (Liu, 2000: 280).

The benefit of such an approach was recognised early to be effective, particularly in improving learners' oral communicative competence (Jia, 2005). However, it only became the mainstream of TCFL in about the last decade. The main reason for a relatively slow progression in the field of TCFL, according to Liu et al. (2018), was that teachers

and educators found it difficult to accept its neglect of linguistic components in language education. In another sense, the implementation of the CLT approach demands a change of mentality of the teachers, which has proved to be a challenge for native-speaker CFL teachers who were heavily influenced by their own language learning experience through the Chinese educational system.

Ji (2011) emphasised the benefit of CLT from the perspective of language control and creating an immersive environment for teaching and learning spoken Chinese. As the CLT emphasises the improvement of competence instead of linguistic knowledge, instructional components on grammar and phonology could be reduced, and more contact hours could be used to create immersive experiences in the target language. Zhang (2015) reviewed the interaction hypothesis (Long, 1983), input hypothesis (Krashen, 1982), and output hypothesis (Swain, 1995) in teaching and learning spoken Chinese. She noted that peer and teacher-student interaction in CFL classrooms should not only focus on interactive communication and cooperation but also the control of the oral language of both parties in a comprehensible range. A balance needs to be maintained between the authenticity and difficulty of the communicative tasks as well as the language that is utilised to ensure the efficiency of spoken language acquisition.

In line with Zhang (2015)'s findings, research conducted in an Irish context discovered that the benefit of the CLT approach was difficult to be realised in an overseas context where there was a lack of Chinese language environment, and the artificial environment appeared to be less authentic and also unconvincing for the learners (Zhang & Wang, 2016). A promising direction to solve the problem might be the synergy between CALL and CLT in TCFL (Chen, 2007; Lai, 2017; Lai et al., 2015). One of the benefits of CALL in language education is to help create authentic visual environments for learners to practise and conduct communication (Hedberg & Alexander, 1994; Lan, 2014), which could complement the application of CLT in TCFL in an overseas context.

2.4.3 Teaching and assessment materials for spoken Chinese

The early-stage materials for teaching spoken Chinese were adapted from research publications on the phonology and linguistics of CFL. Zhao (1979) compiled one of the earliest academic books on researching and describing grammar in spoken Chinese from

the standpoint of TCFL. Then, Chen (1984) published a textbook called *Spoken Chinese*, which systematically described the grammar of spoken Chinese from a learner's perspective. This book became a popular learning material for phonological studies of Mandarin Chinese in the 1990s. These foundational works led to the establishment of a grammatical system of spoken Chinese (Guo, 2002), the syllabus of the spoken grammatical system (Xu, 2016), and the principles of teaching the grammar of spoken Chinese (Chen, 2016). These three studies were the backbones of teaching and learning materials as well as testing materials for spoken Chinese in the past decade.

In recent years, research on spoken Chinese teaching materials mainly focused on Chinese language colloquialization, teaching orders of the language units, and the arrangement and utilization of the language content (Sun, 2010: 23). Li (2001: 18) made suggestions on creating student-centred learning materials for spoken Chinese. She advocated distinguishing the materials for language perception and production in terms of length, speed, and language complexity, forming content with frequent short pieces of conversation instead of relatively long monologues, and keeping the situational communicative purposes at the centre of the learning materials.

Research on language testing in the field of TCFL saw a significant surge after the establishment of Hanyu Shuiping Kaoshi (HSK), the official standardized Chinese language proficiency test for CFL learners in China (Hanban, 1996). The test syllabus introduced a standard for various language skills, including spoken Chinese, and also included guidance on relevant grammatical content for testing and preparing spoken Chinese. Zhao (2008) commented about the test that instead of focusing predominantly on the phonological and grammatical correctness of the learner, spoken competence is measured from three general perspectives of the accuracy, fluency, and appropriateness of learners' spoken production.

Yuan (2017) reviewed the format and material for the spoken Chinese test in the HSKK (oral test of HSK). She investigated the impact of the age gap and different socio-cultural backgrounds between the examiners and the examinees on the accuracy of the test results and reported that smaller gaps contribute to the better reliability of the test. Xu (2005) mentioned that the student-centred principle is also important for designing the content, format, and marking criteria for the diagnostic tests of spoken Chinese. The context and

material of the test should be authentic to accurately reflect learners' spoken language performance in an actual communicative context.

In recent years, the use of corpus linguistics in guiding and designing language tests was one of the major research directions in TCFL. Wang (2016) established the first Spoken Interaction (SI) corpus of CFL with his team in China, which provided a valuable resource for teaching, learning, and assessing spoken Chinese. He described the considerations and process of creating the SI corpus and made suggestions for using corpus linguistics to improve the testing of Spoken Chinese. Wang (ibid.) mentioned that one of the key issues in conventional oral testing is that the proficiency of the examiner is always significantly higher than the examinee, so it is easy for examinees to fall into a passive answering pattern instead of actively interacting with the examiner. Also because of the gap in age and experience, it is not easy for the examiner to engage with the examinee as well. There is great potential for using AI and SI corpus for testing spoken Chinese in the future.

2.4.4 Issues in teaching spoken Chinese in Ireland

There are some issues and challenges in teaching spoken Chinese in the context of TCFL. Some of them are mentioned in previous sections, such as the lack of effective learning strategies and localized teaching pedagogy suitable for overseas CFL learners (Li, 2009; Liang, 2014), the insufficient exposure to the Chinese language in an overseas context (Chen & Zhu, 2018; Li, 2018; Noriko & Tian, 2013), and the negative impact of L1 transfer (Lin, 1985; Noriko & Tian, 2013).

In the context of the current research, based on the limited existing literature, the teaching of spoken Chinese in an Irish context mainly faces two obstacles. The first major obstacle is that the majority of CFL learners in Ireland have little or no exposure to the Chinese language environment. They lack opportunities to communicate with Chinese speakers outside of the classes, a common issue identified by TCFL researchers in different overseas contexts (Chen & Zhu, 2018; Li, 2018; Noriko & Tian, 2013).

The second major obstacle is the shortage of qualified CFL teachers as required by the Irish educational policy (Zhang, 2023). It is challenging for Irish CFL teachers to

demonstrate and teach the Mandarin tones since there is no such system in their mother tongues and the common European languages they might have studied (Lin, 1985; Wang et al., 2006). Such a task is equally challenging for native Chinese teachers due to their unfamiliarity with the English phonological system. They may be able to demonstrate standard pronunciation, but due to their limited phonological knowledge and instructional language competence, it is challenging for them to instruct learners to achieve standard pronunciation.

As stated by Qi, Cao, and Liu (2016), research models within TCFL remain predominantly uniform. The existing literature is characterized by extensive revisions and theoretical dialogues, but empirical investigations are notably scarce. Among the empirical research conducted in this field, the primary emphasis leans towards the teaching perspective, with limited attention directed to the requirements and guidance for learners. Consequently, Qi et al. (ibid.) emphasize the need for increased focus on empirical research related to learning strategies and the acquisition of spoken language in TCFL.

Meanwhile, Li et al. (2018) mention that some of the persistent issues in TCFL, such as the negative impact of insufficient target language exposure, are difficult to resolve using conventional methods. In line with this opinion, more recent investigations have begun to propose the introduction and integration of CALL or iCALL in TCFL as new directions for tackling these issues (Kan, 2018; Lai, 2017; Lai et al., 2015). The application of CALL or iCALL in TCFL is a new area of investigation with great potential and also many unanswered new issues, which are further discussed in the next part of the literature review.

2.5 Technology

In the proposed iCALL tools in the present research, various CALL and iCALL theories and technologies will be integrated. The first tool is a voice-control game for learning Mandarin tones. This requires a combination of Automatic Speech Recognition, Speech Visualisation and Gamification techniques. The second tool is a virtual platform for practising spoken Chinese with Artificial Intelligence. This requires a combination of a

Virtual World, Artificial Intelligence, and a Spoken Dialogue System. This section reviews relevant studies about these six key areas.

2.5.1 Automatic Speech Recognition

Automatic Speech Recognition (ASR) is one of the most exciting research areas of Artificial Intelligence (AI) and has been studied for over six decades since the 1960s (Gaikwad, Gawali, & Yannawar, 2010). Several previous reviews have been conducted to give an overview of ASR (Gaikwad et al., 2010; Haridas, Marimuthu, & Sivakumar, 2018; Karpagavalli & Chandra, 2016; Saini & Kaur, 2013).

ASR is essential in improving human-human and human-machine interaction (Yu & Deng, 2016: 1). In terms of using ASR for L2 studies, Eskenazi's (1999) study showed that ASR-based CALL could help learners to produce more utterances and offer pertinent corrective feedback to the learners. Hincks (2003) researched to evaluate the effectiveness of an ASR-based language learning program named *Talk to Me* for English pronunciation acquisition among a group of middle-aged immigrants in Sweden. The results showed that the ASR system could help students with strong foreign accents to acquire English pronunciation from the early stage of learning.

Karpagavalli & Chandra's (2016) study systematically reviewed the relative perspectives of ASR in L2 studies. The acoustic front-end, acoustic model, lexicon, language model, and decoder were the main components of a classic ASR system. In terms of approaches for ASR methodologies, there were three, namely (i) the acoustic-phonetic approach, (ii) the pattern-recognition approach, and (iii) the artificial intelligence approach. The artificial intelligence approach was a mixture of the acoustic-phonetic approach and the pattern-recognition approach.

Karpagavalli & Chandra (ibid.) also reviewed the databases and tools for ASR and their measurements of performances. They pointed out that accuracy was really at the core of the performance of an ASR system and listed the essential factors that influence the accuracy of an ASR system, which are speaker variability, pronunciation variability, region variability, speech rate variability, and context variability, channel variability, and environmental variability. When designing an ASR system, those factors should be

addressed and considered. Along with the development of big data and computing techniques, ASR has been implemented in various aspects of language education and commercial applications, for example, the voice search and interaction functions on smart mobile devices.

Haridas et al. (2018) conducted a detailed survey of 50 methods regarding ASR since 2000 from relevant international journals. They categorized the techniques based on computer visions and identified six general types, which included (i) neural network-based speech recognition, (ii) fuzzy logic based on speech recognition, (iii) wavelet-based speech recognition, (iv) optimization algorithm-based speech recognition, (v) dynamic time warping (DTW) algorithm-based speech recognition, (vi) sub-band based speech recognition, and other based speech recognition. The metrics and limitations of the existing ASR systems were also illustrated. Some challenges are still yet to be addressed, such as the accuracy of the ASR and the identification of emotional expressions in ASR.

In the context of TCFL, research on Chinese ASR began to appear in the 1980s. It has been rapidly developed in recent years that many higher education institutions in China have been conducting systematic research about ASR, with abundant engagement with scholars in America and Singapore.

Tong, Chen, Ma, and Li (2015) proposed an ASR tool called Goodness of Tone (GOT), a confidence measure inspired by the goodness of pronunciation (GOP) for tone recognition. GOT is a vector representation of the confidence of each lexical tone of the given speech segment. According to Tong et al. (ibid.), the proposed GOT confidence measure is useful in tone recognition due to the following reasons. Firstly, GOT integrates and analyses phonetic and tonal information jointly, so it does not rely solely on the recognition of conventional tonal features such as pitch or fundamental frequency variations. Secondly, GOT explores the competing tonal features which differ only in tonal labels but with the same phonetic labels, and uses that as a reference to conduct cohort normalization. Thirdly, GOT concatenates confidence scores from all possible lexical tones in context, which helps to identify error patterns.

Another important aspect of creating an ASR system is the corpus data. Wang and Zhang (2015) published an open-access Chinese speech database called THCHS-30, which could be used to create an ASR system for TCFL. It is at the moment released and hosted by Tsinghua University. It contains corpus data from 50 speakers of over 30 hours of Mandarin speech data. However, due to the limited dataset, the THCHS-30 is not expected to perform well to create a functional ASR system. In comparison, the AISHELL-1 corpus presented by Bu, Du, Na, Wu, and Zheng (2017) should be by far the largest open-source Mandarin ASR corpus. It is possessed by the Beijing Shell-Shell Technology and contains over 170 hours of Mandarin speech data from 400 speakers. It is publicly available under the Apache 2.0 license.

In the commercial world, Chinese ASR could be implemented in various scenarios, for example, using speech-to-text in the social and gaming context for speech input and human-machine interaction. Several Chinese companies have been involved in the development of ASR, such as *Baidu* and *iFlytek*. Baidu's ASR system is one of the most advanced for Mandarin Chinese, but it is also not quite affordable for personal users. In comparison, the open platform of iFlytek offers Chinese ASR-based products, and they claimed that the recognition rate of their product is over 98%. In the meantime, they not only provide the ASR for Mandarin Chinese but also several dialects, such as Cantonese, Henan dialect, and Sichuan dialect.

When it comes to the design and further development of Chinese ASR, Amodei et al. (2016) had a clear preference for the AI approach as marked by Karpagavalli & Chandra (2016). Their ASR system adopted an end-to-end deep learning approach that can recognize different languages without much manual input and management behind the scenes. Based on the neural network approach, their ASR system could identify not only the core speech data but also a good variety of other speech data such as the noise level, accents of the speaker, etc. They use High-Performance Computing (HPC) techniques to guarantee the efficiency of the speech processing and the Batch Dispatch method to reduce the cost of establishing their service in an online setting, so to aim to be affordable even for personal users in the future.

Another two promising directions for further developing Chinese ASR are the non-autoregressive ASR (NSR) model (Yu et al., 2022; Fang et al., 2022) and the dual-

decoding system (Yang et al., 2022). According to Fang et al. (2022), the NSR model uses phonological tokens to generate phonetically similar corrections with variable lengths instead of the conventional way of modifying each wrong token. With the new model, the speed in correcting word errors could be improved by about six times and also achieve a better correction rate than the autoregressive model. Through a different approach, Yang et al. (2022) proposed to bring Pinyin into the end-to-end ASR when transcribing Chinese phonetics into scripts using characters. The system utilized the characteristics of the Chinese language, using a dual decoding system of Pinyin (phonetic symbol) and character (written symbol) to increase the efficiency and accuracy when converting speech information into text forms.

2.5.2 Speech Visualisation technology

Speech visualization has become a popular research topic in the area of Computer-Assisted Pronunciation (CAP) in recent years. According to Molholt, Hwu, Holland, and Fisher (2008: 91), "speech visualization technology presents new opportunities to assess and enhance hypotheses about patterns of speech sounds and illuminate those patterns for teachers and learners."

Research on the visual feedback of teaching and learning intonation and tone started over half a century ago (James, 1976; Vardanian, 1964). James's (ibid) experiment demonstrated that the intonation of second language learners could be improved through the use of the visualization method. The experiment involved three groups of subjects:

1. The first group implemented the conventional approach, where they were asked to listen and repeat the model sentences without any visual feedback.
2. The second group was provided with instantaneous visual representations of the intonation contours for the model sentences, but no feedback was given on their repetitions.
3. The third group could see immediate visualizations of both the model sentences and their imitations.

The results of the experiments showed that the second group did not perform significantly better than the first. However, the third group, which received immediate reinforcement in the form of visual feedback, performed far better than the other two groups.

Levis and Pickering (2004) provided a brief review of the development of speech visualization technology in language education. They noted that as early as the 1960s, pitch analyzers were used to assist in learning second-language intonations. In the 1980s, instrumental analysis began to be used to interpret spectrographic displays and establish models of intonation. Since the early 1990s, more speech visualization software and hardware have been introduced and implemented in second-language teaching and learning.

This research highlights the effectiveness of speech visualization in improving learners' intonation and pronunciation, particularly when learners receive immediate visual feedback. The evolution of technology has contributed to the development of various tools and methods for visualizing speech patterns, enhancing language education, and helping learners better understand and practice pronunciation.

In the context of language teaching and learning, speech visualisation technology has seen a remarkable evolution, from the early use of pitch analyzer to the integration of sophisticated speech visualisation software and hardware in language education. Its primary function is to illustrate the intricacies of sound production and vocal organ mechanics in a visually accessible format. Visual feedback, combined with auditory input, has proven more effective in teaching suprasegmentals, such as stress, rhythm, and intonation.

One of the main functions of speech visualisation is to illustrate the process of sound production and the mechanism of vocal organs in a clear visual format. De Bot's (1983: 331) experiment showed that visual feedback combined with auditory feedback was more effective than auditory feedback only. Anderson-Hsieh (1994: 6) further pointed out that visual feedback on stress, rhythm, and intonation could help the teaching of suprasegmentals more effectively.

Speech perception is essential for oral communication, whether it is human-to-human or human-to-machine (Gómez et al., 1996). Certain kinds of communication disorders caused by speech production may be triggered by the failure of the speech perception process. To address this, Álvarez, Martínez, Gómez, and Domínguez (1998) presented a methodology to create *Visual Representations of Speech for Speech Perception Enhancement Applications*. When there is a disarrangement in the perception process, for example, some hearing problem or when the mother tongue is different from the language being perceived, the process will fail partially or completely. Thus, giving visual feedback to the users about the quality of the speech perceived, for instance through the *Visual Representations of Speech* might enhance the perception process.

Bian, Li, Wang, Chen, and Xiao (2017: 432) discussed the recent progress of three models of tongue visualisation, which are the physiological model, geometric model, and physical model. The physiological model was constructed based on the anatomy of the real tongue and modelled on the physiological characters of muscle fibres. The geometric model uses the contour of the phonatory organs, focusing on the shape of the phonatory organs and vocal tract rather than the internal physiological structure and characteristics. The physical model used the finite element method to model the tongue, mainly considering the physical and mechanical relationships between the finite elements.

Bian et al. (ibid:434) compared the three models regarding their advantages and disadvantages. Concerning the advantages, all three models showed flexibility and portability. The shortcomings of the three models differ from one another. The complex algorithms and large cost of computing are the disadvantages of the physiological model, while the accuracy of synthetic animation of the geometric model could be affected by the sample sizes.

The importance of tone acquisition in teaching and learning Mandarin Chinese was consistently and extensively mentioned in the TCFL research (Feng, 2012; Jia & Wang, 2013; Xu, 2015). Learners' capacity for tone perception and production needs to be raised systematically along with their learning of the Chinese language, and it is essential to introduce the concept and practice of tones at the beginning of Chinese learning.

Conventionally, the most widely used method among native Chinese teachers in assisting the teaching of tones is to use hand gestures to visualise the pitch height and pitch contour of the four tones in Mandarin Chinese. Jia & Wang (2013) reported that the use of gestures and other body movements can help learners to establish a reflection between pronunciations and symbols. This visual and auditory dual-channel processing method demonstrated better effectiveness in improving the perception of tones in comparison with the sole auditory approach, especially among early-stage Chinese learners. Such a method was also adopted by non-native Chinese teachers, and Baills (2016) mentioned the practice of using hand gestures could facilitate both beginner learners' perception and production of tones.

Liu, Massaro, Chen, Chan, and Perfetti's (2007) experiment used a 3D animated talking head to teach Chinese syllables to 101 adult English speakers. The results of the experiment showed that using the 3D head to train the learners with both visual and conventional speech methods, the learners performed better at the testing than those trained with the conventional speech method alone. A further study was conducted by Peng, Chen, Wang, and Wang (2018) which evaluated the performance of using 3D talking head-on pronunciation learning and comparing with the audio-only and human-face video means. The results of the study further proved that the 3D talking head had great advantages in pronouncing learning.

However, tones as an unfamiliar phonological component of the Chinese language may be perceived by the learners to be either difficult or less essential for communicative purposes. Wu and Miller (2007) reported that such perception was particularly evident among learners with an English language background, as a result of the influence of English being a dominant global language. They experimented with American CFL learners to investigate the effect of a tutoring package on the performance of non-native Mandarin Chinese learners' pronunciation of tones. The tutoring package they used consisted of verbal demonstration, written instruction, verbal practice with native-speaker tutors and individual feedback and encouragement. According to their findings, the implementation of this tutoring process could help learners conceptualise a discriminative technique which facilitates them in both tone perception and production.

Another direction to improve the teaching and learning of tones was to further visualise the process and phonological information of tones. One of the early research in this direction was conducted by Lin (1985). After analysing the difficulties of native English speakers in learning tones, he developed a set of drilling materials for tones, which was adopted from musical scales. This material utilised the concept of visualisation of tone pronunciation and also introduced gamification in the process of practice, in the consideration of raising learners' interest and also assisting their learning of tones. Recent research by Godfroid, Lin, and Ryu (2017) investigated the effectiveness of using colour coding in the teaching and learning of tones and reported a positive result in learners' accuracy in tone perception with the assistance of colourful visual information.

About the visualisation of Chinese tones, Chun conducted a series of research over the past three decades (Chun, 1989; Chun, Jiang, & Ávila, 2012; Chun, Jiang, Meyr, & Yang, 2015). It began with Chun (1989) who reviewed the previous pedagogical applications of acoustic-phonetic research for teaching and learning segmental and suprasegmental. She introduced the available hardware and software for speech analysis and proposed principles for implementing new technology for tone production and perception.

Chun et al. (2012) conducted a pilot study using the speech analysis software Praat. Sixteen L2 Chinese learners participated in the research. The students were asked to hear words and phrases spoken by a native speaker while seeing the visual pitch curves displayed by the native speaker, then they record themselves reading the same words and phrases, and the pitch contours of both sides were compared later. It reported that students in a post-study survey indicated seeing the pitch curves of both the native speakers and their own helped them improve their tones. A further study using a similar research method was conducted by Chun et al. (2015) and the post-survey of the research showed that two-thirds of the learners (n = 11) found the visualisation of pitch contours helpful and acoustic analyses complement auditory analyses with more precise indications of L2 learners' tonal difficulties.

Lam's (2017) study collected speech samples from 13 volunteer participants in Malaysia reading a list of 11 disyllabic Mandarin words and used the acoustic software *Praat* to create visual pitch contours of the speech samples. Then the accuracy of the tones production of the participants was analysed. The result confirmed the third tone was the

most difficult one for learners to perceive and produce. It also reported that learners with non-tonal first language backgrounds might have a lack of sensitivity to Chinese tones. Lam (ibid:44) also suggested that more oral practice should be given to the third tone as it was absent in the learners' first language. It is also mentioned that the speech analysis software *Praat* could be used for learners to improve their tone perception and production.

In the realm of teaching and learning spoken Chinese, the fusion of visual and auditory components has yielded significant advantages. Visualisations, particularly speech visualisation technology, have provided valuable tools for enhancing tone perception and production in Mandarin Chinese. To summarise this section, the use of visual feedback, such as immediate visual representations of intonation contours, plays a pivotal role in aiding learners in mastering tones (Molholt, Hwu, Holland, & Fisher, 2008). This method complements auditory feedback, as it offers learners a clear visual format for understanding the mechanisms of sound production and vocal organs (De Bot, 1983; Anderson-Hsieh, 1994). Moreover, the incorporation of 3D animated talking heads and colour coding further enhances the effectiveness of tone acquisition and accuracy (Liu, Massaro, Chen, Chan, & Perfetti, 2007; Godfroid, Lin, & Ryu, 2017). The marriage of visualisations with AVSR offers a promising avenue for Chinese CALL, allowing learners to delve into the intricacies of phonetics and tonal patterns (Xu et al., 2022).

2.5.3 Gamification technique

According to Werbach and Hunter (2012: 26), gamification refers to the use of game elements and game-design techniques in non-game contexts. In the field of education and training, gamification has become popular in recent years.

Caponetto, Earp, and Ott (2014) collected and analysed 120 papers on gamification between 2011 and 2014. The results showed that the implementation of gamification in the education and training sectors grew rapidly and the main driver for using gamification techniques was the enhancement of motivation and engagement in learning tasks. Nah, Zeng, Telaprolu, Ayyappa, and Eschenbrenner (2014:405) conducted a review on the use of gamification in the educational and learning context and identified eight common game design elements that are used in this field, which included:

- 1) The point system which worked as the measure of success or achievement
- 2) The level system gave players a sense of progress in the game
- 3) The badges worked as a mark of appreciation or task accomplishment during the process of goal achievement
- 4) The leaderboard that used to motivate players
- 5) The prizes and rewards used to motivate players
- 6) The progress bar used to track and display the overall goal progression
- 7) The storyline which provided the narrative or story in the game
- 8) The frequent, intensive and immediate feedback enhanced the learner engagement

The implementation of gamification in L2 studies has also gained attention during the past years. A great number of researches showed that the gamification method could enhance L2 learning by enhancing the learner's engagement and motivation.

Flores's (2015) study focused on the aspects of L2 learning methodology and overviewed the integration of gamification in second language education. Six frequently used gamification tools in second language learning were examined: *Duolingo*, *Class Dojo*, *Edmodo*, *Zondle*, *Socrative*, and *Brainscape*. Flores (ibid: 50) pointed out that the use of gamification contributed to positive effects on second language learning; the learners were motivated based on the positive feedback and the game elements used.

Similarly, Cahyani (2016) also conducted a study to analyse the effect of gamified learning activities among 30 language students in early childhood. The investigation examined three dimensions of the learning process, which are the user experience, engagement, and motivation. The results of the study revealed a positive response that gamified learning scenarios could increase students' motivation and enhance their learning.

Zarzycka-Piskorz's (2016) research investigated the use of a gamified platform Kahoot, an online application commonly used for post-primary education. 112 students participated in the research, and their feedback on the use of the platform was collected and analysed when finishing the class. The research showed that the learners' intrinsic motivation was enhanced by the perspective of winning and getting a reward. Students

appreciate the clear objectives which could help them to master their knowledge or improve their language skills. The implementation of the games into the language learning process motivated students to better engage and achieve their goals.

Osipov, Nikulchev, Volinsky, and Prasikova (2015: 76) conducted a study to investigate the effectiveness of gamification in an online e-learning system. It is mentioned that the system was convenient for the learners to study together, while the actual effect depends highly on individual personalities, that some students could be too shy to engage with others, especially strangers, and appear to be isolated. The session duration was suggested to be within 20 minutes since learners might get tired if the sessions were too long. Some breaks or screen-off periods could be built in between sessions.

Rego (2015) took an eye on the integration of gamification in language teaching in the context of mobile learning. Three mobile language learning applications were examined, which are the Language Learning Game, Duolingo, and Lingobee. The study showed that the L2 learning experience could be enhanced by mobile learning and gamification methods as it could engage and motivate students to learn beyond the institutional limits of formal education.

Gamification has also been used in the field of spoken language acquisition. Loiseau, Hallal, Ballot, and Gazidedja (2016) proposed a digital game prototype for oral production which used the 'guessing game'. Grimshaw, Cardoso, and Waddington's (2016) study investigated the effectiveness of using a 'shouting' digital game to improve oral fluency in a second language. Twenty L2 English learners participated in the study, and they were divided into two groups, the experimental group, and the control group. The former played the game for 15 minutes as a warm-up in class for six weeks, and the latter used conventional classroom activities for the same period. Quantitative data were collected for all participants from the pre-, post-, and delayed post-tests. The participants were recorded telling a short story, the research used Syllables Per Minute (SPM) to calculate the recording samples. The results showed that the digital games helped learners focus more on their speaking skills by overcoming their anxiety. The learner's motivation was improved by the gameplay, and the game encouraged oral fluency development.

Over the past decade, there have been a good number of gamified applications for L1 Chinese studies and Chinese learners' EFL learning at all levels (Chen, Zhang & Mao, 2022; Chu et al., 2019; Kraus, Zhu & Deng, 2020; Mei & Yang, 2019). In comparison, there were much fewer applications for L2 Chinese studies. Among the existing ones, there were more applications for reading and writing (Maksimova, 2022), especially for character recognition (Lim, Tan & Isak, 2018), while the ones that were designed for learning spoken Chinese were uncommon to be seen.

Rawendy, Ying, Arifin, and Rosalin (2017) designed and evaluated a gamified CFL learning application for primary school students who have learned Chinese before. The data from the pre-test and post-test were collected and analysed, and the results showed that the application was effective in improving the grades of learners. The research also pointed out that tools designed for young learners should be attractive to motivate children to use them for learning. Metwally and Yining (2017) presented a framework for using gamification in MOOCs for Chinese language education. They commented that if designed well, gamification in MOOCs could motivate learners to complete the module and reduce the drop-out rate.

Li & O'Rourke (2022) investigated CFL learners' perception of gamification in an informal learning context of using the *Duolingo* application. They examined the perceived effects of five typical game elements, including the storyline, reward system, challenging system, progress indicator, and competition mechanic. According to their report, the storyline and rewards helped to sustain learners' motivation as external factors while the effect of the other three gamifications could be internalized into learners' perceptions, which encouraged self-directed learning and motivation.

2.5.4 Virtual World

Virtual World (VW), as defined by Bell (2008), is 'A synchronous, persistent network of people, represented as avatars, facilitated by networked computers.' Loke (2015) conducted a systematic literature review of empirical work in VW for educational purposes. He used 'virtual world' and 'education' as the keywords and identified 80 relevant papers of VW in education out of 437 publications. He summarised the learning

mechanics in implementing VW in mainstream curriculum education, which were reflective learning, verbal interaction, mental operations, and vicarious experiences.

Second Life (SL) used to be one of the most popular internet-based 3D virtual worlds in the past decade (Lan, etc. 2013). With a free client browser software, SL was widely used and studied for educational purposes, among them, language learning was one domain in which SL provides a simulated immersive environment for language studies. Warburton (2009) systematically reviewed the development of Virtual Worlds back to the early stage of multi-user online computer gaming environments and discussed the current trends in the development of 3D immersive spaces. His assessment of SL affordances and barriers demonstrated that virtual worlds are attractive spaces for education, yet they present design challenges to educators. For example, he discussed the limitation of VW in providing enough sociocultural discovery for the avatars and users, that VW at the current developing stage could only give avatars limited mechanics centred around the purpose of the platform. Because of this, from the educational standpoint, there is a conflict between 1) making the platform as immersive as possible to improve learning experiences and 2) making the social discovery in the VW as a scaffolded process for the out-of-the-VW learning, bringing in real-world achievements while reducing immersive experience in the VW.

Zheng, Young, Wagner, and Brewer (2009) examined the sociocultural and psychological perspectives of language learning in an intercultural avatar-based online environment. They suggested that future research in the field of VW in L2 studies could look at developing and utilising direct measures of new literacy skills in VW. They pointed out that VW can provide and enhance learners' intercultural awareness while providing opportunities for collaborative learning and meaningful communicative work, especially in the context of minority language studies. A similar point was raised in another context, Ní Chiaráin and Ní Chasaide (2016) noted that one of the biggest challenges of teaching and learning Irish was the lack of exposure to the native speaker models. To address the issues, an interactive guided dialogue named *Digichaint* was proposed that allowed learners to progress through a VW of a hotel and its surroundings. The evaluation results of the research were positive for the use of text-to-speech voices in interactive platforms.

Grant, Huang, and Pasfield-Neofitou (2013) noticed the impacts of technical anxiety on language learners in the VW. They conducted research that compared the performance anxiety of learners in the VW environment and the real-world environment. 55 undergraduates aged 18-20 participated in the study. The results of the study showed that though the foreign language anxiety varied in the face-to-face classroom and the VW settings, learners felt less stressed when it came to language use in the VW than in the real world.

Panichi (2015) reported an exploratory case study of learner participation in the context of online language learning using virtual world platforms. Three main features, namely the avatars, artefacts, and spaces were examined. The data indicated that avatar interaction is determined by avatar proximity and positioning, avatar contextualised movement, the scope of avatar interactions and avatar-learner agency. He examined the use of virtual world artefacts and spaces by the virtual avatars through the same template and reported that (i) learner participation manifests itself along with the sharing of information and experience, (ii) learners' linguistic creations contribute to the virtual environment and were strengthened through the visualisation of learners' avatar and interactions.

However, as with any tool and platform invented, VW also has its issues in design and implementation. As reported by Panichi (*ibid.*), the case-study data also indicated three fundamental issues with learner participation in the virtual world. They are summarised as

- (1) **Motivation and Willingness:** The first challenge centres on learners' motivation and their willingness to actively engage in the virtual learning environment. Encouraging students to immerse themselves and participate actively in this digital realm is of paramount importance.
- (2) **Platform Features and Interaction Quality:** The second issue relates to the features of the virtual world platform and the quality of learners' interactions with these features. It is crucial to ensure that the technology is user-friendly and that students can effectively interact with it to enhance their language learning experience.

- (3) **Teacher's Role as Designers:** The third challenge revolves around the role played by teachers in designing tasks and environments within the virtual world. Teachers must craft engaging and effective learning experiences for students within this virtual environment.

When examining the use of avatars by both learners and teachers, Panichi (ibid.) reported that learner participation can be characterised by its representational and performative dimensions. The visual impact of avatars on users plays a crucial role, influencing how learners and teachers are perceived by others in the virtual world and by themselves. Additionally, the nature of learner interactions as avatars within the platform is essential. This includes factors such as avatar proximity and positioning, avatar movement within specific contexts, the extent of avatar interactions, and the level of control that learners have over their avatars. Furthermore, the use of virtual world artefacts and spaces also sheds light on learner participation. In this context, participation involves sharing information and experiences, contributing linguistically to the virtual environment, and visually manifesting learner-avatar intentions, understandings, and learning progress.

In the context of TCFL, the most widely implemented and more extensively researched VW platform was also the SL. Henderson, Huang, Grant & Henderson (2009) conducted a study on whether collaborative language activities in an immersive VW could improve the students' self-efficacy beliefs. 100 college students enrolled in the Chinese language and culture course as participants in the study. The study focused on one of the lessons conducted in SL, which engaged students in a collaborative activity to identify and order food in Mandarin in a Chinese restaurant setting. The quantitative results from the pre and post-questionnaires suggested that there was a statistically significant increase in students' self-efficacy beliefs in using Mandarin in both VW and real-life Chinese settings.

To further examine whether such positive impacts are persistent and what are the reasons behind such impacts, Henderson, Huang, Grant & Henderson (2012) conducted a further study on CFL learners' self-efficacy beliefs in the VW three years later. They reported that in general, the positive impact on learners' self-efficacy beliefs can persist. However, the sustainability of such beliefs (e.g., can order food in Chinese) is highly dependent on

learners' prior experiences (e.g., being to a Chinese restaurant before the VW experience) or past experiences (e.g., having been to a Chinese restaurant after the VW experience) in the real-life setting. In other words, the effect of learning in VW depends on how interchangeable that could be applied in the real world. In terms of technological self-efficacy beliefs, the results revealed that the technological complexity of the SL platform had a negative effect on students' confidence. They suggested that educators should design scaffolded activities, ideally in line with communicative tasks, to familiarize learners with the technical aspects of the VW platform, and to ensure that confidence in communicating in the VW would not be jeopardized by insufficient technological training.

Chen (2010) adopted and tested the existing resources of the SL Chinese School created by Michigan State University. Seven learning tasks were designed to supplement teaching in formal schooling throughout the semester. Along with the face-to-face instruction in class, students were given communicative tasks to be fulfilled in the VW either individually, in a team or with a language assistant in the SL Chinese School outside of class hours. The results showed that from the teachers' perspectives, SL offered more interactive opportunities in a simulated authentic environment for the students. SL provided explorations of cultural aspects in the VW and made the visitation of the target language country possible without any costs. However, the students' attitudes towards the use of SL in learning Chinese varied. One of the major concerns of the students is the synergy of the SL learning content with their curriculum study.

Lin, Wang, Grant, Chien, and Lan (2014: 19-21) also conducted task-based teaching of Chinese in SL and discussed the benefits and challenges of implementing VW. The results showed that conducting TBLT in SL can help teachers provide opportunities for the students to set clear goals and ensure a student-centred and communicative-oriented learning approach. It also provided different formats of opportunities for language perception, production and feedback. Their model is to have a technological expert take care of technical issues in the physical classroom and have another content instructor focus on teaching virtually. This configuration helped reduce common technical issues in the VW and ensured a comfortable learning environment for both the instructor and the students to focus primarily on the language teaching and learning experience.

Another series of studies were conducted by Lan and her team regarding TCFL in SL. Lan conducted two studies to develop guidelines for designing interaction tasks for CFL learners in the VW (Lan, 2014; Lan et al., 2013, Lan et al., 2019). The research aimed to investigate the attitudes of CFL learners toward a full CFL class in SL as well as how the learning activities benefit the learners in SL. Lan et al. (2013) suggested that the ability of beginner learners in completing the tasks would be affected by a low level of language skills. In the VW CFL classes, learners' pronunciations should be addressed by using available streaming videos which show clear mouth movements, which is essential for Chinese pronunciation and tones acquisition for beginner learners. For designing the tasks, Lan et al. (ibid.) noted that clear activity sequencing should also be taken into account. In terms of the attitude of the CFL learners towards learning Chinese in VW, data analysis showed that learners have a higher level of learning motivation and are more inclined to take initiative in learning.

Following the previous years' experience, Lan (2014) conducted a two-stage study to evaluate the use of SL in improving the learners' oral Chinese performance. Twenty overseas Chinese students learning Mandarin participated in the research, and they were assigned to one experimental group (VW) and one control group (face-to-face). All participants studied three learning units at the same pace. The results showed that students in the VW group performed much more actively in comparison with the face-to-face control group. They demonstrated a higher level of autonomy in both interpersonal communication and language learning activities. Their comprehension of the same language content seems to be better than the face-to-face group as well, and the main reason was likely to be the more extensive exposure to a simulated authentic language environment. In the recent publication of the team, Lan et al. (2019) reported that the use of a VW could also affect positively the development of learners' writing skills.

Another interesting research conducted by Chen et al. (2021) examined both the effect of VW as well as teachers' perception of such effect in the context of L1 and L2 Chinese studies at the school level. Their research recruited 21 post-primary students in Hong Kong in a school with well-equipped ICT facilities and curriculum. They listed seven benefits of the VW including 1) increasing exposure to the target language, 2) improving writing skills, 3) enhancing student engagement, 4) promoting student-centric course design, 5) encouraging collaborative learning, 6) cultivating positive socio-cultural value

and 7) helping to build up student identity. They also reported that to achieve these above benefits, teachers need to direct their focus on teaching more into the VW scenarios. Based on the above findings, they proposed three core pillars to be considered in designing the VW, which are:

- 1) **Conception's Orientation:** Initially, teachers view VW as a means to enhance students' writing skills, focusing on exam-based performance. However, their conceptions evolve towards a "community" orientation, emphasising the creation of a social learning environment and the role of socialisation in the writing process. Eventually, the conception shifts to fostering a socio-cultural "writer identity" by helping students find their voice in writing, highlighting the subjective and personal aspects of writing.
- 2) **Teaching Attention Locus:** Teachers' teaching priorities change hierarchically. They begin by emphasising the quantity of content, encouraging students to observe and enrich their compositions with descriptive writing skills. Subsequently, they focus on fostering student engagement and collaboration through VW, aiming to create more relevant and authentic learning experiences. Finally, they concentrate on cultivating students' understanding of local culture and community care by immersing them in local landscapes and literature.
- 3) **Understanding of Writing:** Teachers' understanding of writing also evolves across the categories. Initially, descriptive writing is seen as a cognitive and product-oriented activity. As their conceptions shift, teachers regard descriptive writing as a social activity, emphasising interaction and process in writing classes. In the highest categories, writing is viewed as a cultural activity that connects students to their local culture and community.

These shifts mark a progression from a teacher-centred approach to a student-centred one and from an emphasis on the final product to a focus on the writing process, fostering a deeper and more holistic understanding of writing.

2.5.5 Artificial Intelligence

Researchers of L2 studies have been investigating the implementation of AI in language teaching and learning, while the utilization of AI is normally in conjunction with some other technological tools rather than singularly (Bailin, 1988; Dodigovic, 2005, 2007; Gordon et al., 2016; Thomason, Zhang, Mooney, & Stone, 2015). In the same sense, the review of research about AI was also merged into different sections of this chapter. This section is contributed to a few general discussions and concerns about using AI in language education.

Bailin (1988) outlined the main components of AI-incorporated computer-assisted language instruction (CALI-AI). The central assumption of CALI-AI is around the ‘Acting Humanly’ behaviour of the AI, that CALI-AI could reproduce human cognitive activities. Bailin (ibid.) summarized four components of CALI-AI, which are the abilities of 1) natural language processing, 2) problem-solving, 3) language learning, and 4) modelling teacher behaviour. With these key abilities, CALI-AI can check and give feedback about the syntax of written work as well as help create suitable language environments for practice and assessment. It also develops continuously the capacity to conduct speech processing, so the AI could eventually perform as a personal language tutor for the learners (ibid: 26).

Drawing insights on the future of CALI-AI and AI in general, Bailin (ibid.) also stated clearly that language teachers cannot be replaced but will have a significant change in pedagogy and role in the classroom. Teachers know their students much better in detail than the AI, so they will need to be responsible for programming the AI with intimate knowledge of the users and appropriate pedagogy for the student-AI interaction.

Dodigovic (2007) conducted a quasi-experimental study to investigate whether the implementation of AI could be beneficial for L2 studies. The software they used is called ‘Intelligent Tutor’. It is an AI focusing on the ‘Acting Rationally’ capability and diagnoses some typical errors in the writing of university students who are learning English as a second language. 266 university students from three countries participated in the study which consisted of a grammaticality judgment pre-test, a treatment in the form of the Intelligent Tutor, and a short answer post-test. The result of the study was

quite significant in that the error reduction rate was 83 percentage points in general with the help of AI. This has suggested that their AI can help English L2 learners correct the errors they have made.

However, they have flagged that there were factors that may have contributed to this overly positive outcome of the research, such as the length of the testing units and the general learning capacity of their research participants (ibid: 110). Besides, based on the details of creating and presenting the AI in the research outline in the paper (ibid.) and an earlier book by Dodigovic (2005: 140), it seems that the Intelligent Tutor is with very simple and straightforward design with clear functionality which would contribute to its successful testing results as well. But as Dodigovic (ibid.) mentioned, a large-scale study may be required to test its effectiveness, especially among the younger cohort of learners.

Huang et al. (2023) reviewed 516 studies and applications of AI in language education between 2000 and 2019 with a focus on its integration and implementation. They reported that on a general level, studies on AI-enhanced language education were increasing during the period and summarized the ten most popular areas of research. Among these, three were about the intelligent tutoring system (ITS) itself and its applications, such as the ITS for specific-purpose writing and speech training. Other than ITS, the remaining seven topics were 1) auto-evaluation for written text, 2) auto-detection for errors, 3) computer-mediated communication, 4) AI-assisted learning personalization, 5) natural language process, 6) web-based language learning, 7) affective states and emotions.

2.5.6 Spoken Dialogue System

Bibauw, François, and Desmet (2015) systematically reviewed the previous literature on Spoken Dialogue systems (SDS). Based on their revision, they presented a new term called ‘Dialogue-Based CALL (DB-CALL)’ which refers to ‘the applications and systems allowing a learner to practice the target language in a meaning-focused conversational activity with an automated agent.’ Their SDS has three main features including 1) dialogue activities, 2) computer as the interlocutor, and 3) open learner production. Bibauw et al. (ibid: 63) also pointed out that there was a lack of a common framework for creating and evaluating SDS, and further studies are required to investigate the effectiveness of different SDS models on L2 studies. A few years later,

Bibauw, François, and Desmet (2019) analysed 343 publications regarding SDS and their DB-CALL and identified 96 SDS systems. They proposed categorising those systems into four groups, namely the (i) narrative system, (ii) form-focused system, (iii) goal-oriented system and (iv) reactive system.

While for Kwon, Kim, and Lee (2016), there were only two categories of the SDS, which are the chat-oriented system and the task-oriented system. They believed that the learners' interest in L2 learning could be improved by raising the freedom of dialogue. Kwon et al. (ibid.) first used task-oriented dialogue processing technology to design a DB-CALL system to assist English as a Foreign Language (EFL) learners in Korea. Their DB-CALL system utilises a language understanding module and a dynamic graph-based dialogue management module. The SDS was designed to analyse intention-annotated real dialogue scripts.

Later, Huang, Lee, Kwon, and Kim (2017) presented a chatbot using the above DB-CALL system which aimed to enable free conversation between humans and machines. To design the chatbot, a search engine was implemented with a dialogue corpus for conversations with no fixed scenarios. Twenty English learners participated in the evaluation of the chatbot by freely chatting with the bot for at least twenty turns. The results showed that the chatbot as an auxiliary system showed a much lower turn success ratio than the independent chatbot system. For further research, they would like to extract a smaller but more suitable dialogue corpus for each topic in the DB-CALL system.

After Gunkel (2016) brief reviewed the history of AI and Natural Language Processing (NLP) and the development of chatterbots and SDS research, he noted that in the new era of the digital world, communication no longer refers to exclusively human-to-human transactions, but also the human-to-machine interaction. He also mentioned the technological innovations in SDS, which included automatic speech recognition (ASR), dialogue management (DM) and text-to-speech (TTS) synthesis. He summarised that all these new development is to identify what people say, determine what people want and convey information back to people in the form of speech.

Gunkel (ibid) pointed out that the further development of SDS and efficient conversational agents relies on both engineering technology and the study of human

conversational behaviour. He reckoned that research in communication and L2 studies can provide information necessary to resolve many open problems in SDS engineering, and the development of SDS can provide communication and L2 studies with unique opportunities to test new theories and extend the area of investigation.

In the context of Chinese SDS, along with the rapid development of ASR technology and mobile internet technology, the application of phonetic technology has become quite common in China. People could use the application to enquire about information on weather, flights, or directions through spoken dialogues with the machine. However, the systems are still with little intelligence and are limited to specific domains. The conversations are not as natural as those between humans and their applications were predominantly in the commercial setting rather than for educational purposes.

Yan et al. (2017) claimed that they built the first task-oriented SDS in Chinese which was used for online shopping. The system worked like a human shop assistant which could provide responses to chit-chat utterances and offer recommendations of products and information to users. Chen, Yang, Wu, Liu, and Xia (2015) presented a Chinese SDS for flight reservations. The research focused on spoken language comprehension and dialogue management. The main purpose of the system is to help users make flight reservations through spoken dialogues with the system. The users could enter their departure city, arrival city and departure date for flight information. They also could enquiry information on the airline company, ticket prices, flight number and departure time, etc. to complete the flight reservation.

Corpus plays a very important role in the NLP system and SDS. Li (2017) built the largest spoken Chinese corpus called the Chinese Spoken Dialogue Corpus (CSDC). The CSDC included five different domains and more than 14,000 dialogues which could be a great support for the Chinese SDS practice and research. Zhang, Chen, Che, Hu, and Liu (2017) introduced the first evaluation criteria for Chinese SDS. The study compared the differences between the open-domain chit-chat system and the task-oriented system. To evaluate the former, there is no exact goal and there may be an infinite number of responses. Sustaining the dialogue as long as possible was determined to be one of the main tasks for the system. In contrast, the task-oriented dialogue system has exact goals and a finite space of input and output state, and finishing the dialogue as soon as possible is

the key feature. They developed five evaluation metrics for the two types of SDS, which are (i) task completion ratio, (ii) user satisfaction degree, (iii) response fluency, (iv) the number of dialogue turns and (v) guidance ability for out-of-scope input.

However, with the ever-changing nature of languages and human society, researchers and practitioners have gradually expressed concern about the SDS being overly reliant on large-scale corpus and ASR for spoken language understanding. In an attempt to reduce or even eliminate the need for ASR of SDS, Guo et al. (2021) looked at designing a spoken language understanding pipeline using a transformer encoder architecture. The performance of the novel system was no match for the established technology while its concept provides valuable insights for the future development of SDS.

2.6 Evaluation

The outcomes of the needs analysis serve as the cornerstone for shaping and assessing the two prototypes. To ensure a well-informed evaluation process with applicable criteria, it is essential to establish a clear understanding of the needs analysis that underpins this research and also delineate the nature of the two prototypes. Therefore, this section commences by exploring the contextual framework of needs analysis within the existing literature and the specific context of this study. Subsequently, it provides a concise overview of the definitions of CALL, iCALL and Technology Enhanced Language Learning (TELL). Following this, the section delves into the existing evaluation criteria used in the assessment of CALL and/or iCALL systems.

2.6.1 Needs analysis

Needs analysis (NA) is a critical area of research in the field of language acquisition and CALL. It plays a pivotal role in tailoring language instruction and technology provision to the specific requirements of learners. Needs analysis, also known as needs assessment, is a systematic process aimed at identifying the linguistic, communicative, and pragmatic needs of language learners. According to Robinson (1981), it is "a systematic and analytical process that identifies language needs of the learners for a specific purpose." This process is essential for educators and instructional designers to make informed

decisions about course content, teaching methods, and materials, thereby ensuring that the learning experience is tailored to the learners' specific needs.

The purposes of NA in the realm of language education and CALL are multifaceted, with significant implications for language educators and instructional designers. First and foremost, needs analysis aids in defining the objectives and goals of CALL artefacts with precision and relevance. As Bax (2003) suggests, NA ensures that course objectives align closely with the real needs and expectations of learners. It provides a roadmap for curriculum development, allowing educators to focus on language skills and competencies that are directly applicable to learners' specific contexts.

Furthermore, needs analysis plays a pivotal role in the selection of suitable materials and resources for language instruction and content development. Hutchinson and Waters (1987) underscore the importance of a learner-centred approach, indicating that NA helps educators identify the resources that best serve learners' requirements. By tailoring teaching materials and resources to the needs identified, the learning experience becomes more relevant and engaging. For example, a needs analysis for business English learners might reveal a strong focus on email correspondence, negotiation skills, and presentation language, leading to the selection of materials and activities that address these specific needs.

Additionally, the evaluation of language learning programmes and CALL artefacts is a key purpose of needs analysis, but this process has evolved to accommodate emerging assessment strategies and technologies. Recent references emphasise the role of learning analytics in evaluating the effectiveness of language learning programmes and products (Lin & Hwang, 2018; Wang & Petrina, 2013). These methods provide valuable insights into learner progress and areas for improvement, facilitating data-driven decision-making for educators and instructional designers.

Needs analysis encompasses various types, each with its own specific focus and application. These types include Target Situation Analysis (TSA), Present Situation Analysis (PSA), and Communicative Needs Analysis (CNA).

TSA, as introduced by Munby (1978), examines the language requirements in a specific context or professional field. For example, in aviation English, TSA might investigate the language skills and knowledge needed for pilots and air traffic controllers to effectively communicate in aviation-related scenarios. TSA provides insights into the ultimate language goals and proficiency required for learners to operate in their target situations.

PSA has gained significance with the proliferation of online learning environments. This method now assesses learners' digital literacy and their ability to navigate and interact within digital platforms, offering insights into the need for technology-related language skills. Educators consider not only the learners' linguistic proficiency but also their digital readiness (Kukulska-Hulme & Traxler, 2013).

CNA has broadened its scope to encompass the intricacies of online communication and the nuances of intercultural competence in digital interactions. With the advent of virtual classrooms and global online communities, CNA now delves into the communication skills required to bridge cultural gaps and facilitate effective communication (Belz & Thorne, 2006).

These diverse types of needs analysis provide a holistic approach to understanding and addressing the linguistic, communicative, and pragmatic needs of language learners. They offer essential insights that guide CALL design, resource selection, and instructional strategies, ensuring that CALL is both meaningful and effective. In the context of the present research, both PSA and CAN were adopted, with a focus on PSA in consideration of the very early stage of Mandarin language learning of the participants.

2.6.2 CALL, iCALL and TELL

CALL, as defined by Levy & Hubbard (2005), represents the integration of computer technology into language education. It encompasses a wide range of digital tools, software, and internet-based resources that facilitate language learning. CALL materials are designed to provide interactive exercises, practice opportunities, and feedback for learners. Warschauer and Healey (1998) emphasise that CALL's primary focus is on

providing learners with opportunities for autonomous practice, often without an emphasis on adaptability or personalisation.

iCALL, as articulated by O'Brien & Hegelheimer (2007), is a subset of CALL that goes beyond the static exercises of CALL. iCALL integrates AI components, especially NLP, to create systems capable of adapting and responding to individual learner performance. According to Gamper and Knapp (2002), the key distinction is the system's adaptability. iCALL employs data-driven algorithms to analyse learner input and performance, offering customised feedback and exercises. The focus is on personalisation, adaptability, and the ability to mimic human-like responses.

Regarding the use of NLP in iCALL, NLP can indeed be a component of iCALL, as suggested by Heift (2004). However, to qualify as iCALL, NLP must be part of a system that provides personalised and adaptive language learning experiences. NLP is a technology used in numerous language-related applications, but to fall under the iCALL category, it should be integrated into a system that can intelligently adapt to individual learners' needs (Gamper & Knapp, 2002).

TELL, as explored by Stockwell (2010), provides a broader framework that includes CALL and iCALL but encompasses any technology used to enrich language learning experiences. TELL recognises the evolving role of technology in language education and can involve various tools, such as mobile devices, audio-visual resources, and even traditional technologies employed innovatively. TELL is characterised by its inclusivity of a wide range of technology-based approaches that enhance language learning, without specifying the level of adaptability or personalisation.

To summarise, CALL, iCALL, and TELL represent distinct approaches to technology-enhanced language learning, with varying levels of adaptability and personalisation. While NLP may serve as a component of iCALL, its mere use doesn't automatically classify it as iCALL, as iCALL entails a more advanced and customised approach to language learning. TELL, on the other hand, offers a more inclusive framework that encompasses a wide range of technology-based tools, not limited to the adaptability or intelligence of the system.

In the context of the current research, the two artefacts are categorised in iCALL by integrating NLP and mimicking human-like responses using the Wizard of Oz method (see more details in Section 2.6.3) to achieve adaptability in iCALL systems. It fits more appropriately in the research framework to identify needs in teaching and learning and to address them through the pilot of the artefacts, providing customised experiences in a Universal Design for Learning (UDL) framework to cater for individual learners, which aligns with the primary principles of iCALL (Gamper & Knapp, 2002).

2.6.3 The Wizard of OZ method

The Wizard of Oz method has been widely utilised in human-computer interaction research to simulate human-computer interactions by employing human operators behind the scenes to mimic the capabilities of a fully automated system (Dahlbäck, Jönsson & Ahrenberg, 1993).

The Wizard of Oz method offers a cost-effective way to prototype and test novel interaction designs before investing in full-scale development. This can help in the early identification of usability issues, potentially saving time and resources. The method promotes a user-centred approach by involving human operators who can adapt to user feedback in real time, ensuring that the design closely aligns with user expectations (Hanington & Martin, 2019). The Wizard of Oz method is also particularly useful for exploring complex scenarios and handling edge cases, where automated systems may struggle to respond effectively (Lewis and Rieman, 1993) or to explore novel interface concepts, providing insight into user behaviour and preferences (Dow et al., 2005). Researchers can easily adjust and adapt the interaction during studies, enabling them to test various design options without complex system changes. More importantly, it encourages participants to interact naturally, as they are unaware of the human operator, allowing for a more authentic user experience (Lazar, Feng & Hochheiser, 2017).

However, the method also presents a number of limitations. To begin with, the method inherently involves human operators, limiting its applicability for full automation. The effectiveness of the method depends highly on the skill and training of human operators, which may introduce variability in study outcomes (Green & Wei-Haas, 1985). Conducting Wizard of Oz studies can be time-consuming, especially when large

participant samples are required, and participants might behave differently when they realise that a human operator is involved, potentially skewing the results (Lazar, Feng & Hochheiser, 2017). The method may require significant resources in terms of human operators, equipment, and facilities. Researchers must also consider ethical implications, such as potential deception, when conducting Wizard of Oz studies.

The present study implements the Wizard of Oz method due to practical limitations (see Section 3.3.3). The designing process of the iCALL tool prototypes will be further described in Section 3.5.

2.6.4 Previous research on the evaluation of CALL and iCALL

There are several definitions for evaluation. For instance, Johnson (1993) stated that the purpose of an evaluation study is to assess the quality, effectiveness or general value of a programme or other entity. Krathwohl (1993: 524) mentioned that evaluation is decision-driven and argued that its main goal is to decide on ‘the worth of something’. Evaluation offers a method by which the evaluator can reach an informed, logical, and convincing judgment or decision on the worth of a certain practice, a design feature, or a particular approach. Levy and Stockwell (2006: 42) discussed the characteristics of evaluation studies and concluded that they have a pragmatic outcome and are primarily carried out to determine the worth of something and report the results to a defined audience.

In the context of evaluation in CALL and iCALL, evaluation is a process used by CALL developers to improve their materials or by users to assess the effectiveness of a CALL program or task. However, one must first

According to Levy and Stockwell (*ibid.*), there are two main types of evaluators, namely the designer evaluator and the third-party evaluator. In terms of CALL software evaluations, they are usually carried out by journal reviewers, teachers, and institutions or even by a learner evaluating for possible use or purchase. When considering implementing CALL materials, the effectiveness of CALL is of critical importance.

Hubbard (2006) explained the purposes of evaluation for CALL, which are summarised below:

- 1) To understand the technical infrastructure of the artefact
- 2) To acquire and analyse data about the learning materials, student background, learning outcome and objectives of using the artefact
- 3) To investigate how language is learned through this new type of learning method

CALL practitioners use a variety of methodologies to evaluate their CALL materials. These methodologies range from the simple checklist or survey to the more multifaceted approaches such as those developed by Hubbard (2006) and Chapelle (2001).

One of the most widely used instruments for CALL evaluation is the checklist. Susser (2001: 262) defined the checklist as “a series of questions or statements to be checked off ‘yes/no’ or marked 1-5 on a Likert scale or has blanks to be filled in”. Susser (ibid.) further explained that the checklist can be in the format of a questionnaire or with text explanations of each question. In certain circumstances, a plain paragraph with a series of questions will also qualify as a checklist.

However, there were objections to using checklists to evaluate CALL artefacts. The main argument is that the checklist approach focuses predominantly on the technical aspects of evaluation while tending to be less robust for pedagogical and educational discovery. Squires and McDougall (1994) listed a few very specific objections such as (i) the checklist looks at the artefact itself rather than factoring in the associated learning activities, (ii) the checklist does not consider the fundamental changes in learners’ mindset and method of learning, (iii) checklist weighs criteria equally and (iv) checklist cannot cope with the sociocultural background of the learners and the wider learning context.

To reflect more on the teaching and learning methodology in the evaluation, Hubbard (1982) developed the methodological framework for CALL evaluation. He first mentioned a list of reasons why CALL artefacts, at the time using the term ‘courseware’, are difficult to evaluate in comparison with the conventional teaching and learning materials. This includes that CALL is often through a new medium, its structure is

normally more complex than the linear model of conventional materials (e.g., textbook), and it is often interactive with multimedia texts.

There was a need that before the CALL artefact could be evaluated, it first needs to be defined. Hubbard and Siskin (2004) updated the term 'courseware' with 'CALL software' and defined it as the computer programmes and the accompanying content with an instructional purpose and a language learning objective. For the evaluation of methodology using CALL, Hubbard (2006) adopted Richards and Rodgers's (1982) framework of evaluation while adding another three essential elements.

Richards and Rodgers's (1982) framework of evaluation:

- 1) Approach, the underlying language teaching and learning theories
- 2) Design, that meets assumptions of the approach and includes syllabus, learning outcome and role of teacher, students and the artefact itself
- 3) The procedure, the classroom activities which deliver the outcomes set in the design

Hubbard's (2006) additional three essential elements:

- 1) Assess the artefact in a language-specific and learning-specific context
- 2) Identify how the artefact is being effectively implemented
- 3) Ascertaining its degree of success

The study by Tsiriga & Virvou (2004) evaluated a web-based iCALL system across three dimensions. First, it assessed the impact of the system's intelligent features on student learning outcomes. Second, it examined the system's ability to provide individualised support for more effective use. Finally, it gauged the overall usability and user-friendliness of the iCALL system. An empirical study compared the iCALL system with a non-intelligent version. Results showed that students using the intelligent version demonstrated improved domain knowledge acquisition and more effective interactions. However, it was noted that students using the iCALL system faced a steeper learning curve and required additional time to become familiar with it compared to those using the non-intelligent version. It emphasised the advantages and potential challenges associated with the intelligent features, highlighting the need for a balanced consideration of intelligent elements and user-friendliness in iCALL system design and deployment.

In the context of TCFL, Chen et al. (2016) explored the development and analysis of an iCALL corpus, which was designed to assess Mandarin mispronunciations by non-native European speakers. It focused on phonetic and prosodic pronunciation patterns, addressed challenges in corpora development, and discussed applications and research directions. The iCALL corpus consists of 90,841 utterances from 305 speakers with diverse linguistic backgrounds, including Germanic, Romance, and Slavic native languages.

The implications for the present research are mainly reflected in the key findings on perspectives of iCALL evaluation and the training for NLP. For example, incorporating non-native data from iCALL can significantly improve ASR performance, especially for accented speakers. Adapting ASR engines to L1-dependent error patterns can compensate for distortion caused by non-native accents. Automatic fluency assessment is vital for providing feedback on non-native speech production. Chen et al. (2016) suggested that automatic fluency assessment can enhance computer-assisted pronunciation training by evaluating pronunciation, tone and tone sandhi, rhythm, and fluency. The well-defined tonal structure in Mandarin allows for the investigation of both segmental and prosodic aspects of L2 learning. The research also highlighted that defining suitable phonetic and tonal categories to characterise non-native pronunciation can be challenging, requiring iterative transcription processes. Additionally, the subjectivity of human raters in identifying mispronunciations is influenced by the learner's proficiency level.

An evaluation can also be done by way of judgmental and/or empirical analysis (Chapelle, 2001). Judgmental evaluation, often associated with expert opinions and experience, relies on the expertise of language educators or professionals to assess the effectiveness of language learning practices or assessments. This approach is inherently subjective and may be influenced by personal bias or professional judgment (Shohamy, 2001). For instance, a language teacher may rely on their own experience and expertise to evaluate the suitability of a teaching method.

In contrast, empirical evaluation is grounded in data, research, and scientific methods. It involves the collection and analysis of objective, quantifiable data to assess the efficacy

of language learning practices or assessments (Norris & Ortega, 2000; Roever & McNamara, 2006). Empirical evaluation may include conducting controlled studies, using statistical analyses, and drawing on empirical evidence to make assessments.

Chapelle's (2001) approach advocates for the use of empirical research to measure the impact of computer applications on language acquisition, emphasising the need for rigorous, data-driven evaluation. Taking an SLA-based approach, Chapelle (*ibid*: 55-59) developed six criteria as well as questions that can be used for the judgmental analysis of CALL (see Table 3). These criteria and questions assume a task-based approach to language teaching/learning. Chapelle (*ibid*: 66) also provided questions for the empirical evaluation of CALL tasks (see Table 4).

Chapelle's (2001) approach significantly contributed to the integration of technology in language learning and assessment. Her perspective underscored the importance of leveraging computer applications to enhance language acquisition. However, it is essential to critically examine the strengths and limitations of this approach.

Chapelle's (*ibid*) advocacy for technology integration is undeniably relevant in the modern educational landscape. Technology can provide dynamic and interactive learning experiences, facilitating language practice and feedback (Stockwell, 2010). Nevertheless, the practical application of technology in language education can be challenging in resource-constrained contexts. The digital divide, varying access to technology, and differences in technological proficiency among learners can limit the universality of Chapelle's approach.

Moreover, Chapelle's (2001) approach tends to emphasise the quantifiable aspects of language acquisition, often relying on computer-generated assessments and automated feedback. While these tools can offer efficient data collection and instant feedback, they may fall short in capturing the intricacies of language learning, especially concerning cultural and contextual nuances. Additionally, there is a risk that this approach may inadvertently promote 'teaching to the technology' instead of fostering genuine language. Overemphasis on standardised computer-based assessments may lead educators to focus primarily on test preparation, potentially neglecting the broader educational objectives.

Table 3 Chapelle's (2001) criteria for judgemental analysis of CALL

Qualities	Criteria	Questions
Language Learning Potential	The degree of opportunity present for beneficial focus on form.	<ul style="list-style-type: none"> • Do task conditions present sufficient opportunity for beneficial focus on form?
Learner fit	The amount of opportunity for engagement with language under appropriate conditions given learners characteristics.	<ul style="list-style-type: none"> • Is the difficulty level of the targeted linguistic forms appropriate for the learners to increase their language ability? • Is the task appropriate for learners with the characteristics of the intended learners?
Meaning focus	The extent to which learners' attention is directed toward the meaning of the language.	<ul style="list-style-type: none"> • Is learners' attention directed primarily toward the meaning of the language?
Authenticity	The degree of correspondence between the CALL activity and target language activities of interest to learners out of the classroom.	<ul style="list-style-type: none"> • Is there a strong correspondence between the CALL task and second language tasks of interest to learners outside the classroom? • Will learners be able to see the connection between the CALL task and tasks outside the classroom?
Impact	The positive effects of the CALL activity on those who participate in it.	<ul style="list-style-type: none"> • Will learners learn more about the target language and about strategies for language learning through the use of the task? • Will instructors observe sound second language pedagogical practices by using the task? • Will both learners and teachers have a positive learning experience with technology through the use of the task?
Practicality	The adequacy of resources to support the use of the CALL activity.	<ul style="list-style-type: none"> • Are hardware, software, and personnel resources sufficient to allow the CALL task to succeed?

Table 4 Chapelle's (2001) criteria for empirical evaluation of CALL

Qualities	Questions
Language learning potential	<ul style="list-style-type: none"> • What evidence suggests that the learner has acquired the target forms that were focused on during the CALL task? • What evidence indicates that learners focused on form during the CALL task?
Learner fit	<ul style="list-style-type: none"> • What evidence suggests that the targeted linguistic forms are at an appropriate level of difficulty for the learners? • What evidence suggests that the task is appropriate to learners' individual characteristics (e.g., age, learning style, computer experience)?
Meaning focus	<ul style="list-style-type: none"> • What evidence suggests that learners' construction of linguistic meaning aids language learning? • What evidence indicates that learners use the language during the task for constructing and interpreting meaning?
Authenticity	<ul style="list-style-type: none"> • What evidence suggests that learners' performance in the CALL task corresponds to what one would expect to see outside the CALL task? • What evidence suggests that learners see the connection between the CALL task and tasks outside the classroom?
Impact	<ul style="list-style-type: none"> • What evidence suggests that learners learn more about the target language and about strategies for language learning through the use of the task? • What evidence suggests that instructors engage in sound second language pedagogical practices by using the task? • What evidence suggests that learners and teachers had a positive experience with technology through the use of the task?
Practicality	<ul style="list-style-type: none"> • What evidence suggests that hardware, software, and personnel resources prove to be sufficient to allow the CALL task to succeed?

Drawing from Chapelle's (ibid) framework, Leakey (2011) presented a new comprehensive framework for CALL evaluation, emphasising two evaluative routes: a judgmental appraisal of twelve CALL enhancement criteria and the empirical evaluation of CALL units through qualitative and quantitative measures, aligning with the Three Ps (platforms, programs, pedagogy).

The CALL enhancement criteria provided a well-rounded framework addressing the entire scope of CALL. In addition to Chapelle's (2001) six principles (see Table 4), Leakey (2011) proposed another six principles (see Table 5). Each criterion is furnished

with an evaluator checklist, aiding in a systematic assessment. The qualitative and quantitative measures route offers methodological guidance for conducting empirical studies, including research design, data collection methods, and considerations for internal and external validity. The framework assists evaluators in designing, implementing, and reporting on CALL evaluations.

Table 5 Leakey's (2011:81) additional six principles

6 new principles for CALL 'PPP' evaluation		Definitions
Leakey	Language skills and combinations of skills	the ability to deliver, either in isolation or in combination, all the main language skills, listening, speaking, reading, writing, vocabulary, grammar and area studies as well as meta-cognitive language skills
	Learner control	the degree of opportunity for self-directed, self-paced and autonomous learning
	Error correction and feedback	the extent of automated correction of error (whether explicit or implicit, formative or summative) and the monitoring, tracking, storing and reporting of progress, level and achievement
	Collaborative CALL	degree of opportunity for paired, group or class interaction creating the social dynamic for learning through concerted and collaborative effort
	Teacher factor	the influence of individual teacher personality and style factors on the effectiveness of CALL; the quality and relevance of ongoing staff training and development
	Tuition delivery modes	capacity of the CALL platform, software or pedagogy, to enable the delivery of a variety of teaching modes (such as lecture, seminar, tutorial and practical) in a CALL setting

This framework equips evaluators with a structured approach for assessing the effectiveness of CALL systems, ensuring that both judgmental and empirical perspectives are considered. It offers valuable insights into the evaluation of CALL, promoting a systematic and comprehensive evaluation process.

In the context of evaluating game-based CALL artefacts, Ní Chiaráin and Ní Chasaide (2017: 229) proposed nine criteria for both the design and evaluation:

- 1) The game should be task-based with a focus on meaning and the use of the target language.
- 2) Learners should have the opportunity to develop metalinguistic awareness by having the language difficulty set at an appropriate level
- 3) The game should be enjoyable and have a playful spirit
- 4) The game should have a clear plot with helpful aids such as a hypertext dictionary
- 5) The game should have a logical structure with appropriate cues for manoeuvring through it successfully
- 6) The game should promote an appropriate intensity of engagement
- 7) The game should be visually attractive and have appropriate aural material
- 8) The game narrative should have cultural legitimacy
- 9) There should be clarity in the screen layout with no unnecessary distracting features

The primary aim of the current research project is to assess the effectiveness of two unique iCALL tools designed to enhance the teaching and learning of spoken Chinese within the context of Irish post-primary schools. This evaluation criteria (see Table 6) is mainly guided by a comprehensive framework that incorporates key elements from Chapelle's model (2001) and aligns with the criteria established for game-based Computer-Assisted Language Learning (CALL), as outlined by Ní Chiaráin and Ní Chasaide (2017, p. 229).

Table 6 Criteria for iCALL evaluation in the current research

Qualities	Criteria	Approaches of evaluation	Methods of Evaluation
Language learning potential	Learners should have the opportunity to develop metalinguistic awareness through having the language difficulty set at an appropriate level	Judgemental	Subjective Likert scale Questionnaire
Learner fit	The game should be enjoyable and have a playful spirit	Judgemental	Subjective Likert scale Questionnaire
Meaning focus	The game focus on meaning and on the use of the target language.	Judgemental	Subjective Likert scale Questionnaire
Authenticity	The game should be visually attractive and have appropriate aural material	Judgemental	Subjective Likert scale Questionnaire
Impact	The game should promote an appropriate intensity of engagement	Judgemental	Subjective Likert scale Questionnaire
	The positive effects of the CALL activity on those who participate in it.	Judgemental and Empirical	Subjective Likert scale Questionnaire Objective One empirical group and two control group 'pre-treatment test', 'treatment' and 'post-treatment test'
Practicality	The adequacy of resources to support the use of the CALL activity.	Judgemental	Subjective Likert scale Questionnaire

2.7 Summary

This chapter reviewed the relevant theories in three disciplines of Chinese language acquisition, spoken Chinese pedagogy, and iCALL. The review is structured around the TATL framework proposed by Ní Chiaráin and Ní Chasaide (2015).

The learner section reviewed the background of the learners and the Chinese curriculum and outlined some challenges in the teaching and learning of Chinese as a foreign

language. The theory section reviewed acquisition theories of Mandarin Chinese. This mainly focused on theories about spoken Chinese acquisition, Mandarin tones acquisition as well as their progression and adaptation in the technology-mediated context. The action section reviewed the teaching pedagogy and methodology of TCFL. These include the historical development in spoken Chinese pedagogy, communicative approach and task-based language teaching, and the material development for teaching and assessing spoken Chinese. The technology section reviewed the key technologies and the evaluation criteria, including automatic speech recognition, speech visualization, gamification, virtual world, artificial intelligence, and spoken dialogue system. The last section reviews and proposes the evaluation framework for CALL and iCALL in the context of the present study.

After reviewing the relevant literature for designing and evaluating the iCALL tools for the present research, the next chapter reports on the design of both iCALL tools and the research setting as well.

Chapter 3 Research Design

3.1 Overview

This chapter introduces the three-phase mixed-methods design of the present research project. The nature of the research project itself requires a three-phase design. The first phase is the needs analysis for both teachers (Native and non-native Chinese teachers) and students (heritage and non-heritage Chinese learners) in teaching and learning spoken Chinese respectively. It is important to have up-to-date and highly relevant data for the needs as they inform the foundation of the iCALL tool's design and evaluation. Also, at the time of the present research, there are not many references on the topic in context, which further makes the needs analysis essential (see Section 2.2). The second phase is to design the two iCALL tools. The third phase is the evaluation of the iCALL tool prototypes.

The presentation of the research design follows the same three-phase sequence as well. Section 3.2 first introduces the research question and hypothesis of the study. Section 3.3 discusses the disciplinary, ethical, and practical considerations of the research design. Section 3.4 presents the different aspects of the research design for the needs analysis. Section 3.5 describes the process and outcome of developing the two iCALL tools. Section 3.6 introduces the different aspects of the research design for the evaluation of the iCALL tools.

3.2 Research questions

The present research aims to design and evaluate two iCALL tools to assist the teaching and learning of beginner-level spoken Chinese in the context of Irish post-primary education. The research questions of the current research project are summarised and presented below.

1. What are the challenges for teachers in teaching spoken Chinese in the context of Irish post-primary education?

2. What are the challenges for learners in learning spoken Chinese in the context of Irish post-primary education?
3. To what extent can iCALL tools aid teachers in teaching and assessing learners' spoken Chinese in the Irish post-primary context?
4. To what extent can iCALL tools aid beginner learners in learning and assessing their spoken Chinese in the Irish post-primary context?

3.3 Considerations for the research design

As mentioned earlier, the present research is a three-phase mixed-method design. Before going into explaining the design of each phase and the rationales of the different research methods adopted, this section first presents some general considerations for the overall research design from the disciplinary, ethical, and practical perspectives.

3.3.1 Disciplinary considerations

Among the previous studies in CALL and iCALL, there were a good number of quantitative research as well as qualitative research, while it seems that the mixed-method approach is the most popular type of research design (Altıncı & Mohammadzadeh, 2018).

As Fraenkel, Wallen, and Hyun (2012) explained, in general, quantitative methods are good for acquiring descriptive data and exploring relationships and causes, but the challenge lies in their interpretation. In comparison, the qualitative methods are much more robust in investigating behaviour and emotion, but they could be time-consuming, and the data acquired normally has less statistical power due to the smaller number of participants in comparison with the quantitative methods.

The strength of a mixed-method approach as explained by Dörnyei (2007: 173), is that the quantitative approach could be good to look at the general trend on a macro level of the investigation, while the qualitative approach can help discover more details of the individuals and further explore the impact of the general trend on them on a micro-level of the research. When it comes to the implementation of both qualitative and quantitative

methods, Dörnyei (ibid.) also mentioned three types of mixed-method research design below.

- Sequence: use both qualitative and quantitative methods interchangeably
- Dominance: use one method as the main approach and the other as assistance
- Concurrent: use both methods separately and simultaneously

Meanwhile, as Chapelle (1997) put in her paper reviewing CALL research mentioned that there was and still needs attention in taking more of an SLA perspective to investigate CALL, instead of focusing primarily on the technological side of the research. She also mentioned the importance of conducting empirical studies rather than relying much on inferential data to evaluate the CALL products.

The present research project requires a three-phase model by its nature. Due to the different needs for data collection and analysis, different research methods were adopted.

In phase one, the needs analysis, a qualitative approach is ideal for getting data from the teachers. As mentioned, there was no existing literature on spoken Chinese teaching and learning in the context of Irish post-primary education, so a qualitative approach, such as semi-structured interviews, could gain more details and a wider scope of vision without having any presumptions. While conducting needs analysis for the students, error analysis is adopted to collect data about learners' performance and needs related to the research topic. The rationale is that, in the context of the current research, the targeted student participants normally possess no experience in learning Chinese at all, so they will not have the competence to comment on their needs directly. Error analysis and some indirect insights from their teachers about their needs in learning, through the teacher interviews, would instead provide more valid data for this phase of the research.

In phase three, the evaluation of the tools, it would be good to keep the qualitative approach to acquire data and detailed feedback from the teachers, as they would be rather extensively experienced with the two tools. While for the students, considering the potentially greater number of participants in comparison with the teachers, their age and current level of cognition about the iCALL tools as well as the GDPR and individual

school data protection policy, a quantitative approach such as an evaluation questionnaire might be the most suitable method for data collection. Also, due to the same reason explained for phase one, that student participants would, in general, have very limited learning experience and target language proficiency, some empirical experiments would be useful to acquire concrete data about the effectiveness of the iCALL tools. This will be further discussed in Section 3.6 when presenting the design of students' evaluation.

3.3.2 Ethical considerations

In many, if not all disciplines, especially in the context of the current research with direct participants of human beings (CFL teachers and students), research ethics and necessary accommodations should be considered rigorously. As Hesse-Biber and Leavy (2010) stated, one cannot discuss ethics issues without the specific research context, and such discussion should be made at the very beginning of the entire research process, instead of in the middle or at the end of the research as a sought-after solution.

Furthermore, Birnbacher (1999) emphasized the critical importance of collectively addressing ethical considerations, particularly within the domain of social science and its related disciplines. To ensure the research yields valid results, ethical considerations should be seamlessly integrated into the research process and treated as an intrinsic part of the context and research outcomes, rather than a separate task that merely needs to be fulfilled.

In the context of the present research, ethical approval was first acquired before the commencement of any data collection from the research ethics committee of the university. The general perspectives of ethical practices were followed strictly, such as data confidentiality and participants' anonymity, which will be further explained in future sections where necessary (see Section 3.4.1.3 and 3.4.2.3). While beyond these standard procedures, one particular ethical issue that needs to be considered is the identification and recruitment of the student participants.

Originally, at the stage of conceptualizing the entire research project, it was intended that the targeted student participants and future users of the two iCALL tools were set to be the new Leaving Certificate Mandarin Chinese students, in particular, those in the 5th

year who have just begun to study the language. One of the major rationales for such a decision is that the Leaving Certification Mandarin Chinese curriculum is ab initio one (NCCA, 2019). The targeted students are beginner learners in a high-stake foreign language subject (see Section 4.3.1).

However, with good intentions, the impact of the research on those students' learning and motivation is unknown. Considering it is the very early stage of the curriculum implementation, that the provision only started in 2020, the year the researcher intended to begin data collection, an alternative group of students (TY year students) was identified and selected as the targeted participants to prevent the current research from unintentionally jeopardizing students' learning or causing them to become demotivated (Zhang, 2020). Eventually, after discussing with fellow researchers and the CFL teacher participants, it was decided that the student participants' profiles needed to be changed. At the time of the research, the Transition Year students who were studying in preparation for proceeding to the Leaving Certificate Chinese course would become the targeted student participants, as in terms of background they are the most similar to the original and most ideal participants, while it is a much lower stake for these students in comparison with those in the 5th year already (see Section 2.2.1). More details about the participants are presented when discussing participant identification and recruitment in Section 3.4.2.2.

3.3.3 Practical considerations

After explaining the disciplinary and ethical considerations, to ensure the research is feasible, a reality check is also highly necessary. This section presents these practical challenges throughout the entire research process to help make sense of some decisions in research design and administration.

The first practical challenge is the COVID pandemic as a significant and particular social context at the time of the research. Other than its impact on personal life, it also has an evident, and from some perspectives, even a fundamental impact on this research and other research in the foreseeable future. First, the pandemic has had a huge negative impact on the mentality of schools, teachers, and students participating in research projects at the time. People needed to focus on the health and safety side of things and

did not have either the capacity or the motivation to help with research, which was not an essential need in that context. This has made the recruitment of participants extremely difficult. Second, all communication about and administration of the research needs to move online. The demonstration, explanation, and cooperation have increased time consumption with reduced effectiveness. Third, also most importantly, this significant underlying condition may have an impact on research results with an uncertain strength from one or more unknown perspectives, and the method of uncovering such impact is also unknown.

The second practical challenge is the pace of technology advancement and the cost of technology required by the research design. Some initially conceptualized technologies were not at the level of being effectively applicable to the research, such as the ASR for Mandarin Chinese and its collaboration with AI both in the front and backstage. While some technologies were in place but simply not affordable for the researcher, such as the cost of creating a game and a VW scenario for non-profit educational purposes by an individual. All these challenges require reasonable accommodations, for example, collaborating with colleagues with technical skills to help create the tools and reduce costs for product design, using the Wizard of Oz method as simulated AI to test the theoretical effect of the product etc (see Section 2.6.3). These will be further explained when relevant design and administration are presented in the later sections.

3.3.4 Overview of research design

Below is a brief outline of the design and methods used for the research project (see Table 7). The next few sections will present the research design of each phase of the research in more detail.

Table 7 Structure of the research design

	Participants	Research methods
Phase 1 Needs Analysis	Teacher: <ul style="list-style-type: none"> • Native Chinese teachers • Non-native Chinese teachers 	<ul style="list-style-type: none"> • Qualitative • Semi-structured interview
	Student: <ul style="list-style-type: none"> • Heritage speaker students • Non-heritage speaker students 	<ul style="list-style-type: none"> • Quantitative • Empirical experiment – error analysis
Phase 2 iCALL tools development	Researcher and colleagues	n/a
Phase 3 Evaluate the iCALL tools	Teacher	<ul style="list-style-type: none"> • Qualitative • Semi-structured interview
	Student	<ul style="list-style-type: none"> • Quantitative • Evaluation questionnaire • Empirical experiment – controlled experiment

3.4 Phase one: Needs analysis

The first phase of the research aims to answer the first two research questions (RQ). RQ1 is to investigate the challenges for teachers in teaching spoken Chinese, and RQ2 is to investigate the challenges for students in learning spoken Chinese. This section presents the design of the needs analysis in the first phase of the research project.

3.4.1 Needs analysis for teachers

This section reports the design of the research instrument, participants identification, administration of data collection and methods for data analysis when conducting the needs analysis for the teachers.

3.4.1.1 Semi-structured interview design

The semi-structured qualitative interview was selected as the research instrument to investigate and acquire some details of teachers' needs in teaching spoken Chinese (see Section 4.2).

The interview contained two parts (see Appendix B). The first part of the interview gathers participants' background information, such as their current Chinese proficiency, their experiences in TCFL, and the subjects they teach beyond Chinese. The second part consists of six questions to investigate mainly their needs in teaching spoken Chinese but also touches base on students' needs in learning spoken Chinese.

The reason for the latter part has been discussed in Section 3.3.1. To summarise, it is mainly to address the concern that students at the current level of Chinese proficiency and with limited learning experience (a few weeks from scratch) might not be capable of offering concrete data about their own needs, so teachers' insights on the topic could be valuable references for the research.

For the six questions in the second part of the interview, some of the questions are to check whether some commonly reported issues around the world would also be suitably assumed in the context of Irish post-primary education. For example, question five examines whether insufficient exposure to the Chinese language environment (Chen & Zhu, 2018; Li, 2018; Noriko & Tian, 2013) is also a significant issue for teaching and learning spoken Chinese in the context of the current research. The majority of the questions are exploratory to investigate teachers' needs and self-perceptions about their TCFL and their experiences in using digital tools in Chinese classes.

The interview questions were written in English as the working language of these teachers in schools. The creation of interview questions was based mainly on the research conducted in the field of TCFL in different educational contexts in Ireland (Ji, 2015; Ruddock, 2010; Wang, 2015; Zhang & Wang, 2018), while adaptations were made to address the tonality in Mandarin phonetics (Wang et al., 2006) and the context of TCFL in Irish post-primary education (Zhang, 2020).

A pre-pilot was conducted, and based on the feedback, the structure of the interview was further condensed and was used for the pilot. Two teachers were invited for the pilot with one-to-one interviews, and the data that emerged was examined and considered valid to be included in the research. No further major changes were made according to the results of the pilot, except minor corrections were applied, such as adding multiple references of language benchmarks (e.g. CEFR and HSK) to better assist interviewees in identifying their Mandarin Chinese proficiency.

The approved consent form was also included to inform the teacher participants regarding the aim of the research, the estimated time for the completion of the interview, the policy of data protection, the voluntary nature of the participation, and the contact information of the researcher (see Appendix A).

3.4.1.2 Participant identification

Proper documentation of the sampling process is essential to enhance the research's credibility. Purposive sampling, a non-random selection method, offers advantages for research by allowing researchers to intentionally choose participants or data that are most pertinent to the research objectives (Dörnyei & Csizér, 2012). It is efficient, cost-effective, and time-saving, particularly when in-depth insights are required or when dealing with specialised populations. However, there is a potential for bias due to the subjectivity in participant selection, which can impact the generalisability of results.

At the time of the investigation, there were teachers with different backgrounds involved in TCFL in Ireland (Zhang & Wang, 2018). Intending to acquire insights into these teachers and achieve potentially inferential findings with good representation, the identification of the interview participants used purposive sampling. Purposive sampling allows the researcher to utilise her judgement when identifying and choosing suitable members of the Chinese teacher population to participate in the interview. This method allows for the intentional selection of participants based on their teaching and learning background and iCALL experience, aligning with the research's goal of gaining specialised insights. This approach ensures that the chosen participants possess relevant expertise, contributing to the study's depth and focus.

The sampling process targeted exclusively teachers who were teaching beginner-level Chinese courses in schools at the time of the research. Based on the various backgrounds of Mandarin Chinese educators in Ireland (Zhang & Wang, *ibid*), a good mix of teachers' backgrounds was achieved in terms of their native language (e.g., English and/or Irish, Mandarin Chinese, other Chinese dialects such as Cantonese and Northeastern dialect), CFL teaching experience (e.g., newly qualified, experienced), teaching context (e.g., public schools, complementary schools), and students' backgrounds (e.g., Irish students, heritage students).

To meet the needs of the purposive sampling, the researcher used personal contacts and got in touch with an Irish association for Chinese teachers and the Post-Primary Languages Ireland for their assistance in recruiting suitable research participants. Eventually, a total of 12 teachers (Native Chinese teachers, n=8; Non-native Chinese teachers, n=4) were invited for interviews. The demographic information of these teachers is reported in Section 4.2.1 when presenting the findings.

3.4.1.3 Data collection

A total of 12 interviews were conducted over two months from 28th May 2019 to 10th July 2019. Before each interview, normally after the initial contact was made between the researcher and the teacher participants, the consent form was sent to the participant. Then at the beginning of the interview, some key information in the consent form would be repeated by the researcher, and oral consent acquired before proceeding to the interview questions.

The interviews were conducted in a language of the participant's choice to ease communication. Each interview lasted about 20 minutes and was conducted only between the interviewee and the researcher as the interviewer. Five interviews were conducted face-to-face at a place chosen by the interviewees, while the other seven interviews were conducted online. All interviews were audio-recorded for transcription (see Appendix F).

3.4.1.4 Methods for qualitative data analysis

Data collected from the interview was content analysed, and the process was iterative (Longhofer, Floersch, & Hoy, 2012; Neuendorf, 2017). The analyses were carried out between interviews to allow information acquired from earlier interviews to assist the later ones, so as to increase the possibility of achieving better saturation on the topic (Dörnyei, 2007: 244).

To conduct content analysis, recordings were transcribed into textual form, and Neuendorf's (2017) marking system was adopted (see the beginning of Appendix F and Appendix G for the marking system used for transcriptions). The transcriptions aimed to stay true to the original material, so no adjustments were applied to the transcribed text, even when phenomena such as repetition and language mistakes occurred. However, standard orthography was applied in consideration of readability (Dörnyei, 2007: 248). In the case of interviews conducted in Chinese, transcripts were first created in the original language and then subsequently translated into English before commencing any data analysis.

To ensure the anonymity and privacy of the participants, personal and sensitive information was substituted with coded marks, as recommended by Christian (2000). Once the interview data was transcribed, the initial reading involved a general overview of the text without any specific engagement, focusing only on information relevant to the research questions or noteworthy points. Upon subsequent readings, the initial coding process was initiated, and the text passages were selected and assigned descriptive codes. These codes were employed in a manner that maintained the clarity of the data and refrained from interpretation, preventing any premature conclusions or overgeneralizations.

For normal circumstances, it will require at least one last re-reading of the texts. The last round is to reduce the amount of information highlighted while in the meantime, identifying patterns that emerged in the texts and the coding process. This was through changing the descriptive codes into conceptual codes, which were created based on the cluster of interview data, including both the current one and the interview data acquired previously.

Regarding the technological tools used for qualitative data analysis, two main tools were used to facilitate the process. *Dragon Dictation* was intended to be the tool that helps with creating the transcription. However, likely, the current version of the software is still not quite robust in processing accents, and some interview recordings were with noises in the interviewing environment (e.g., a coffee place), the tool is not very useful in processing most of the recordings, especially with non-English native speakers. The transcription eventually relied mainly on the manual work of the researcher. Another tool that was used to facilitate the coding process and many conceptual works in the research is a mind map software called *EDraw MindMap*. The mind map is used to (i) keep records of different layers of coding (mainly the initial and secondary level of coding), (ii) keep research notes and reading reflections of the researcher, and (iii) conceptualize and illustrate the structure of themes of coding.

3.4.2 Needs analysis for students

This section reports the design of the research instrument, participants identification, administration of data collection and methods for data analysis when conducting the needs analysis for the students.

3.4.2.1 Error analysis design

As explained in Section 3.3.1, an empirical experiment in the format of error analysis was designed to collect data from beginner CFL learners to identify their needs in spoken Chinese acquisition. The experiment was designed for participants to repeat familiar syllables in Mandarin Chinese after the demonstration of standard pronunciation, to identify phonological difficulties in perceiving and producing Mandarin phonetics, tones in particular. The listening and repetition procedures of each item were conducted twice, and the whole process was audio-recorded.

For the design of the experiment, references in two general perspectives were mainly consulted to prepare suitable content for the experiment. The first area is the benchmark for the Chinese language to make sure the content would be at the right linguistic level. Two benchmarks were consulted. The first one is the Common European Framework of

Reference for Languages (CEFR) companion document for Mandarin Chinese (Guder, 2015) and some relevant research (Lu & Song, 2017; Zhang & Li, 2019). In these documents, a recommended list of lexical items for CEFR A1 entry-level learners was examined. The second benchmark is the Hanyu Shuiping Kaoshi (HSK), which is the standardized CFL proficiency test in China and a popular reference for Chinese programs in Irish higher education (Zhang & Wang, 2018). After the inspection, 96 lexical items were initially shortlisted. This step is to ensure the syllables that will be used for the experiment, in the form of single-syllable or disyllable words, would be generally suitable from a benchmarking standpoint for the experiment.

The second area of reference is the popular textbooks the targeted student participants would use. After consulting with the Chinese teachers of the student participants, the vocabulary lists of three popular Chinese textbooks, namely *Happy Chinese*, *Easy Steps to Chinese*, and *Chinese Made Easy* were compared (Zhou & Li, 2019) and cross-checked with the vocabulary list identified based on the two Chinese benchmarks. This step intends to try to keep the testing vocabulary rather familiar for the student participants, to limit unnecessary factors that may reduce the validity of the experiment.

After the two areas of consultation and the drafting of the vocabulary list, 32 lexical items including both single-syllable words and disyllable words were selected as the material for the experiment (see Appendix D). It is anticipated that such a list is stage-appropriate and could make good coverage for the potential combination of Mandarin tones at a beginner level of TCFL.

Other than the experiment, the original design of the needs analysis for students also included an open-ended questionnaire to inquire about their difficulties and needs in learning Mandarin. When piloting the questionnaire, it was discovered that almost no participants of the pilot (CFL students in schools) responded adequately to the questions.

After engaging with the pilot participants, a number of issues were discovered that contributed to this phenomenon. The students have provided vague and general responses that did not offer clear insights into their learning difficulties and needs. This means that the students may not have had a sufficient understanding of their own learning challenges

and needs at the time of the research. They might have struggled to identify and articulate their issues because they were still in the early stages of their learning journey.

The shortcomings of the student responses had implications for the research. Since the initial goal was to directly gather information from the students about their learning needs, the failure to obtain meaningful contributions from them through the open-ended questionnaire necessitated changes in the research design. The subsequent inclusion of teacher interviews and empirical experiments aimed to indirectly and directly capture insights into the students' needs in a more effective way.

3.4.2.2 Participants identification

Similar to the identification of teacher participants, the identification of the student participants used the same purposive sampling aiming to achieve a good representation of the diverse backgrounds of the CFL learners in Irish post-primary education.

To look at the potential impact of L1 accents and the teacher factor on the results of the experiment, students in three schools were identified as participants in the experiment. The first one is an Irish post-primary school with an Irish Chinese teacher teaching Mandarin in the county of Galway. The second one is also an Irish post-primary school with a native Chinese teacher teaching Mandarin in Maynooth. The third one is a complimentary school in Dublin with a native Chinese teacher teaching heritage speaker students.

Gatekeepers are essential in the context of the current research. In terms of research ethics, the student participants as minors require gatekeepers as a median between the researcher and themselves. The gatekeepers also help with the efficiency of the data collection by controlling the access and collection of the data required by the research. In the context of the current research, the Chinese teachers of the student participants were recruited as the gatekeepers, and then the gatekeepers recruited their students to participate in the research. More demographic details of the participants will be presented in the next chapter when reporting the result of the needs analysis (Section 4.3.1).

3.4.2.3 Data collection

As the target participants were school students as minors, the procedure of conducting the experiments, gatekeepers were approached first and were supplied with the consent letter for parents (See Appendix C). A copy of this consent letter was also sent to the school management to keep a record. The written consent from the parents was acquired before the commencement of the data collection. Any students who did not supply the consent letter signed by their parents were excluded from the experiment.

On the day of the experiment, the researcher would travel to the school and a room was typically arranged for the experiment by the school. The researcher would be accompanied by another teacher from the school as the supervisor of the experiment and also for child protection, while the gatekeeper would mind the participants waiting to be tested in a separate classroom.

The experiment was conducted on a one-to-one basis with the researcher and a student, though the supervising teacher will be present in the room but not engaging unless necessary. The process of the experiment was audio-recorded, and the software used for both data collection and analysis is *Praat*. The process of the experiment was about five minutes for each participant, and some sweet choices were offered to students after consulting their allergic information of students and any associated school regulations as a token for their participation. During the whole process of data collection, no personal information of the participants was recorded.

3.4.2.4 Methods for data analysis

Among many previous studies in the field of TCFL, the speech analysis software *Praat* was widely used for the visualisation of tones (Chun et al., 2012; Chun et al., 2015; Lam, 2017). In the context of conducting the error analysis, *Praat* was also the software used for speech data collection and analysis.

In terms of the speech data analysis, the pitch contours of participants were first compared with the standard pronunciation, and the errors in producing Mandarin phonetics were calculated and categorised. Results of the error analysis are reported in the next chapter

when presenting the research results (see Section 4.3.3). Upon finishing the needs analysis as the first phase of the current research project, it moved on to the designing stage of the two iCALL tools.

3.5 Phase two: Develop the iCALL tools

This section presents the design and outcome of the two iCALL tools. In line with the three phases of research design, the design progress of the two tools also adopted Ní Chiaráin and Ní Chasaide's (2015) TATL framework. TATL framework is an initial analysis tool to guide CALL artefact development. It includes four key elements of Theory (the most commonly used language acquisition theories), Actions (learning activities that are embedded by the theories), Technology (the technology which could be used to support the actions) and Learner context (learners' language level, background, cognitive style, motivation, etc.).

Of the two tools, the first one is a gamified tool to help visualise the process of Mandarin tone production, which was named *ViewTones*. The second tool is a virtual language partner in a virtual world. In the context of the research, it was named *Trip2China*.

3.5.1 The first iCALL tool - ViewTones

3.5.1.1 Overview of ViewTones

ViewTones is a voice-controlled game that helps players acquire instant feedback on their Mandarin tone production. The interface of the game is the classic *Super Mario* jump game while the control mechanic is realised by voice. The player controls the character in the game by pronouncing words and phrases with different tones. Below is a screenshot of the game to better illustrate this iCALL tool (see Figure 5 below).

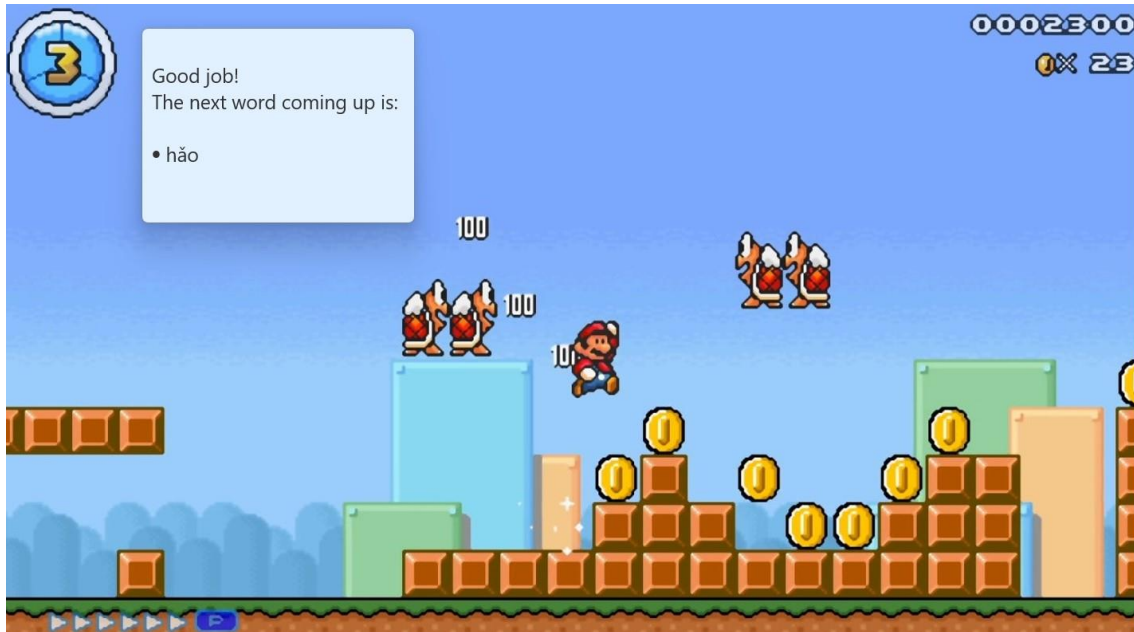


Figure 5 Screenshot of *ViewTones* (in the game)

The *ViewTones* was designed to utilise three main technologies of Automatic Speech Recognition (ASR), Speech Visualisation and Gamification. In theory, *ViewTones* uses the Artificial Intelligence of the ASR to recognise the tones (pitch contours) and transform them into the visualised movement of the character in the game. From a player's perspective, as reflected in the figure above, the player follows the commands given in the blue floating message window (on the top left of the screen), pronounces the words and commands the *Super Mario* character, tries to proceed with the game and gets as many gold coins as possible (calculated on the top right edge of the screen) while avoiding contact with the 'monsters' (red flying turtles on the screen in this screenshot).

While in reality, due to the practical considerations mentioned in Section 3.3.3, the AI, ASR and voice control were substituted by a human being to manually recognise the voice and control the game character, to provide a simulated voice control experience for the player. In other words, as limited by several factors in reality (further discussed in the next session), in practice, players think they command the character in the game by their voice, while backstage it was a colleague who recognises the player's voices and moves the character by the keyboard. In this Wizard of Oz method, a simulated iCALL experience was created for the participants. The only difference between the simulated experience and the more 'authentic' experience as theoretically conceptualised is the

minor lag between the player giving pronunciation and the AI (simulated by a human) moving the character in the game, as in theory, this part should be nearly automatic.

To look into more detail about how this game works, it is necessary to explain the backstage settings of the game. The first part is the configuration of the four tones (see Figure 6).

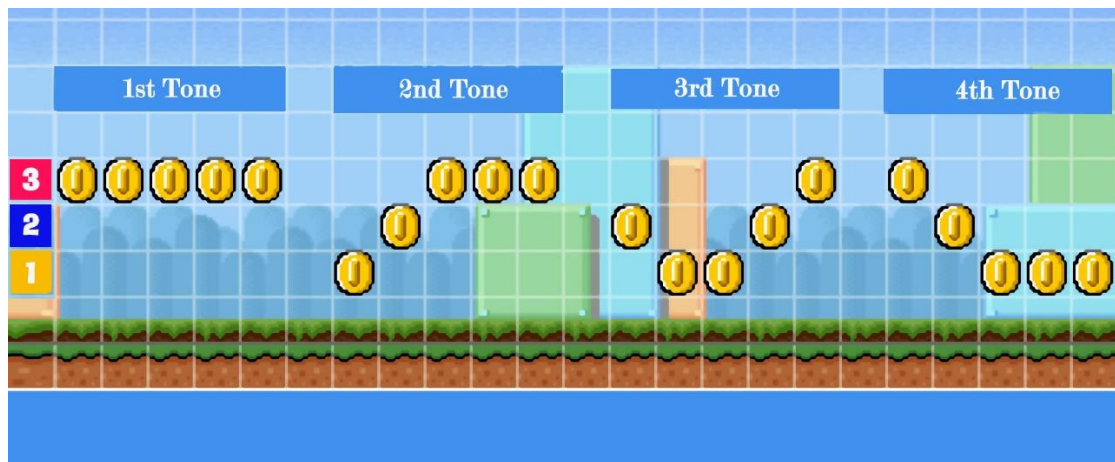


Figure 6 Screenshot of *ViewTones* (four tones)

Looking at the left edge of Figure 6, there are three levels from the lowest to the highest, marked yellow as the first level, blue as the second level, and pink as the third level. This is a simplified three-level tone system derived from Chao's (1968) classic five-level marking system for Mandarin tones (see Section 1.6). The reason for a simplified tone system is limited to the functionality of the game platform, that the character could only move up to three square spaces vertically in one jump. This is the configuration of most jumping games and game engines on the market. Hence, the first level is standing idle, the second level is a normal jump, and the third level is a big jump. And then, the length of a single-syllable word is five horizontal square spaces. This is set after measuring the moving distance of the game character matching the natural length of time to produce a Chinese syllable.

In the *ViewTones*, as shown in the figure above, the four tones were coded with a length of five steps (horizontal square spaces) and three levels (vertical square spaces). The codes for each tone are '33333' for the first tone (high level straight out), '12333' for the second tone (rise from the bottom to and remain at the top), '21123' for the third tone

(drop from the middle to the bottom and then rise to the top), and '32111' for the fourth tone (drop from the top to and remain at the bottom).

While in the game, the game recognises the pitch contours and moves the character in the game accordingly. For the four tones, when the game character is idle on the ground, the game expressions are 1) the first tone (code 33333), the game character jumps up instantly to level three and begins walking straight on that level (normally there will be a support unit to sustain the walking on at level three), 2) the second tone (code 12333), the game character jumps upward to level three and walks straight on that level, 3) the third tone (code 21123), the game character drops from the level two to the bottom and jumps back to level three going forward, and 4) the fourth tone (code 32111), the game character jumps down from level three and keeps walking forward on the ground level.

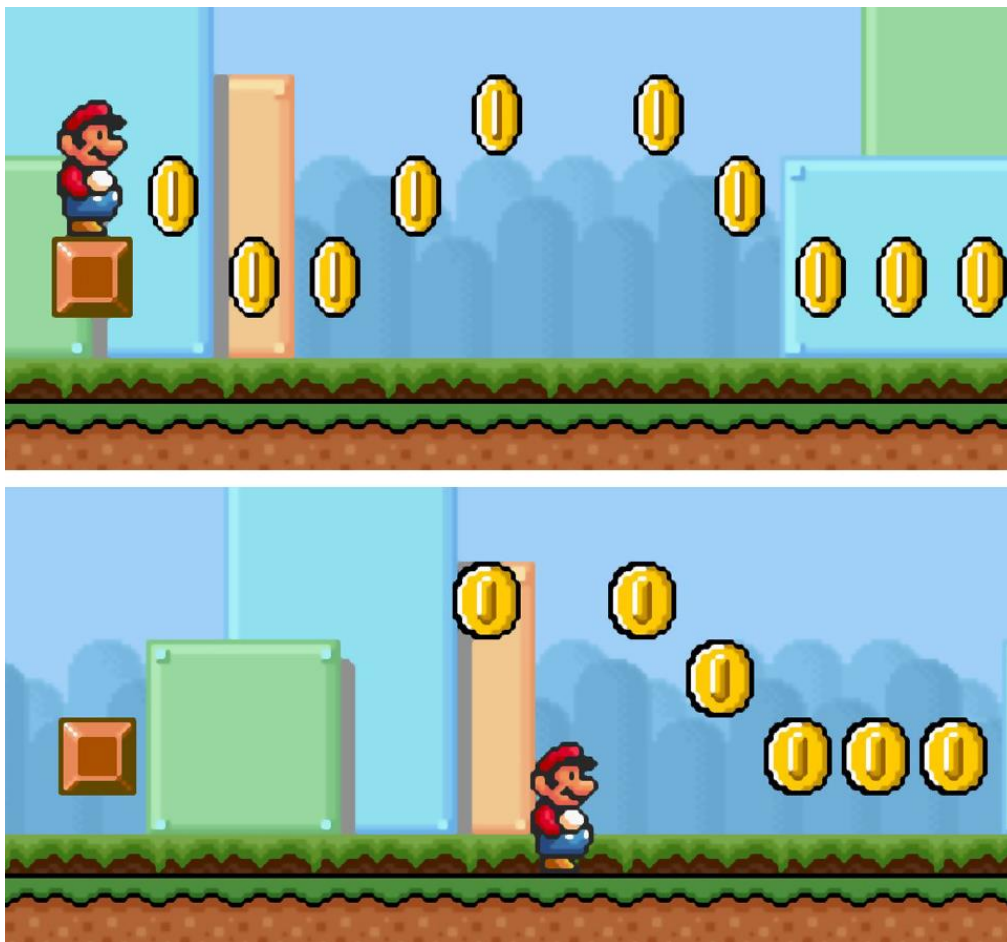


Figure 7 Screenshot of *ViewTones* (third tone practice)

In the game, standard tone pronunciations are expressed as the pattern of the shining and spinning gold coins. The aim is to collect all the gold coins, as it means the pronunciation of the player is almost identical to the standard pronunciation. However, the most meaningful and beneficial part of this tool is to provide instant feedback to the student players. See Figure 7 above, the top part is a player trying to produce a third tone, and the bottom part is the result. The third tone code is 21123, and the result shows that the last gold coin did not get collected, which means the last bit of the pronunciation (the '3') is missed.

Looking at the figure above, there could be at least three reasons, (i) the player did not make the pronunciation long enough, (ii) the last bit of the pronunciation was too low or (iii) the last bit of the pronunciation was too high. While for that particular player, he or she would know what the issue was instantly after the completion of the production, and that is the valuable instant visual feedback this tool aims to provide. If this is a practice, the player could go back whenever and whatever many times to keep practising until they get to the standard pronunciation, and the feedback is always provided on the spot instantly. If this is used as a testing tool, for example, a map with twenty words with a hundred coins (five coins for each word), then as the final coins are calculated automatically, the teacher could consider this as a pronunciation test with a score of a hundred and self-calculated.

The difficulty of the game (also the learning tasks) could also be scaffolded. In the beginning, when the focus was still on building up the language confidence, easier tasks could be designed, for example, a map with more replay chances and filled mainly with coins but no or very few monsters. While towards a later stage of learning, there could be more restricting elements such as blocks and monsters to help scrutinize the pronunciation and add extra challenges to the game.

As shown in Figure 8 below, both screenshots are a practice of two first tones (code 33333). While the one on the left was designed to be easier, no monsters appear on the map, only gold coins with bricks assisting the production of the correct pronunciation. While the one on the right has more restrictions that require a more rigid pattern of movement, hence stricter requirements on pronunciation. For example, the initial pitch contour of the word needs to be high enough for the game character to get on the brick

instead of walking straight on the ground being blocked by the brick, or an insufficient high pitch makes the character jump and faces the mushroom monster, or to be too high to hit the flying turtle monsters as shown in the figure. In comparison, the design on the left appears to be more suitable for initial learning, while the design on the right could be used more for practising the pronunciation at a later stage of acquiring this particular set of pronunciation.

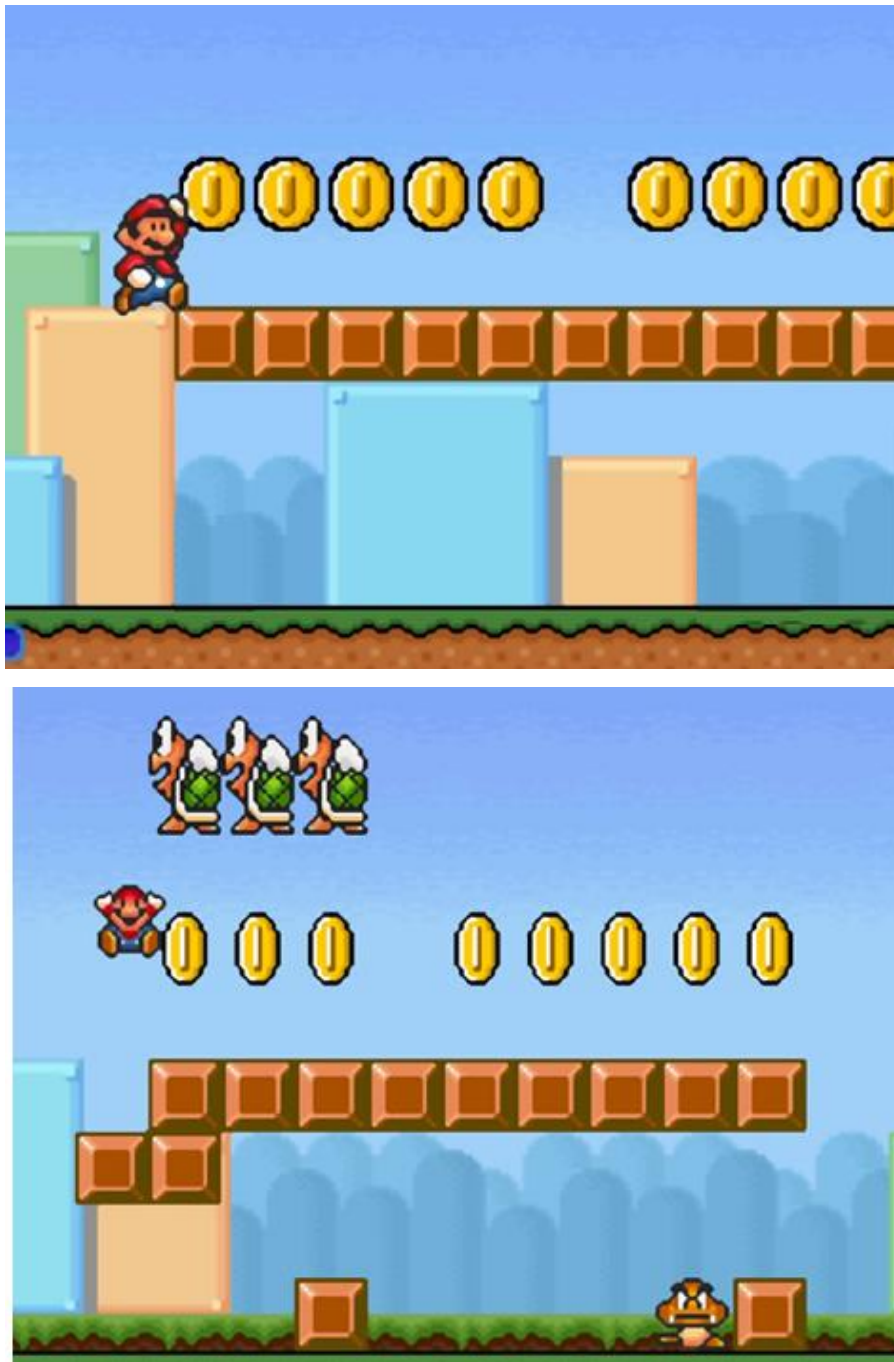


Figure 8 Screenshot of *ViewTones* (difficulty)

3.5.1.2 Development of ViewTones

The initiative of *ViewTones* was inspired by a voice-controlled game called *Don't Stop Eighth Note* (see Figure 9), in which one can speak or sing to keep the game character – the eighth note of music to walk and using high-pitched voices (e.g., shout or scream) to make the character jump.

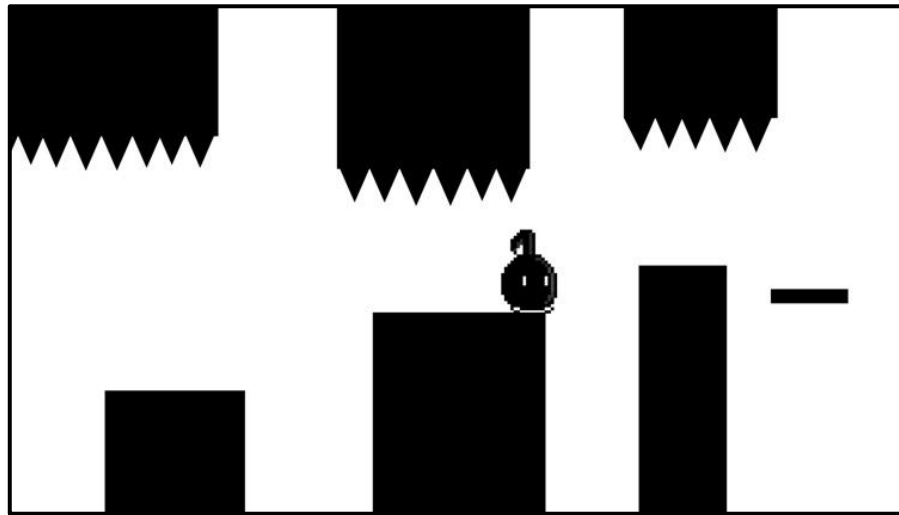


Figure 9 Screen Shot of Don't Stop Eighth Note

After reviewing the base of *Don't Stop Eighth Note*, the research considered that it has a good potential to be further developed into an educational game. It almost has no learning curve to get going, so in an educational setting the players, who are also students, could focus on the language learning tasks as easily and as soon as possible, either consciously or even subconsciously. In the meantime, this game gets extremely challenging moving to the late stage of the game, so the design also has the potential for scaffolding and build-in challenges. The interface though could be further polished to make it more attractive for young learners in the context of the current research.

In terms of the interface, the *Don't Stop Eighth Note* reminds the researcher of the classic game *Super Mario Jump*, as though the latter one was not a voice control game, it is probably the most famous platform jump game in the world. A similar interface with *Super Mario Jump* will be attractive and also further imply the game genre partially (platform jump), so the early stage experience of the player could be more streamlined towards learning. After that, the design idea became rather clear, which was to create a

game with a *Super Mario Jump* alike user interface and a *Don't Stop Eighth Note* backstage to assist the learning and acquisition of Mandarin tones (see Figure 10).



Figure 10 Screen Shot of *Super Mario Jump*

To kick things off, with the help of the supervisor, the researcher got in touch with some fellow PhD researchers in computer science and exchanged ideas about the research project. The computer science researchers were to help work on the front end, while the researcher of the present study would source suitable Chinese ASR and AI to be used backstage. Both teams met to discuss how to bridge the front end and the backstage along with a few practical issues (see Section 3.3.3).

The first challenge was that, after consulting with almost all the personnel and companies with products about Mandarin Chinese AI and ASR on the market, there was not a single suitable product for the present research at the time of the investigation. The dilemma was that the accuracy of some personal or small-scale open-source products was not enough to detect speech errors while the industry-level products were designed to be robust enough to always acquire the meaning or intention of the speech even with a great number of speech errors. In other words, they were either too ‘dumb’ or too ‘smart’.

For example, there was an open-source product called the Auto Speech Recognition Tool (ASRT) developed by a Chinese tech and AI expert called AILemon (AILemon, 2021). The ASRT has a decent accuracy to recognise Chinese speech made by native speakers, as the core speech databases were the THCHS30 (Wang & Zhang, 2015) and AISHELL-

1 (Bu et al., 2017). The first one was an open Chinese speech database published by Tsinghua University, and the latter one was by far likely the largest corpus for Mandarin speech corpus published by the Beijing Shell Shell Technology Company. However, this means the ASRT would not be able to cope with the speech data of non-native speakers, especially beginner learners, and therefore not suitable for the research.

Then for the large-scale industry-level products, such as the *Baidu AI* (Baidu, 2021) and *iFlyTek AI* (iFlyTek, 2021), the ASR is too robust to ignore most speech errors as they were designed to be industry level fully functional Chinese AI. AI products mentioned above may have such a level of accuracy but that would be in their developing stage and such information will not be open source. Even if they would be, the amount of work to adapt such information and implement them into both iCALL tools would be significantly beyond the scope and workload of the present research project. The fundamental issue is that no products were and currently are working towards the needs and context of assisting TCFL. There is a need to establish more CFL speech databases and tailored ASR products for TCFL. However, though such a need is with the goodwill of the educators, it might not be significant enough for technology or education companies to consider developing a product or service for it before any significant interest arises from the market.

Not even before the first challenge was addressed, the second issue came as well. The COVID pandemic hit before the actual designing stage of the prototype could begin. This has changed the overall research context drastically. My fellow researchers in computer science all struggled to proceed with their research projects for many issues caused by COVID, not to mention the capacity to take on the current project as their external work. The researcher consulted with a few programmers and idle small-scale game creation studios in Ireland and China and the conclusions were (i) the cost would be unbearable on a personal level, (ii) regardless of the cost, due to the absence of a suitable Chinese ASR, the conceptualised design could not be achieved. Changes and adaptations were necessary at that stage.

The researcher consulted with the supervisor and had a few rounds of brainstorming and discussion with a fellow researcher and decided to change the approach of the design for both iCALL tools. As there was no suitable Chinese ASR and Chinese AI on the market

and in the field, it was decided that all these functions would be fulfilled by using a fellow researcher, a human being. The approach at this stage is to (i) create a jumping game as the front end of the game using one of the *Super Mario* fan game engines, as they are free and do not require much coding knowledge, (ii) use a fellow researcher to simulate the ASR and AI backstage, (iii) combine the front end and the backstage to create the experience similar to the original design of the tools for the users. This new approach was agreed upon by the supervisor and supported by a fellow researcher.

As a result, an open-source Mario game engine called *Mario Editor* was identified and used to create the front end of *ViewTones* as shown in Section 3.5.1.1. One detail that should be mentioned is that the game was initially designed to provide indications and support for producing tones (see Figure 11 below in comparison with Figure 5 in Section 3.5.1.1). In Figure 11 below, there were two types of indicators implemented in the game originally. One type was the pinyin for the word being pronounced on top of the gold coins (marked by the pink square in the upper screenshot) and the other type was the arrows as the tone indicator (marked by the pink squares in the lower screenshot). When trialling the prototype with students, both forms of indicators were found to be redundant. It was more straightforward for students to just focus on the gold coins as the main and only indicator for the patterns of tones. Therefore, they were eventually all removed from the *ViewTones*.

For the ease of data collection, student participants used the researcher's laptop to play the *Viewtones*. The researcher would have an online meeting with the assistant in place already at that moment. The assistant would open the game from that side on full screen and share the screen with the researcher's laptop. Then the researcher would also make the shared screen of the game full screen, and then ask students to play the game one by one. The whole process looked as if students were playing with their own voice control, while in reality, it was the assistant manually moving the game character around based on the pronunciation of the students.

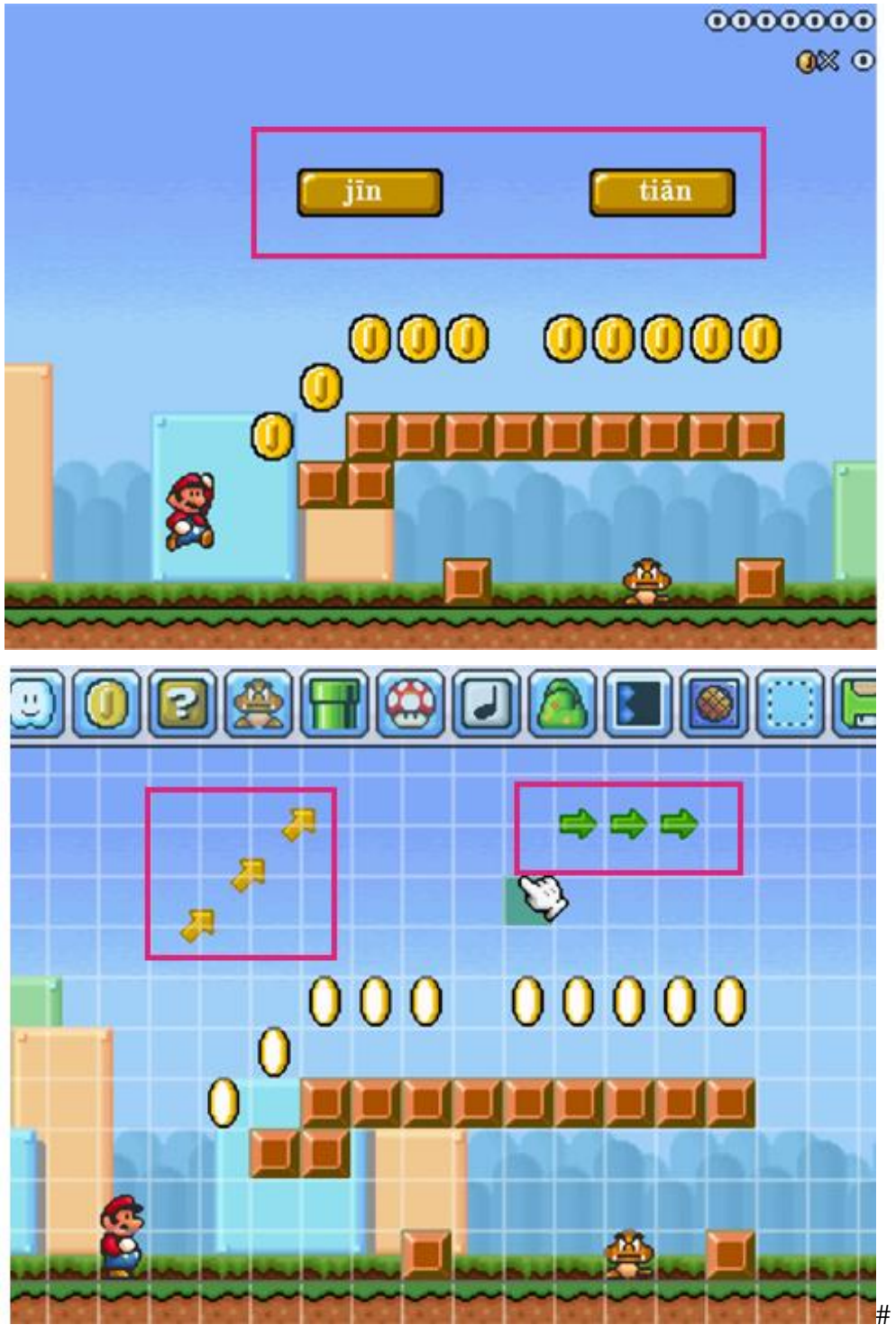


Figure 11 Screen Shot of *ViewTones* (tone indicators)

3.5.2 The second iCALL tool - Trip2China

3.5.2.1 Overview of Trip2China

The second tool is named *Trip2China*, which is a Chinese Spoken Dialogue System (SDS) implemented in a Virtual World (VW). *Trip2China* is mainly to provide a virtual language partner powered by AI for participants to practice their spoken Chinese in a virtual world. In the context of the present research (see more detail in Section 3.6.2.1), the scenario for *Trip2China* is that the user, an Irish student, has just arrived in Beijing, the capital city of China, and is going to stay for a month as a short-term exchange student.



Figure 12 Screen Shot of *Trip2China* (first scenario)

See Figure 12 above, this is the user interface of *Trip2China*. The virtual avatar is the representation of the AI, in this context as a female teacher. Some instructions and tasks would appear on the screen to guide the conversation between the student and the AI. And the background provides a better immersion experience for oral practice.

In this VW, students could engage with multiple characters and have conversations on different topics. Among them, students engage with one main AI character called ‘Mei’. Her role in this VW is as a Chinese post-primary student in the school of exchange. See Figure 13 below, Mei is one of the virtual classmates the user came across since the

beginning of the VW journey. In the top screenshot, she says ‘Hello! My name is Mei. Are you Irish?’ In the bottom screenshot, the user was instructed to practice asking for time and greet people properly according to the time of the day with Mei.

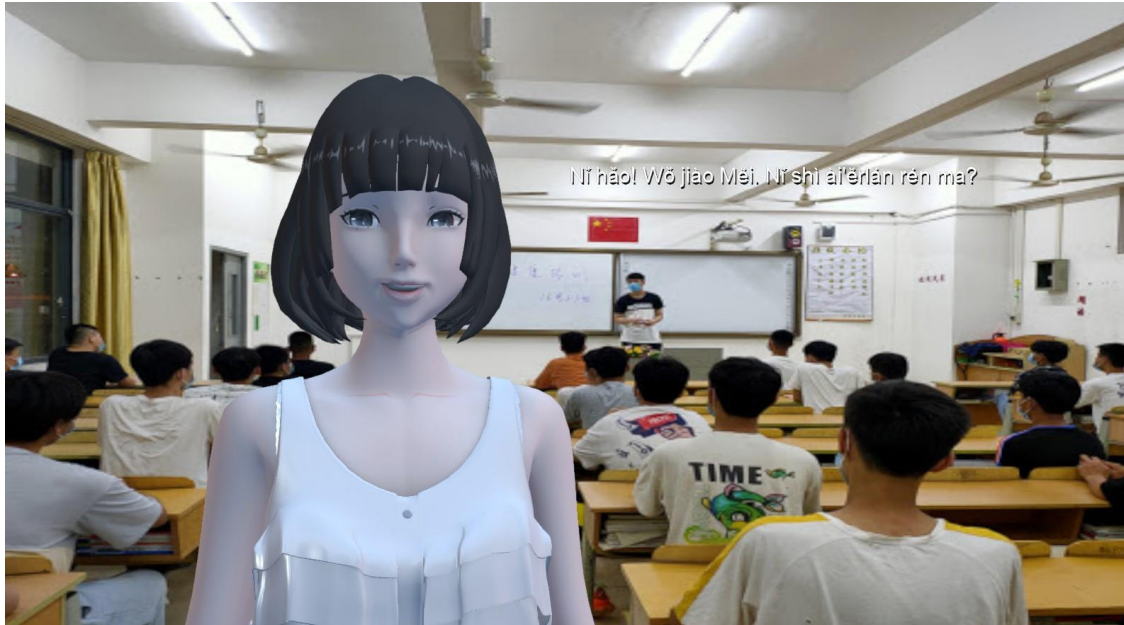


Figure 13 Screen Shot of *Trip2China* (Mei)

3.5.2.2 Development of Trip2China

The initiative of *Trip2China* was inspired by the text and image-based role-playing games called *Second Life* (see Figure 14) and the AI-powered chatbots called *PandoraBots* (see Figure 15).



Figure 14 Screen Shot of *Second Life*

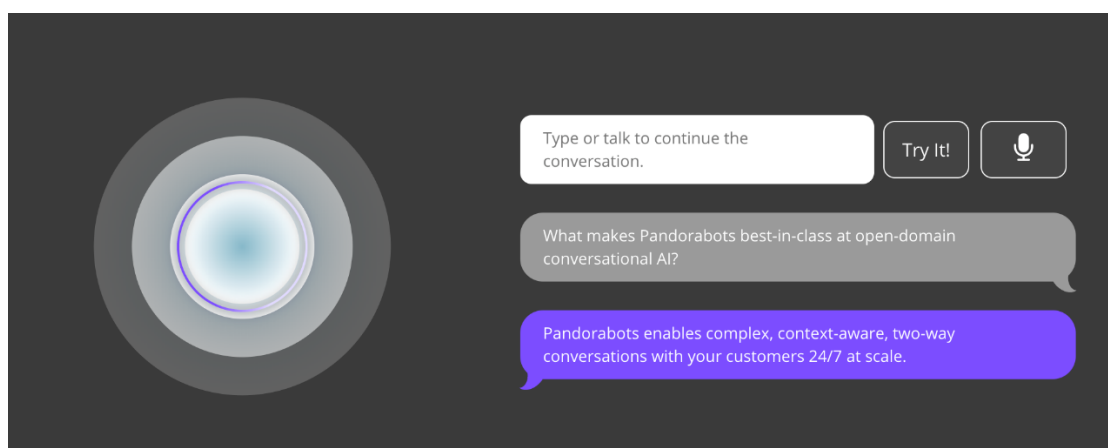


Figure 15 Screen Shot of *PandoraBots* platform

The initial idea was to create a VW platform similar to or even using the *Second Life* and in the combination of a backstage like *PandoraBots*, allowing students to practice speaking Chinese in the VW. However, due to the same challenges mentioned previously

(see Section 3.5.1.2), AI needs to be simulated by a human being. In the context of developing *Trip2China*, the researcher herself was built in as a simulated AI.

After deciding on the design, the first step is to design the speech content for VW. As the researcher was teaching the students who were also the participants to use and evaluate the iCALL tools (see more details in Section 3.6.2.1), the content of *Trip2China* was designed along with the students' course materials. On top of the content, a logic scheme is required for the researcher to simulate the AI, which is summarised below.

- If no errors in the user's speech, proceed with the conversation.
- If errors occur in the user's speech, then when the same error occurs for
 - 1) the first time, the AI responds with 'I am sorry, I don't understand' in Mandarin
 - 2) the second time consecutively, the AI responds with the identified location of the error, such as 'I am sorry, the second word in your speech is incorrect' in English
 - 3) the third time consecutively, the AI responds 'please check the screen before moving on further' with pop up text bubble stating the error in English

Then for the technology side, the *FaceRig* was identified as the tool to create the VW. *FaceRig* is a programme to digitally embody media captured or streamed by a webcam with virtual 2D and 3D characters. It uses a facial tracking system to capture the facial expressions and mouth movements of the user and simultaneously reflects them on the virtual characters (see Figure 16 below). It also allows the change of custom backgrounds, on-screen texts and images and some other functions that would help to create a simulated VW.

To play different characters (AIs) in the VW, the voices need to be edited as well. The software used to realise this is called Screaming Bee - MorphVOX Pro 5 Voice Changer (see Figure 17 below). The researcher could use it to simulate the voices of human beings of different genders and ages, and sometimes even voices with special sound effects such as animal voices (see Figure 18 below).



Figure 16 The backstage of *FaceRig*



Figure 17 The Voice Changer

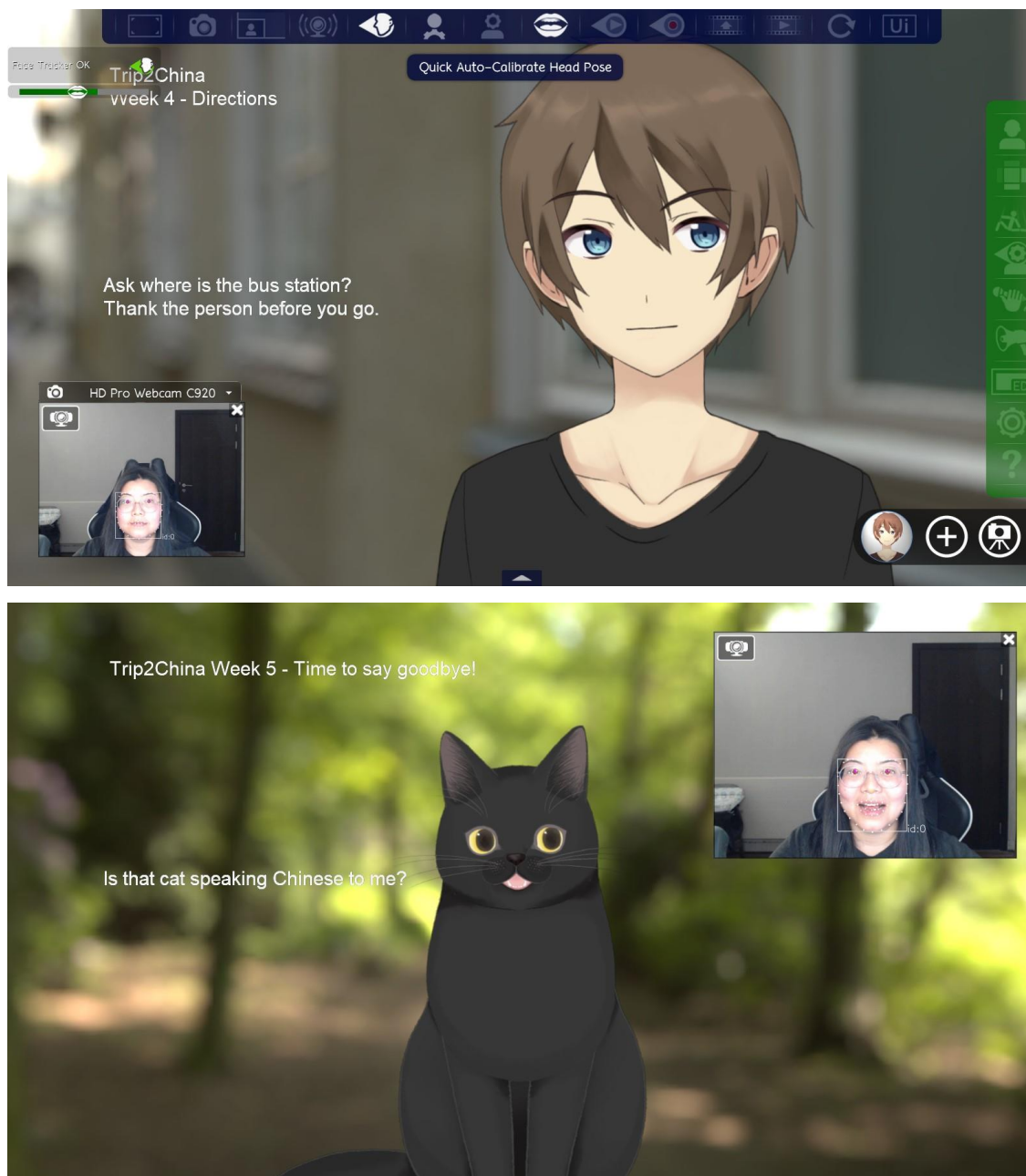


Figure 18 Sample characters in *Trip2China* using *Voice Changer*

In practice, the student participants were explained that *Trip2China* is a VW hosted on the researcher's computer and they could talk to the AI in the VW to practice speaking Chinese outside of the class. Then when the researcher assigns tasks for the participants to fulfil in the VW, students will be given a schedule and arranged to have a video call with the researcher. Then the researcher shares her screen using the *FaceRig* and the voice changer and begins to play all the AI in the VW. Similar to the *ViewTones*, students

have never been explained the nature of the VW and the AI to acquire meaningful data on the research topic.

3.5.3 The implementation of the Wizard of Oz method

In light of several challenges, which included a limited budget for the research project, access to suitable technology meeting the research requirements, and communication difficulties exacerbated by the COVID-19 pandemic, the present research project opted to employ the Wizard of Oz method. This method allowed for the simulation of AI behaviour behind the scenes, aiming to recreate the intended learning experience as closely as possible for the participants.

To implement the method, an assistant was recruited to oversee both iCALL tools. The assistant is a native Mandarin speaker and a highly experienced Mandarin Chinese teacher, boasting over a decade of Mandarin teaching experience in Ireland. The assistant's capacity to engage in conversations with clear Mandarin pronunciation and a strong grasp of the language was essential to align with students' proficiency levels. The assistant had been following the research project from its early stages out of personal interest and remained well-informed by the researcher. When the Wizard of Oz method was deemed necessary for the research, the assistant was engaged in tool design and data collection procedures to a certain degree.

The assistant gained access to the experimental materials as soon as they were finalised. Pilots of the Wizard of Oz method were conducted with the researcher (in the role of the learner) and the assistant (simulating AI) to fine-tune the data collection process. After each pilot, the assistant's commands of the tools were scrutinised to ensure that the control over the game character in *ViewTones* could reflect the participants' performance to the best extent and that the language and interactions with *Trip2China's* target participants remained as consistent as possible.

On the day of data collection, the researcher attended the school alone, with the assistant operating remotely, typically at home. Several factors and limitations influenced this arrangement. Firstly, child protection requirements dictated that the assistant, unlike the researcher, was not Garda Vetted at the time of the research, making it inappropriate for

the person to operate within a school environment. Secondly, concerns regarding the operating space necessitated the assistant's absence from the classroom to prevent students from discovering the Wizard of Oz method. Therefore, an additional classroom or staff room had to be reserved for the experiment. This, however, posed practical challenges, especially in the context of school life, which is often constrained by limited space, further exacerbated by the ongoing impact of the COVID-19 pandemic. The third rationale was the potential for noise in schools, which could impede the assistant's ability to accurately assess student participants' performance. In contrast, a private location provided the assistant with better access to audio equipment and greater focus for simulating an AI's responses.

Shortly before the experiment, the researcher engaged in an online video call with the assistant, sharing the laptop screen with the assistant, and subsequently minimising the video call window to operate from the background. The assistant's microphone was muted and the video turned off, but the assistant retained access to the researcher's laptop screen and its audio input. Prior to the experiment, the researcher informed student participants that the laptop might operate slowly due to its age, citing the significant backstage data processing to cover for the Wizard of Oz method.

During the experiment, students took turns engaging with the researcher's laptop individually. The researcher closely monitored the process, ensuring that the interface of the tools remained maximised and that students remained unaware of the Wizard of Oz method. In the background, the assistant adjusted actions based on the student participants' performance. For *ViewTones*, this primarily involved controlling the game character's movements based on the student's pronunciation, particularly the production of tones. For *Trip2China*, the assistant's main task was to engage student participants in semi-scripted conversations while maintaining the range and level of language in responses to be in line with students' level and the experiment's provided materials.

Following the data collection, the researcher usually would briefly explain the use and purposes of the Wizard of Oz method to the student participants, who typically displayed a high degree of understanding.

3.6 Phase three: Evaluate the iCALL tools

After the completion of the two iCALL prototypes, the next stage is to arrange for teachers and students to use and implement both tools in their teaching and learning. The evaluation of the iCALL tools was the third and last phase of the research project. This section presents the design of teacher evaluation and student evaluation respectively.

3.6.1 Teacher evaluation

This section reports the design of the research instrument, participants identification, administration of data collection and methods for data analysis when conducting the teacher evaluation of the two iCALL tools from a teaching perspective.

3.6.1.1 Semi-structured interview design

The rationale and approach in designing the semi-structured interview questions are the same as presented in the previous sections when outlining the design of interviews for the teacher needs analysis (see Section 3.3.1 for rationales and Section 3.4.1.1 for designing approach). Therefore, this section focuses on presenting the interview questions used for the teacher evaluation (see Appendix E).

The interview consists of two parts. The first part is to collect some background information about the participants, such as their teaching experience, Chinese proficiency, type of Chinese courses and the target students as well as their experiences of engaging with any digital tools in TCFL. The second part is to collect data about the evaluation of both iCALL tools in line with the research questions (see Section 3.2). Q1 asks about existing challenges in teaching spoken Chinese and Q2 asks whether the implementation of the two tools could help address the challenges mentioned or assist any other areas of teaching. Following the same pattern, Q3 and Q4 ask about assessment while Q5 and Q6 ask about the learning experience of students. Q7 asks about any challenges not being mentioned so far and suggestions for improvement of the tools, and the final Q8 inquire whether the participant would be interested in continuing using the tools in the future.

3.6.1.2 Teacher participants' identification

The identification of the participants used the same purposive sampling technique. To achieve good coverage and representation of different types of CFL teachers in schools, six teachers were recruited for the interviews. Among them, three are native Chinese and three are native Irish; three are female and three are male; three are newly qualified teachers with at most two years of TCFL experience in Irish schools, and three are relatively experienced teachers with at least four years of TCFL experience in schools. More detailed demographic information is presented when reporting on the results of the evaluations in Section 5.3.1.

3.6.1.3 Interview administration

Before the interviews, all participants were sent the consent form (see Appendix A) and were given the chance to experience using both tools. Four teachers managed to trial the tools with the assistance of the researcher in their Chinese class for one to two classes, while two teachers only managed to watch a demonstration of the tools by the researcher. There were two main reasons for not being able to experience the tools firsthand. For the first teacher, there was a severe COVID condition for the period of this part of the investigation. The teacher needed to move all teaching and management online, so could not implement the tools in teaching. For the second teacher, the two iCALL tools were still prototypes and failed to meet the schools' General Data Protection Regulation (GDPR) requirements to be granted permission for classroom usage.

After each participant had a chance to experience the tools, an interview was scheduled online, as at the time it was extremely difficult to arrange in-person meetings due to the COVID situation. All six interviews were conducted between July and September 2021. Interviews were carried out in English and audio recorded for transcription (see Appendix G).

3.6.1.4 Methods for data analysis

The method used for analysing the qualitative data in the format of interview transcriptions was the same content analysis explained earlier (Section 3.4.1.4).

3.6.2 Student evaluation

This section reports the design of the research instrument, participants identification, administration of data collection and methods for data analysis when conducting the student evaluation of the two iCALL tools from a learning perspective.

3.6.2.1 Experiment and questionnaire design

A controlled experiment and a quantitative questionnaire were selected as the research instruments to evaluate the iCALL tools. The table below briefly outlines the design of the student evaluation (see Table 8).

Table 8 Student evaluation of the iCALL tools

Approach adopted	Research instrument	Aims	Experiment group	Control group A	Control group B
Empirical experiment	Error analysis	Comparing phonological performances, empirical data	Yes	Yes	Yes
Controlled experiment	Quantitative questionnaire	Comparing learning progress, descriptive and inferential data	Yes	Yes	Yes
Empirical evaluation	Quantitative questionnaire	Evaluation of the iCALL tools, descriptive & inferential data	Yes	No	No

The first part of the evaluation is a controlled experiment that aims to use empirical, descriptive and inferential data generated by students to examine the effect of the two iCALL tools. This controlled experiment was designed to be administered for five weeks. Student participants were put into three groups based on the different treatments of spoken Chinese acquisition approaches that were applied.

The first group is the experimental group, in which the two iCALL tools were used in their learning of spoken Chinese both in and out of the classes. They were instructed to use the *ViewTones* to practice the Mandarin tones and use *Trip2China* to practice oral

after class. The other two groups are all control groups. For the control groups, there was no implementation of the iCALL tools, so the teaching and learning of spoken Chinese followed conventional methods. The only difference between the two control groups is that students in one control group (Group A) only received visual feedback about their oral performance while the other group (Group B) only received conventional written feedback. The visual feedback received by Group A largely consisted of graphics of students' pronunciations generated by Praat against the standard pronunciations, with occasional markings made by teachers to highlight some more subtle differences that could be more difficult for students to identify. The written feedback received by Group B was a text version of the description of the differences between students' pronunciation against the standard ones.

For all three groups, a pre-test and a post-test were administered to collect students' phonological performance using error analysis and their perception of the learning outcome and achievements using a quantitative questionnaire. For the phonological performance, all three groups of students were arranged to record their pronunciation of the four Mandarin tones in disyllable words first at the very beginning of the first week of the experiment and then at the end of the experiment in week five. The words used for this process are the same for the pre-test and post-test as shown below (see Table 8).

Table 9 Syllables used for the controlled experiment

	Word 1		Word 2		Word 3		Word 4	
Charater	今	天	明	天	你	好	再	见
Syllable	jīn	tiān	míng	tiān	nǐ	hǎo	zài	jiàn
Tones	1	1	2	1	2	3	4	4

The first syllable in the third word should be pronounced in the second tone by the linguistic standard due to the dissimilation in speech (when two third-tone connect, the first one changes into the second tone).

The pre-test and post-test questionnaires used in the controlled experiment are identical. They contain two parts (see Appendix H). The first part of the questionnaire gathers

students' background information, such as their year group, the number of foreign languages and Asian languages studied or have been studying, length and frequency of study, and frequency of playing video games. The second part consists of five questions to investigate their self-evaluation of perception and production of Chinese tones, their confidence and anxiety in speaking Chinese, and their motivation in learning spoken Chinese. As part of the controlled experiment, this questionnaire is filled in by students at the beginning and the end of the experiment session.

Among the three groups of participants, the experimental group is the one with good exposure to the two iCALL tools. Therefore, other than the controlled experiment (see Section 3.6.2.3), they were also given two evaluation questionnaires for the two iCALL tools at the end of the research (see Appendix I). For this group of participants, the evaluation questionnaires were merged with their post-test questionnaire, so their demographic information doesn't need to be filled in and collected repeatedly. In that sense, the contents of the two evaluation questionnaires are both twelve five-point Likert scale questions and one open question for comments. The questions for the two tools are slightly different, but they mainly inquire about participants' opinions about the user experience (e.g., overall enjoyment, instruction and interface clarity, technical difficulty) and the effects or benefits of the tool being evaluated from different perspectives (e.g., tone perception and production, perception of spoken error, learning outcome and progress assessment, increasing confidence and motivation, as well as reducing anxiety).

3.6.2.2 Student participants' identification

As discussed in Section 3.3.2, based on ethical considerations, this part of the research targeted students who were Transition Year students studying Chinese in preparation for commencing the Leaving Certificate Mandarin Chinese curriculum study in the following year. This approach helped to (i) ensure a baseline of motivation, as the students were treating the language study more seriously instead of it being just a taster with no further commitment, (ii) ensure a baseline of anxiety levels since the students were still in a preparation stage for a 'higher' level of the curriculum rather than directly in the Leaving Certificate curriculum study, (iii) be ethical and reduce potential disturbance to students' actual learning for the curriculum Chinese.

With these considerations in mind, the researcher recruited her own Chinese class as the experimental group and approached another two CFL teaching colleagues to recruit their students as the two control groups. At the time of data collection, the researcher herself and the other two teachers were all employed by Post-Primary Languages Ireland to support the implementation of Leaving Certificate Mandarin Chinese. Including the researcher herself, the three teachers had all received the same teacher professional training in Ireland and were theoretically qualified to teach Chinese up to the Leaving Certificate level. This approach helped reduce the likelihood of teachers being influential factors in the research. The two teachers were recruited as gatekeepers, and their students were the participants in this part of the research project.

3.6.2.3 Experiment and questionnaire administration

The experiment was conducted for five weeks from 5th October 2020 to 15th November 2020. Before the commencement of the experiment, the two gatekeepers were approached. The researcher explained and made sure all gatekeepers understood the purposes and design of the research. Then, the researcher assigned the grouping, with her Transition Year group as the experimental group and students of the other two gatekeepers as the two control groups. Then the consent forms for parents were disseminated and collected back from the parents. The consent form used in this part of the research is the same one used for the first phase of the research (see Appendix C).

Since the beginning of the five weeks, three teachers (including the researcher) met regularly to make sure the content, pace and format of the teaching were consistent between each other and across the five weeks. The same content and practices were used for teaching and practising Mandarin tones during the class for all three groups and classes were all synchronised.

Regarding the feedback, the three teachers met twice a week to ensure the content of the feedback for the experimental group (instant multimedia feedback), control group A (asynchronous visual feedback) and control group B (conventional written feedback) were the same. To reduce the control group A teacher's workload and lift the technical burden, the researcher will process the students' audio recordings using *Praat*, transform them into visual feedback and return them to the teacher ready to be shared with students.

In terms of the implementation of the different methods of feedback, each group had a dedicated part in the class for the reflection of the feedback and the correction of pronunciation. In the experimental group, this is integrated into the use of the tools and feedback can be given and taken simultaneously, while the teacher can monitor the process and provide additional oral feedback whenever necessary. For control group A and control group B, as the feedback was asynchronous, a set period of time was given during the class to examine and help students improve their pronunciation based on the feedback received after the previous class. The length of these periods was similar to approximately 15 minutes in all three classes. To avoid the disturbance of content teaching and communication, and to build up students' learning confidence, correction of pronunciation was minimised in the rest part of the classes for all three groups.

At the end of the first week and fifth week, three groups of students took a performance test for spoken Chinese and a questionnaire for self-reflection. For the experimental group, the student evaluation of the iCALL tools was also carried out in the last week of the experiment. At the time of the research, because of the COVID impact, all the above-mentioned data collection was made through an online platform called Survey Monkey.

3.6.2.4 Methods for data analysis

There were three types of data generated in this phase of the research, which all require different methods for data analysis.

For the speech data acquired from the three groups of participants, *Praat* was the software for data collection and analysis. After the data collection and preparation for *Praat*, they were entered into the software and the pitch contours were first compared with the standard pronunciation, and the errors in spoken Chinese were calculated, categorised and compared between groups.

For the data collected from the two questionnaires, the IBM Statistical Package for the Social Science (SPSS) Version 27 was the software used for statistical analysis. After data was collected from Survey Monkey, they were prepared and entered into the SPSS

for further analysis. Depending on the different aims of the questions, the most commonly used statistical calculations were (i) descriptive data, (ii) t-test for relationships between two groups and (iii) analysis of variance (ANOVA) test for relationships between multiple groups (e.g., the impact of language competence). When assumptions were violated, corrections and nonparametric replacements were consulted, in the context of the present research, it normally referred to the use of (i) the Wilcoxon signed-rank test to replace the paired samples t-tests and (ii) the Kruskal-Wallis test to replace the one-way ANOVA.

3.7 Summary

This chapter introduced the design of the present research project. It started by presenting the research questions and associated hypotheses. Considerations from the disciplinary, ethical and practical perspectives were discussed before outlining the research design overview. Following that, the three phases of the design of the research were briefly presented.

Phase one is a needs analysis to investigate the needs of teachers and learners in the teaching and learning of spoken Chinese in the context of Irish post-primary education. Phase two is the development of the two iCALL tools and phase three is the evaluation of the two tools from the perspectives of both teacher and learner. For phase one and phase three, the designs were introduced in the format of (i) research instrument design, (ii) participant identification, (iii) research administration and (iv) methods for data analysis. For phase two, both iCALL tools were introduced along with their developing process.

With the literature reviewed and the research design presented, the next two chapters are dedicated to reporting the results of phase one (see Chapter 4) and phase three (see Chapter 5) of the research projects.

Chapter 4 Result of the needs analysis

4.1 Overview

TCFL faces several complexities in the context of Irish post-primary education. According to Zhang & Wang (2018), the first major obstacle is the shortage of suitably qualified teachers demanded by the groundwork of teaching and learning. The second major obstacle is the insufficient opportunity to use the Chinese language both in and outside of the classroom. It is within this context that the research conducted a needs analysis to identify the challenges in teaching and learning spoken Chinese and develop appropriate ad hoc iCALL solutions to address these issues.

This chapter presents the results of the needs analysis as the first phase of the research, considering the perspectives of both teachers and learners. Section 4.2.1 begins by introducing the demographic information of the teacher participants. Section 4.2.2 presents the findings regarding the challenges identified by the teachers in teaching and learning spoken Chinese. Section 4.2.3 discusses the current implementation of ICT in the context of TCFL. Section 4.2.4 reports on the attitudes of the teacher participants towards using iCALL to assist TCFL.

From the student perspective, Section 4.3.1 provides background information on the student participants. Section 4.3.2 presents the findings regarding the current level of awareness among students about the challenges in learning spoken Chinese. Section 4.3.3 reports on the findings of the error analysis and the identified challenges for beginner students in acquiring Mandarin tones.

4.2 Results of Teacher Needs analysis

The needs analysis for teachers adopted the semi-structured qualitative interview as the research instrument. The interviews centred around three key topics about

- (i) The main challenges in teaching and learning spoken Chinese (Section 4.2.2)
- (ii) The extent to which TCFL technology is incorporated in post-primary schools (Section 4.2.3)

(iii)The willingness of teachers to use digital and iCALL tools in their classrooms (Section 4.2.4).

The report of findings also follows the same sequences. Section 4.2.1 introduces the demographic information of the interview participants. Section 4.2.2 presents the challenges identified by teachers. Section 4.2.3 reports on the status of ICT implementation. Section 4.2.4 reports on the attitude of teachers towards iCALL.

4.2.1 Participants

A total of twelve post-primary CFL teachers were recruited for interviews. Among the twelve teachers, eight teachers were native Chinese speakers and four were non-native speakers. Half of the teachers had a teaching experience of over three years and the rest were newly qualified teachers with various teaching experiences. The backgrounds of these teacher participants and their students are summarised in Table 10 below.

Table 10 Demographic information of the teacher interviewees (needs analysis)

No. of teachers	More than 3 years of TCFL	Teacher background	Learner background	Learner level and goal
4	2	Irish and teaching Irish students in secondary schools	Irish 2 nd level transition year students	Very basic, taster course
4	3	Chinese and teaching Irish students in secondary schools	Irish 2 nd level students in a school that has introduced Chinese (including both transition year and junior cycle Chinese courses)	CEFR A2 in both spoken and written proficiency
4	1	Chinese and teaching Chinese students in Chinese community schools c. two hours per week	Irish students of Chinese parents who speak various Chinese dialects but not the Mandarin	Fluent in dialect or variation of Chinese but wish to acquire standard Mandarin pronunciation

In terms of the four Irish Chinese teachers, they were all Teaching Council registered qualified post-primary teachers teaching in Irish schools. Two of them had less than two years of teaching experience. All of them were quite familiar with the Irish school system through their teaching and learning experiences. They are all working full-time in schools and have rich experience in teaching some curriculum subjects other than Chinese. These Irish teachers studied Chinese through various language and training programmes in Irish higher education which range from one to two years. Two of them gained a Chinese proficiency equivalent to CEFR B1 and the other two were at the level of circa CEFR A2. All of them were teaching the taster TY Chinese module to ab initio learners with about 10% components in language and 90% in cultural studies.

In terms of the four Chinese teachers teaching in Irish schools, they were not registered with the Irish Teaching Council while they were deemed to be qualified TCFL teachers by their hosting unit or institutions. They were all peripatetic teachers at the time of the research. During their normal teaching weeks, they need to travel from school to school to deliver Chinese classes. Most of them were not quite familiar with the Irish school system and the teaching context as they were only in Ireland for no more than three years, and they had no experience working full-time in a school. Their teacher training was mainly received outside of Ireland, therefore adaptations in pedagogy were necessary to cope with the Irish teaching and learning context. They mainly teach taster TY Chinese modules and the Junior Cycle short course Chinese with students' levels up to CEFR A2.

In terms of the four Chinese teachers working in community schools, two of them registered with the Teaching Council under further education and the other two were not registered. They were never trained systematically to be a TCFL teacher while two of them received training in teaching L1 Chinese back in China. They were more familiar with the Irish school system in comparison with the previous type of native-speaker teachers, as they have experience in observing the system from a parent's point of view. They mainly teach heritage speakers with various language backgrounds at the weekend in complementary schools, while some of them have other jobs during the week which are normally irrelevant to teaching Chinese.

At the time of the investigation, the TY Chinese module was still mainly of a taster nature with a limited language learning experience and no pathway to the Leaving Certificate

programme (not yet implemented in schools). However, the level of learners in these ‘old’ taster TY Chinese programmes is *ab initio*, which is the same as those who studied the ‘new’ TY preparing for the Leaving Certificate programme as well as students who began to learn Chinese directly in the 5th year. The challenge they face and the needs they perceive would be quite relevant if not all the same as the Leaving Cert students, therefore it is meaningful to conduct the needs analysis and evaluation based on their experience.

Twelve individual interviews were conducted. The length of each interview was typically about 15-20 minutes. To increase the feasibility of data collection, five interviews were conducted face-to-face in a place of the interviewees’ choice, while another seven interviews were conducted online using the *Google* video conference platform *Meet* or a Chinese social media and video chat platform *WeChat*. All the interviews were audio-recorded for transcription.

4.2.2 Challenges identified in teaching and learning spoken Chinese

Both Irish and Chinese teachers identified strengths and challenges they have in teaching spoken Chinese. For native Chinese teachers, the strength mentioned by the interviewees is mainly about being able to provide standard pronunciation and feedback almost instantly due to the native level of language proficiency.

CZ: I think I could always give, sort of standard pronunciation, so whatever the kids asking for demonstration, I could always give it to them. I don’t need to postpone it ... Because I see some of my colleagues, they need to go back to and find some audio online and give it to the kids, Well I could just give it spontaneously. And also, a little bit more, I guess, linguistic knowledge, because we trained to teach Chinese to the non-native speakers, so a little bit advantage. (CZ-N-M, 50)*

* See Appendix F and G for transcripts of interviews. The reference codes used to identify transcripts are written in the format of ‘initials of the interviewees – code for text (N for Needs Analysis, E for Evaluation) – code for language background of interviewees (M for Mandarin, E for English), number of lines in the transcript’.

As for the Irish teachers, they appeared to be much more confident in their teaching methods and knowledge of the students. As they were once in the shoes of their students

as a Mandarin Chinese learner and a pupil in school, they could provide more reliable and effective tips.

MC: I think I realised that I am used to getting them to interact with me in my French class, my music class, so I know I have to come up with some tasks better interactive. I think I have a good idea of their attention band when they are doing activities. The discipline is another thing, you know, there is a certain code. A conduct code, that maybe the external person doesn't know. (MC-N-E, 55)

In terms of challenges, there are three common challenges identified by most of the participants.

(i) All 12 interviewees regardless of being native or non-native speakers, cited learners' difficulty in perceiving and producing Mandarin Chinese tones as a significant challenge. For Irish CFL learners, the Chinese prosodic system is an entirely different system to be acquired.

YZ: As far as the pinyin (oral) I teach, the biggest problem is to make them understand that Chinese has different pronunciations, four tones. This content has still not been fully understood by students, even when our Pinyin (oral) class has ended. Most students still make mistakes occasionally, and some students still don't understand it at all...

HW: Can they distinguish four tones?

YZ: Not completely. The worst students cannot distinguish completely, the best students can. (YZ-N-M, 20)

(ii) Another common challenge that was mentioned frequently is the difficulty in finding suitably designed materials for teaching spoken Chinese in the context of Irish post-primary education. Interviewees mentioned that the materials available from the school, which are passed on from previous teachers or kept in the department, are often out of date so the contents are no longer suitable for the current learners.

CZ: For beginners, I guess one of the difficulties is the materials we have is still old, so sometimes it is not that easy to let the kids understand how to pronounce the words. Cause we have some of, you know, the recording of the words, the vocabulary. Occasionally we have a video demonstration on how to pronounce the word, how to put your tongue, how to shape your mouth. But sometimes that is not really helpful to kids don't understand it. (CZ-N-M, 10)

(iii) Teachers also mention consistently the insufficient opportunity for students to practise speaking Chinese outside of designated class hours. Irish CFL learners generally do not have access to Chinese speakers. Chinese speakers in Ireland typically have a high proficiency in English. Therefore, it is perceived that there is no 'need' for the Chinese to speak Mandarin to the Irish.

QW: I think it is more limited. There are more Chinese students in my place. If students play more with Chinese students outside of the classroom, of course, they will practice a little more accent (Chinese) and normal oral English. But there are also many students who are rather shy and have no Chinese friends, so they have no chance to practice spoken Chinese except in class. (QW-N-M, 50)

There were also two challenges identified to be particularly evident among the native Chinese teachers.

(i) Due to the absence of experience in learning Chinese as a foreign language, it is not easy for native teachers to stand in the shoes of the learners. Therefore, some of the interviewees mention that they find it challenging to give effective feedback and instruction to correct and guide pronunciation. When this phenomenon persists in the long run without improvement, they lose scaffolding and tend to simply repeat the standard pronunciation as a means of providing feedback.

FG: The disadvantage is that we are not as good as local teachers in understanding the difficulties of students in the learning process, because Chinese is too simple for us, and the difficulties in the text are marked out in the textbook, but for other things, we learn to ignore them. (FG-N-M, 50)

YZ: I think it is to understand where the student's problem is, and then design a solution, practice and explanation model from this perspective, maybe local teachers in Ireland are better at it. Because these problems may have occurred when they were learning Chinese, their methods may be better and more direct. (YZ-N-M, 55)

(ii) At the time of the research, most native Chinese teachers do not work in a full-time capacity in schools. They in comparison are not as familiar with the students and the school environment as the non-native school teachers, so it is more challenging for them to get connected with the students and understand their needs.

MF: The main advantage is that I know the students better. Because I work with them all the time. So I have a relationship with them. I know their strengths and weaknesses. That is a big help instead of somebody just coming in. (MF-N-E, 30)

There are also some challenges mentioned in teaching Chinese heritage learners. This cohort of students is immersed in a dialect environment at home while in public they are exposed to an English-speaking environment. Their other Chinese friends would speak either the same or a different dialect to themselves, and they tend to communicate either through dialect or through English, but not through Mandarin Chinese.

XX: In my own class, most of the people are probably from Fujian, parents are from Fujian. Their front and back nasal sounds are obviously not good. In pinyin, although they have also taken some pinyin lessons, they may have no problem speaking, but when you ask them to do the kind of questions with pinyin, or to spell something, they can't distinguish the front and back nasal sounds. (XX-N-M, 50)

Some heritage learners, learn a different variation of Chinese other than Mandarin. They have already acquired models that are in many instances close to Mandarin, but due to language transfer, they have difficulty incorporating these models in learning and using Mandarin Chinese. Since they do not have exposure to the Chinese culture outside the home, culture-embedded common expressions are also poorly grasped and as a consequence are used less and less.

YZ: Yes. There is also a very strong language transfer in English. This kind of influence, when they read the spelling, sometimes they will read the pinyin of Chinese into English, and there are many people. The worst person in the class, he has a tone*, and the other has this problem. He is still remembering according to the English pronunciation. (YZ-N-M, 30)

* This is a description of the phenomenon that speakers of English and other dialects of Chinese may use their L1 to mark the pronunciation of Mandarin in a romanised way, which can assist pronunciation at the initial stage but can be misleading and discourage accurate phonological production once the learning has progressed further. This is particularly evident when it comes to the neglect of the differences in and the marks of tones.

4.2.3 The extent to which TCFL incorporates technology in Irish schools

According to the results of the interviewees, the ICT tools are used to a certain extent for language teaching and learning, but not much in the context of TCFL. Three teachers, two native speakers and one non-native speaker, reported that they never used technology for teaching Chinese. Among these three teachers, two teachers report that they never use technology in their CFL classroom because the necessary facilities are not available to them, while the other teacher commented that the school's technology policy is the reason for the inactive use of ICT.

YF: In our school, they don't have multimedia... There are not many other things. (TF-N, 80)

MC: Not really, because the school is only starting to introduce a mobile phone policy. My principal says she is going to take it slow because she knows this is going to be a mistake made. So to be honest, we haven't been encouraged. (MC-N-E, 70)

Among the rest of the interviewees, most teachers are using some level of technology in their classrooms. The implementation of ICT appears to be at different levels. A majority of the interviewees still use ICT at a rudimentary level, while there are also a small number of interviewees who are quite proficient in using ICT tools to assist teaching and learning. While even though, their use of ICT in TCFL is at a lower level in comparison

with their other school subjects.

For the rudimentary users, eight interviewees report that the main ICT technology they use is online videos. Among them, non-native Chinese teachers often use these video demonstrations as a model for their students as they are not confident in their ability to produce the correct pronunciation.

TW: I don't think so. Again, as I only teach basic language I have a good master of pronunciation. I also support my own teaching of pronunciation by using video clips of native speakers saying the words/phrases that I am trying to teach. (TW-N-E, 30)

For a similar consideration, native Chinese teachers, especially those who are relatively new to Ireland, prefer to use videos to explain cultural content due to their unfamiliarity with the Irish context and also a lack of confidence in their English competence.

QW: I may show some videos for students, and let them watch some TV dramas and movies... I can only take my computer with me, and then when I introduce traditional culture to them, I use some videos or other things to explain. (QW-N-M, 70)

For the advanced users of ICT, three tools are mentioned more frequently. Two interviewees report that they find *Duolingo* to be helpful and have recommended it to their students. Other two apps, *Pleco* (Chinese-English dictionary) and *Memrise* (vocabulary learning platform) are also mentioned by the interviewees.

RG: I told them to bring *Duolingo* home and to use it on the phone. If they are bored, they can practice on the phone. (RG-N-E, 70)

MF: Yeah, I mentioned that I do about 15 minutes a day on *Duolingo*. I tell the students about as well the *Happy Chinese* on *Memrise*, there is no end of free app you can use. The great advantage of those, if you are just waiting for a bus, or something, you can do it anytime, if you spend 5, 10 minutes on those. And *Pleco* is another really good one designed for Chinese characters, you know, you can check what it means. (MF-N-E, 50)

However, the interviewees tend to provide more details about how they use these apps in

their learning instead of how they implement these tools in their teaching. One interviewee stated directly that it is challenging to implement the ICT tools in teaching as the tools are mostly content-based, so they become out-of-date or not suitable for the particular teaching and learning context fairly quickly.

CZ: It is not that easy to implement it into your lesson. Because it is like, I don't know, like how you measure their achievement in the games and how to link that to the course. I could not really leave homework, let's say, play this app as homework because coming back, I don't know how long they played it and what's the effect. And everything just mixed together, I don't know like what the app really plays a part in the learning. I don't think, also like, most of the software or application, you couldn't really change the content. The content is set, so it is like, you could only use the very small part of one app for limited content, or limited function, and you need to go find another one. (CZ-N-M, 85)

Also, only one teacher among all the interviewees mentioned regular use of the tools. Most of the interviewees are focusing on using different tools once-off and mainly as a means of attracting or entertaining students, instead of as an integrated part of teaching and learning. This issue is particularly evident as identified in the use of gamified tools. It is reported that the tools are often not quite useful for educational purposes, while the product and the use of the product may serve the purpose of entertainment more than education.

CZ: I think it is more, how to say, it is more entertaining instead of educational, and, you could see the kids play, they very into the apps, very into the games, but in terms of the pronunciation, it really did not improve that much. (CZ-N-M, 80)

4.2.4 The willingness of teachers towards iCALL for TCFL

The willingness to use ICT and iCALL tools in CFL classrooms is positive among the interviewees. During the interviews, the interviewer briefly introduces the proposed iCALL tools to the teachers. Teachers demonstrated a very positive attitude towards the potential of using iCALL tools in the classroom.

It appears that with the further development of TCFL in the Irish context, the trend is that teachers are becoming increasingly proficient in using the more conventional ICT tools. Because of the lack of materials, the teachers started exploring themselves. They call for the development and deployment of a variety of resources with different contents and formats to support the teaching, learning and assessment of TCFL.

RG: At the start, I was using the teaching pack and the power points from the (anonymous unit). But now I feel that some of them are a little bit out of date. It is a little bit boring. And I want to change it. We do a little bit of *Duolingo*, there are videos, youtube, called *Learning Chinese Now*, and *Learn Chinese with Emma*, it is a good one. So when we were doing the family, I found a Chinese song, so these kinds of things I look for at home, to bring to the classroom. I think you do need a little bit of technology. (RG-N-E, 65)

The interviewees commented that among the ICT tools on the market, there were significantly more tools developed for reading and writing in comparison with those that help develop listening and speaking skills. Also the existing tools for TCFL, not many are interactive.

QW: There are a lot of reading materials or some audio-visual materials now available... But whether it is an application or an interactive website that allows them to practice oral Chinese, I really don't have the resources in this area. I haven't heard some of my colleagues mention it, so if someone can develop a language like this for them to practice oral Chinese directly with Chinese native speakers, for example, they may be divided into different levels, elementary, intermediate, and advanced, and they can practice oral Chinese directly. Whether it is such a platform or a mobile phone application, I think it is more urgently needed. (QW-N-M, 95)

As mentioned in Section 2.3.1, interaction is important in language learning (Rivers, 1987), and this is reflected in the results of the interviews. Six of the 12 teachers emphasise the lack of interaction their learners have with Chinese speakers. One of the interviewees bemoaned the lack of opportunity to practice and mentioned how she would find even a virtual Chinese interlocutor incredibly useful.

A need is identified by the interviewees for iCALL intervention to provide immersion and interactive learning environment as well as human or simulated human interaction for learning spoken Chinese.

RG: When I was studying German or Spanish, I really benefited from language exchanging partner, so like someone meets me for a coffee, 20 minutes speaking Chinese, 20 minutes speaking English. That would be a huge help. And at the moment it is very hard to find. So a language exchange partner, that would be a good idea. Or you know, even for a virtual one, talking to a machine if no real people are available, would still be much better than the current nothing. (RG-N-E, 80)

Optimising the language learning environment is crucial to enhancing language learning (Young, 1991: 426). Three native Chinese teachers make this point strongly. They agree that even a virtual world context could provide the necessary structures for their beginner learners. All the 12 teachers expressed a willingness to try new technology even though they did not know too much before as it would come onstream and they were very keen to be kept informed of any new developments in the field.

Based on the above findings, it is evident that teachers are willing to use technology to assist in the teaching and learning of spoken Chinese, while the current shortage of ICT implementation is mainly due to (i) limitation of the adequate facilities and (ii) suitable tools that match the needs of the teaching and the demand of the curriculum. The solution to how the iCALL tools address these issues will be further discussed in Section 6.2.4.

4.3 Results of student's needs analysis

An experiment was carried out among post-primary CFL learners to investigate the awareness of challenges in learning spoken Chinese. The experiment (i) asks student participants to name challenges they perceived or anticipated in learning spoken Chinese and (ii) an error analysis based on this cohort's Chinese pronunciations (Section 4.3.3). This section reports on the findings.

4.3.1 Participants and experimental set-up

Two groups of students took part in this research (Section 3.4.2.2). Group A were 26 fourth-year TY students from two Irish post-primary schools and Group B was nine heritage Chinese learners, from a Chinese community language school in Ireland. All the participants were beginner-level learners with no more than a few months' experience in studying Chinese. Group A were non-heritage learners who had no previous Chinese learning experience. Group B were children of Chinese parents, this being their first experience of 'formal' Chinese class, learning Pinyin (see Section 1.6).

For the experiment, they were asked to repeat familiar syllables in Mandarin Chinese, in the format of lexical items, after the standard pronunciation. The data collected was used to compare and analyse the phonological information and identify the challenges and needs in learning spoken Chinese at the beginner stage.

For each of the lexical items, the listening and repetition task was conducted twice. Both the standard pronunciation produced by the researcher and the pronunciation of the participants were recorded. In terms of the recording materials, 44 syllables were selected from a popular Chinese textbook used in Irish post-primary schools. Those syllables included single-syllable words and disyllable words (see Appendix D). The topics covered are family, food, school life, time and weather, work, hobbies, transportation and travelling. The range of the lexical items covered common syllables in different tones at the level of CEFR A1, which is in line with the learning outcomes, as outlined in the Leaving Certificate Mandarin Chinese specification (NCCA, 2019).

Upon the completion of the experiment, an open question was given to each participant and was then asked to identify their needs and challenges for subsequent analysis in learning spoken Chinese. The data was collected in November and December 2019.

4.3.2 The participants' reporting of challenges in learning spoken Chinese

All the participants were asked to identify the needs and challenges of learning spoken Chinese. Among the 35 student participants, nine participants (five non-heritage and four heritage students) stated that as they have very limited experiences in learning Chinese,

they have not yet realised their needs nor have developed the awareness of any challenges in learning spoken Chinese. The rest of the participants identified the acquisition of Mandarin tones as the greatest challenge in learning spoken Chinese.

4.3.3 Analysis of participants' Mandarin tones production

An error analysis was conducted using the data collected from the 35 learners, to explore the particular challenges of the participants in the spoken production of Mandarin Chinese at the beginner level. Among the 44 syllables, each tone occurred 11 times. Each syllable was repeated twice by the participants (n=22).

Based on the results, no systematic patterns of errors are found in producing the initials and finals. In comparison, non-heritage speakers make little errors in producing the initials and finals while though there were a small number of errors made by heritage speakers, there is no cluster of these errors.

The results of the non-heritage speakers indicate that the pronunciation of vowels and consonants is not a significant challenge for this cohort of students. The results of the heritage speakers are likely to be associated with the diverse language backgrounds of the participants, as they come from regions with different Mandarin variations and Chinese dialects.

In contrast, there are a great number of errors made in producing Mandarin tones by both types of participants. The general mispronunciation rates of Mandarin tones among the participants are presented below (see Figure 19).

Tone 3 has the highest misappreciation rate of 19.48%(n=150), suggesting that for the participants, it is the most difficult tone for oral production, this is in line with Lam (2017) that tone 3 is the most difficult one for learners of non-tonal background (see Section 2.5.2). Tone 2 is the second hardest for participants, with a slightly lower misappreciation rate of 17.14% (n=132). This is in line with previous research (Elliott, 1991; Guo and Tao, 2008) (Section 2.3.4) In comparison, tone 4 (11.56%, n=89) and tone 1 (2.99%, n=23) are much easier for oral production.

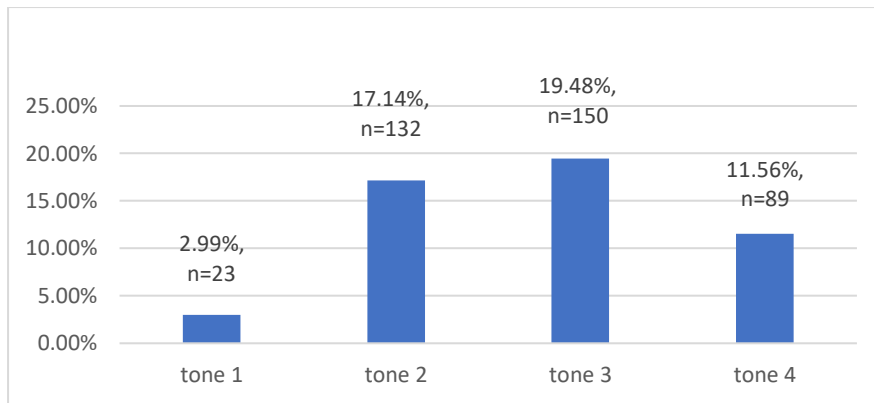


Figure 19 Mispronunciation rates for all participants

Figure 20 presents a comparison between heritage and non-heritage speakers, the errors in tone production demonstrated different patterns.

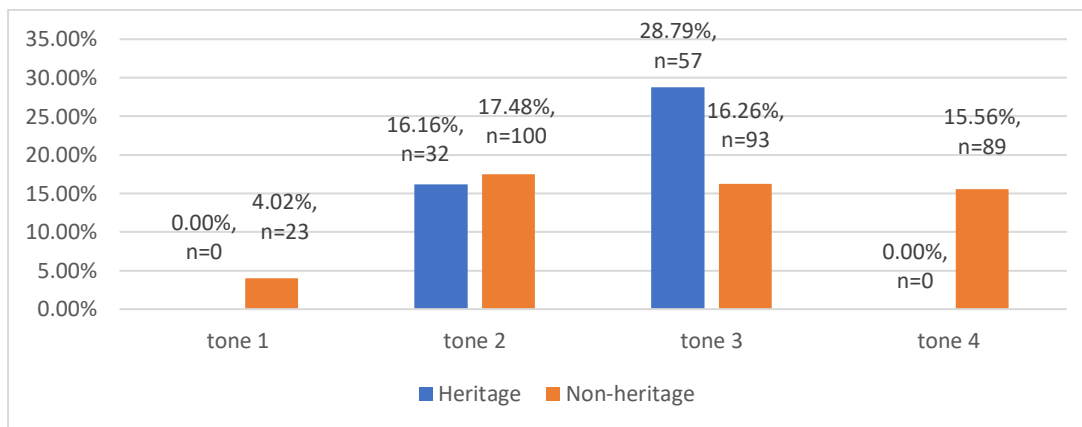


Figure 20 Mispronunciation rates of heritage and non-heritage speakers

Heritage speaker participants had no difficulties in producing tone 1 and tone 4 as no mistakes were made on those two tones. In line with the general trend, tone 3 is an even more serious issue for heritage speakers, with a mispronunciation rate of almost one-third of the total production (28.79%, n=57). Tone 2, however, is less prominent in causing errors while still not being overlooked (16.16%, n=32).

For the non-heritage speaker participants, there is a small number of errors made in tone 1 (4.02%, n=23). Tone 2 becomes the most challenging one to be produced by non-heritage speakers, with a moderately higher error rate of 17.48% (n=100). Different from the general trend, tone 3 and tone 4 appear to be similarly challenging for them, with a close misappreciation rate of 16.26% (n=93) and 15.56% (n=89) respectively.

There are also some interesting findings when looking at the errors made in producing single-syllable words (see Figure 21) and disyllable words (see Figure 22) by the two groups of participants.

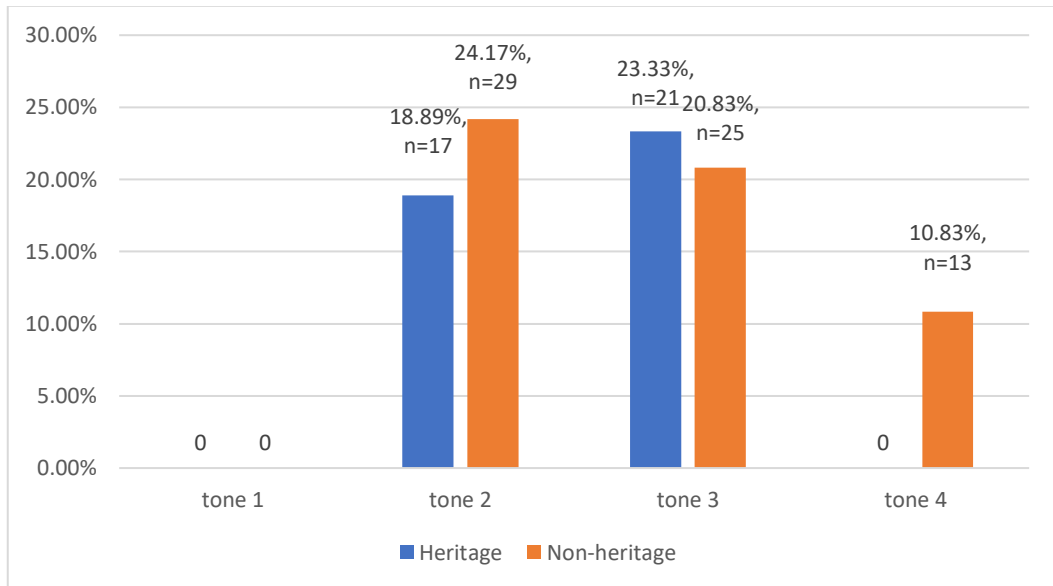


Figure 21 Mispronunciation rates of single-syllable words

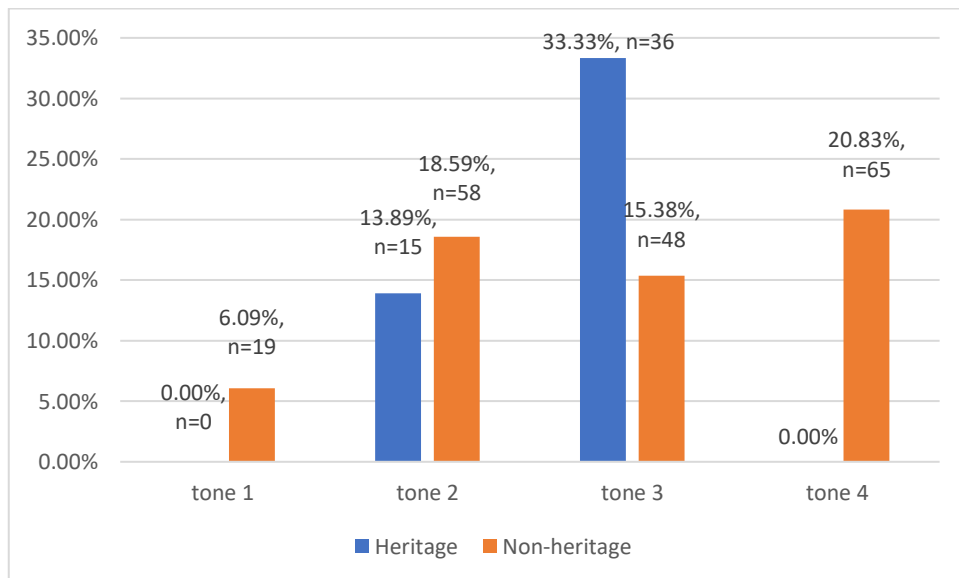


Figure 22 Mispronunciation rates of disyllable words

For the single-syllable words, the patterns of errors were relatively similar. No errors were made in producing tone 1 by either heritage or non-heritage learners, and the error

rates for tone 2 and tone 3 are close. For heritage speakers, the error rates are 18.89% (n=17) for tone 2 and 23.33% (n=21) for tone 3. For non-heritage speakers, the error rates are 24.17% (n=29) for tone 2 and 20.83% (n=25) for tone 3. The major difference lies in the error of tone 4, that heritage speakers make no error while it is still a moderate issue for non-heritage speakers with an error rate of 10.83% (n=13).

For producing the disyllable words, the patterns of the two groups are evidently different. Other than the persistent issues in producing tone 2 (13.89%, n=15), a significant increase of over 10% is seen in errors made by heritage speakers when producing tone 3 (33.33%, n=36).

The main reason for such an increase could potentially be a reflection of their language background. The majority of the heritage speakers in this part of the research come from the south of China where the dialects they or their family speak have significant differences, particularly on tone 3 in comparison with the Mandarin dialect (Chen, 2000: 13).

In comparison, non-heritage speakers have a more balanced distribution of errors. Tone 1 is consistent in being the least challenging for production (6.09%). The error rates of both tone 2 (18.59%) and tone 3 (15.38%) are lower in comparison with errors made in single-syllable words, while errors in tone 4 (20.83%) are almost doubled.

4.4 Summary

This chapter reports on the results of the needs analysis. For teachers, the main challenge in teaching spoken Chinese is the acquisition of Mandarin pronunciation, particularly Mandarin tones. The insufficient quality teaching and learning materials and the lack of opportunities to use the language outside of class hours are both identified to contribute to the main challenge. Native Chinese teachers also face challenges in giving effective feedback and increasing their presence in schools. Some particular challenges in teaching heritage speakers are also reported, such as the unwillingness to use the mother tongue and the negative impact of the L1 transfer.

Regarding the implementation of ICT and iCALL, though the majority of the teacher participants are still using rudimentary ICT tools, a need has already been identified for more interaction between the students and native speakers, including AI-simulated communications.

In terms of student needs, not many student participants are aware of their own needs and challenges in learning spoken Chinese due to their short experiences in learning the language. The most common and evident challenge identified by students is Mandarin tone acquisition. Further error analysis identifies that heritage and non-heritage learners both have different challenges and difficulties in producing Mandarin tones, although they are different in nature. A more in-depth discussion identifying the reasons is provided in Chapter 6.

The findings of this chapter are used to inform the design of both iCALL tools (see Section 3.5) and their evaluation, which is presented in the next chapter when reporting the findings of the iCALL evaluation.

Chapter 5 Findings of the iCALL evaluation

5.1 Overview

This chapter reports on the findings of the third phase of the research project. This phase of research contains three parts. The first part explains some backgrounds and methods in consideration of the reliability and validity of the research. The second part concentrated on the teachers (Section 5.3), a qualitative investigation to acquire data from teacher participants on the evaluation of the two iCALL tools. The third part focuses on the learners (Section 5.4), an empirical experiment with a quantitative study to gather data from student participants on evaluating the iCALL tools.

In terms of the structure of this chapter, Section 5.3 reports on the findings of the qualitative interviews with the teacher participants. Section 5.3.1 introduces the demographic information of the participants. Section 5.3.2 outlines the implementation method and process of the iCALL tools. Then Section 5.3.3 reports on existing challenges identified by participants in the teaching, learning and assessment of spoken Chinese. Section 5.3.4 describes the implementation of using the tools as treatment. Section 5.3.5 reports on participants' experience with the tool, i.e. using tools on the impact of the iCALL tools on the three mentioned perspectives as well as the limitation of both tools.

Following the findings for teachers, Section 5.4 reports on the findings of the quantitative questionnaires and the empirical experiment with the student participants (see Section 3.6.2). It begins with Section 5.4.1 outlining the backgrounds of participating students and schools. Section 5.4.2 reports on the findings of the pre-test quantitative questionnaires and Section 5.4.3 presents the findings of the comparison between the pre-test and post-test questionnaires. Section 5.4.4 outlines the findings of the empirical error analyses and then Section 5.4.5 reports on the findings of the post-test evaluation of student participants on the two iCALL tools.

5.2 Reliability and Validity

The reliability and validity of research methods are critical factors in ensuring the trustworthiness of a study. Reliability pertains to the consistency of results under similar

circumstances, while validity concerns the extent to which a method accurately measures what it is intended to measure.

In the context of the current research project, reliability and validity were considered from the design phase to ensure the robustness of data collection and analysis. Sections 3.3.2 and 3.3.3 highlighted ethical and practical considerations for data collection. Sections 3.4.1.4 and 3.6.1.4 discussed the methods for data analysis and outlined statistical approaches to address data when assumptions of the tools were violated. These considerations were carried through the research to ensure that the data collected and analyzed were reliable and valid.

The research faced the challenge of having a limited population of suitable teacher and student participants, given the nascent state of the Leaving Certificate in Mandarin Chinese in the Irish post-primary school curriculum. To address this, the research recruited a balanced group of six teachers, considering their qualifications, experience, and teaching contexts. This approach aimed to represent the diversity of Chinese language educators in the Irish post-primary education system, as reported in Section 5.3.1. While additional teaching personnel could have been recruited, the researcher opted not to include them to prevent introducing unnecessary factors that could reduce data reliability.

In terms of student recruitment, the researcher faced reluctance from schools to engage in research involving Leaving Certificate students due to the high stakes and difficulty of the language. To obtain reliable data, the researcher identified suitable teachers as gatekeepers and recruited Transition Year students who were preparing to continue their Mandarin Chinese studies in the Leaving Certificate program the following year.

The evaluation questionnaire used for students employed a five-point Likert scale. This choice was based on the scale's relatively high reliability, the need for anonymity in the questionnaire, and considerations of age-appropriateness and construct complexity for the participants.

In summary, the research employed a rigorous approach to ensure the reliability and validity of the research methods, even in the face of a limited pool of participants. This

included careful participant selection, ethical considerations, and well-structured data collection and analysis methods to produce trustworthy results.

5.3 Results: Teacher interviews

This section reports on the findings of the qualitative interviews (see Appendix E), which aims to explore the teachers' perceptions of the implementation of the two iCALL tools in facilitating the teaching and learning of spoken Chinese in Irish post-primary schools. The transcripts of the interviews are attached at the end of the thesis (see Appendix G).

5.3.1 Participants

The present research recruited six Irish post-primary school teachers who are currently involved in the teaching of Mandarin Chinese in their schools. The background of the teachers was asked in Part 1 Questions 1-4 in the semi-structured interview (see Appendix E). There are three male teachers and three female teachers. Three of them are Irish Chinese teachers while the others are native Chinese teachers. Three teachers have been teaching Chinese in Ireland for more than four years while the rest are newly qualified teachers with teaching experience of no more than two years. Below is a summary of the distribution of this demographic information (see Table 11). To protect the anonymity of the participants, their names were replaced, and they were referred to using the initials of the replaced names.

Table 11 Demographic information of teacher interviewees (evaluation)

No.	Interviewee	Gender	Ethnicity	Teaching experience
01	MC	Female	Irish	2 years
02	SC	Male	Irish	0.5 year
03	MS	Male	Irish	6 years
04	CT	Male	Chinese	6 years
05	HS	Female	Chinese	2 years
06	WX	Female	Chinese	4 years

Interviewee 01 is MC. MC is a newly qualified Irish Chinese teacher. She studied Chinese for about seven years which included four years of an undergraduate degree in studying

Commerce and Mandarin Chinese, a gap year living in China and two years of Professional Master of Education (PME) back in Ireland. She holds a Chinese proficiency of HSK 6, which is broadly equivalent to CEFR B2/C1. At the time of the research, she has been teaching Chinese for two years in school, including a one-year work placement for the PME. She was teaching Transition Year Chinese at a school in Dublin. The students were all beginner learners.

Interviewee 02 is SC. SC is an Irish Chinese teacher. He just started his second-year PME and began to teach Chinese for about half a year. He has been learning Chinese for about five years, including his four years of undergraduate degrees in world languages and one year in PME. He has recently passed the HSK 5 test at the time of the research, which is broadly equivalent to the lower band of CEFR B2. He was teaching Transition Year Chinese module in a school in North Dublin as part of the placement and the students were all beginner learners.

Interviewee 03 is MS. MS is an experienced Irish Chinese teacher who has been teaching Mandarin Chinese culture and language for at least six years in the Galway schools. He studied Chinese on and off for more than ten years. He holds an HSK 3, which is roughly equivalent to CEFR A2/B1. He taught Transition Year Mandarin Chinese for many years and the students were mostly beginner learners.

Interviewee 04 is CT, he is a native Chinese teacher who has been teaching Mandarin Chinese for at least six years in Ireland. He taught in a few post-primary schools around the country. He taught mainly the Transition Year module and sometimes a taster course for first-year students or as an afterschool club for students who were interested in learning the Chinese language and culture. The students were mainly beginners who did not have experience in learning Chinese.

Interviewee 05 is HS, she is a native Chinese teacher who has been teaching Mandarin Chinese for two years in Irish schools. She teaches mainly the Transition Year module and has recently begun to teach the Leaving Certificate Chinese module. She teaches two kinds of Transition Year Chinese modules; one is a taster course for all students and the other one is mainly for students who have studied Chinese in their Junior Cycle and aim to take on the Leaving Cert course in the following year. For both Transition Year groups,

the majority of students are Irish while there were two Chinese heritage speakers in the second type of the Transition Year class.

Interviewee 06 is WX, she is a native Chinese teacher who has taught Chinese for over four years in Ireland. She teaches both Transition Year Chinese and Leaving Cert Chinese. Her Transition Year group was mostly Irish beginner learners. For her Leaving Cert group, there were one-third of heritage learners with mixed Chinese competence and the rest were Irish or international students who never studied Chinese before.

5.3.2 Teachers' experience with CALL to date

This section is the report of the answers to Part 1 Questions 5-7 of the semi-structured interview (see Appendix E).

According to the interviews, the Google platform and Microsoft platform are the most used platforms for teaching and communication in schools. When face-to-face teaching was mandatorily shifted to online teaching during the lockdown of COVID, Google Classroom and Microsoft Teams were the most common platforms teachers used for delivering the class. Tablets are equipped for teaching and learning in some schools (n = 3). In terms of general CALL tools, tools for creating digital textbooks and apps for making short videos seem to be the most popular among the interviewees (n>3).

When asked generally about apps for teaching and learning spoken Chinese in specific, the answers returned are still mainly non-subject-specific tools for general teaching and learning. Among them, OneNote, Quizlet, Kahoot and Padlet are the most frequently mentioned (n >2). They are commented to be handy for organising classroom activities and for conducting formative assessments.

CT: Our school is a Microsoft Teams school, so we use Microsoft Teams for basically everything, especially during Covid. We use OneNote as the platform to facilitate teaching. I don't know whether it would account. And for particular apps, ..., I use Quizlet and Kahoot more often. You mean the teaching of spoken Chinese in particular, yes?

HW: Yes.

CT: I would say Quizlet and Kahoot. ..., In terms of how it works, I use OneNote as a platform to distribute information and then my students could hand in their homework through OneNote, and I could give them some feedback on that platform. And I have recently been giving audio feedback instead of writing. Because it is faster, and it is more personal. And then for Quizlet and Kahoot, it is mainly to..., I could use some of them in my classroom, mainly just give homework, you know the flashcard and quiz, that type of thing. You could create some videos with questions, something like that. (CT-E-M, 15)

When continuing to ask about participants' experiences in using apps for teaching and learning spoken Chinese specifically, very limited answers returned mentioned spoken Chinese, and they are mostly tools designed for reading and writing or character study.

HW: Are these tools mainly for facilitating general teaching and learning?

SC: Yes, because for Chinese specific ones... I am using one called Arch Chinese, which is a platform with a lot of small tools for Chinese. But I had to say most of the tools are for reading and writing. (SC-E-E, 25)

When responding to the question, the most frequently mentioned tool is the Chairman's Bao, which is a learning website using Chinese newspapers to practice reading and writing skills. Some interviewees claimed to use it for teaching and learning spoken Chinese, while it is in general not designed for the purpose and not age and stage appropriate in the context of the present research.

MC: I use a few apps but they are mainly for reading and writing, I suppose. I myself used Chairman's Bao and you know, in the Chairman's Bao you could... there is a... there's a video recording for each of the reading pieces, so I would use the interesting reading pieces and also use the recording materials for my class for spoken, but they're basically monologues. It's not conversation. And again, I use the app more for reading and writing. That recording is just trying to make up the spoken part of it... (MC-E-E, 15)

No interviewees reported that they have come across any good apps or software that are suitable for their students in learning or practising spoken Chinese. The closest tool

mentioned to the topic is a pinyin chart to help demonstrate the pronunciation of different pinyin combinations. While the tool itself is designed mainly for CFL teaching, it is not lacking as although it demonstrates correct pronunciation but in listen and repeat model cannot provide corrective feedback for learners to help them achieve the correct pronunciation. In essence, it is a tool for demonstration, not for learning.

MC: Yeah... and... I don't know there are few... I don't know whether the pinyin chart would count? I think I have a few websites where you could use a combination of pinyin. I have a few websites they have the pinyin chart which you could click on and you could have the combination of the pinyin and the pronunciation... That helps my teaching for demonstration. I give that to students as a reference after class. But... you can't really practise conversation or spoken Chinese using that... just practice pronunciation, I guess. (MC-E-E, 30)

Interviewees also reported that many of the tools are more suitable for adult learners rather than younger learners in terms of both content and display. There are a lot of similar apps designed for young beginner learners, but many of them are highly repetitive and lack the potential and mechanics for systematic learning. In terms of methodology, most of the apps for young learners are designed with an L1 approach either intentionally or unintentionally, which is not suitable for the TCFL context here in Ireland.

MS: I think that is useful for students to check the words and characters. And then, besides that... maybe a few apps... there are lots of apps for beginner level Chinese but like... they are really similar to each other, and I found... I found a few ones that are more systematic. But they do not seem to be made for foreigners... (MS-E-E, 25)

When asking interviewees about any game-based tools for learning spoken Chinese or learning Chinese in general, the interviewees were not aware of any TCFL apps that are intentionally gamified, though it appeared that many apps do incorporate game elements. However, the mentioned game elements may not necessarily be well integrated into the framework of the apps, and the effect and effectiveness of the game elements remained unclear.

HW: Then is there any tools or apps that you use are gamed based?

HS: (long pause)... No, not really game based... they have this kind of game elements or competition... like that... like I said the 'show me board'... I could create a game around it, but it's like... the app itself is not really based on a game. (HS-E-M, 30)

There is another perspective on this issue. Though it is good for teachers to pass on useful apps they have used, the experiences might not be entirely transferrable as the purpose and context for teachers to use these apps could be different from the students, not to mention the differences in age and learning methods between the teacher and the students.

SC: I do... I do pass on some... some of the apps that I used to use when learning Chinese, for example, I used to use *Memrise* for vocabulary, and then I used Chairman's Bao for reading. But that's too advanced in general for my students... but I do give them those information... but it just doesn't seem to be that helpful for my particular student group. (SC-E-E, 25)

5.3.3 Existing challenges in the teaching/ learning/assessing of spoken Chinese

This section is the report of the answers to Part 2 Questions 1,3 and 5 of the semi-structured interviews (see Appendix E). Interviewees report their challenges in teaching and assessing spoken Chinese based on their different backgrounds as native or non-native teachers or experienced and newly qualified teachers, as well as challenges they witnessed among their students in learning spoken Chinese. This section reports on the results of the interviews on the existing challenges identified by the six interviewees.

5.3.3.1 Challenges in teaching spoken Chinese

The challenges in teaching spoken Chinese varied a lot as identified by 6 interviewees with different educational and sociocultural backgrounds (see Section 2.3.1 and Section 5.3.1). Overall, there are five main challenges for teaching as identified by the interviewees.

Challenge 1: Competence in tone production

For non-native Chinese teachers (n=3) with a lower level of Chinese language proficiency, the challenge reported is their competencies of Mandarin tone production and perception affecting their teaching capacity. In one example (below), an interviewee expresses concerns about his capability to demonstrate standard pronunciation and identify the errors in students' speech due to his level of Chinese proficiency. He mentions that he finds his oral production is fairly accurate on the lexical level, but it drops significantly when using longer forms of expression.

MS: I would say the demonstration is the number one issue. I mean I have HSK 3 and I think my pronunciation is okay. But I think my pronunciation is more accurate at the level of vocabulary. Sometimes when I pronounce a long sentence... with something... I'm... I'm not quite sure where... I'm not quite confident that my pronunciation is very standard. So I DO always try to find a video or something to demonstrate that pronunciation, and I think because of that, sometimes my... like... my demonstrations could vary a little bit, and I found it a bit challenging to... to guide them towards one standard pronunciation. They all sound a little bit different from each other... sometimes. That's one of the challenges. (MS-E-E, 45)

Challenge 2: Teaching and learning materials

Availability of suitable materials for teaching and learning Spoken Chinese. There are at least three perspectives on this challenge.

First, some of the teachers (n=3) are in areas with no viable presence of the Chinese language or culture or community, therefore it is challenging for them to find or create materials that would be authentic and also engaging in the context of students' daily lives.

MS: So they... it's actually quite challenging to find a meaningful context for them to practice the language. When they practice with each other, it's just... it's not authentic. If I could find a good activity, they could immerse more into it, and they would be more willing to practice. But still... you know... when they are aware that they are just practising, and they are just talking to each other using only these few words they know in Chinese

all the time, it just doesn't really feel very authentic. And they couldn't be very engaged in that way. (MS-E-E, 55)

Second, there are still relatively few quality materials and resources for teaching and learning spoken Chinese available for young CFL learners, which is a common problem found in many jurisdictions in the world (McNaught, Phillips, Rossiter, & Winn, 2000; Yue, 2017).

Third, as discussed above and at the end of Section 2.2.2, this challenge is linked to the qualification and capacity of the teacher. A low level of proficiency would hinder the teachers from getting access to many more quality resources, especially those published on Chinese websites.

Challenge 3: Language awareness and learning confidence

Building learner confidence (see Section 5.3) and Chinese language learning awareness. According to the results of the interviewees (n=4), it is a common problem for both native and non-native Chinese teachers, especially for newly qualified teachers. The reflections on such issues are not entirely the same for the two types of teachers.

For native-speaker teachers, Zhang (2020) has discussed extensively the lack of awareness of Irish students' challenges in learning Chinese. This phenomenon could be extended to the Chinese community because the interviewees find sometimes native Chinese speakers do not understand the differences between a language speaker and a language learner, in this context young beginner learners. Even when they are aware, they don't appear to know how to control the language to cope with the level of the learners and make communication possible. This might have a devastating effect on learners' language confidence.

MC: You know... you can convert the text to speech, and you can do that reverse sometimes. So I've set up a WeChat group to kind of have a chat with the kids and sometimes I'll ask my Chinese friends to join that group just for my students to have that feeling of talking to Chinese people. But the thing is... my friends... they are not language teachers. They don't really have very good control of their language. I mean they tried their

best... but it's very difficult for them... especially (for students) at this level. It is basically that you really need to know what they (the students) know (in terms of the target language) to be able to talk to them. So what happened... most of the time... it is just very general conversation or greetings and that's it... nothing deeper... and it always stuck. It's not even as smooth and effective as talking to a robot, to be frank. (MC-E-E, 60)

For non-native teachers, as they were once CFL learners themselves, it is much easier for them to be in the shoes of the learners, so they know and can encourage students on precious spots of learning, but some of them found their positive feedback and reinforcements are not as convincing as a native speaker teacher once past the initial stage of learning. In other words, teachers could perceive that it is relatively easier for them to initiate students' motivation while more challenging to sustain such motivation due to their identity. Based on the results of the interviews, this phenomenon is not exclusive to newly qualified teachers but also appears among some very experienced teachers.

MC: I'd say at this stage is... it's language confidence... it is a major issue for my students. You see... I'm not a native speaker. So I have my advantage, that my experience of learning the language is pretty convincing for my students. They see if I could do it, they could do it. But at the same time, in terms of spoken Chinese, I think... I think... I think they sometimes still lack the confidence of being able to speak to a native speaker or just communicate with a native speaker, you know. I found sometimes when... they could... could practice spoken Chinese with me, and even if I give them recognition, there is still... I suppose them wondering about how good they are. That's because I think they know that I was in their shoes, so I will be able to understand them, but what if they talked to Chinese people, you know? Someone in our neighbourhood or something like that, whether people would understand them? So I thought this doubt is always there. So it's kind of like... I could give them the confidence, to begin with... I could boost their confidence at the beginning... to motivate them to learn, but the exit ticket I couldn't give to them. The exit ticket would be more convincing if a native person is talking to them or something else...(MC-E-E,

Challenge 4: Mixed-ability classes

Catering for different levels of proficiency and Universal Design for Learning (UDL). UDL is defined by CAST (2018) as a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn. It aims to improve the educational experiences of all students through flexible methods of teaching and assessment to cater needs of a diverse background and level of learners, which is the norm of foreign language classrooms.

Some interviewees mentioned that they are not used to having students with various levels of proficiency in one class. This would typically refer to a mixed class with both beginner-level Irish students and some very advanced-level heritage speaker students, all in one Transition Year class. Interviewees report that it is very challenging to ensure the engagement of all students and the right pace for the class.

WX: My biggest challenge... because I have a mixed group... at first their level are very mixed... so it's hard to... it's hard for me to find a balance for the content. Second, the biggest issue is the... is the atmosphere of the classroom. Okay, see... I have this group of heritage speakers and it really depends on... most of the time they're very cooperative. I ask a question that they are very willing to answer but in Chinese. And their level of Chinese is REALLY high. And that is kind of a little depressing for the other students because they could... they could be struggling with some basic pronunciation while they hear the other group like fluent in Chinese. And some of the other students (Irish group) are like already very shy and they don't really like to stand out already, so in that type of mixed group, it makes it even more challenging for me to engage with them (Irish group). I think that's one of the biggest challenges. (WX-E-M, 35)

Challenge 5: Effective demonstration of pronunciation

The fifth main challenge the interviewees mentioned is the demonstration of pronunciation. This is in line with the results of the NA results (see Section 4.2.2) and is mentioned again here and will be further discussed later (see Section 6.2.1). Interviewees (n=6), regardless of language backgrounds and teaching experiences, find that the

demonstration of the pronunciation methods and process in a student-friendly way is extremely challenging. Not all the interviewed teachers have the competence to describe the methods of pronunciation as well as give precise instructions for students to correct their pronunciation. Those who cannot rely more on the ‘listen and repeat’ method which was criticised for many years for being ineffective (Orton, 2013). However, even those who can find the liberal description very dull for students and hence less effective.

HS: OK I think the most difficult part is to teach or to demonstrate the process of pronunciation. Because... as a native speaker... there's no problem for me to demonstrate standard pronunciation. But then... but then... it's not quite active. If you ask them to follow you... because they don't know how to get there... from their pronunciation... Other than some very basic instruction, like showing the shape of my mouth and telling them where the tongue is supposed to be... that type of thing... it's... it's not easy to demonstrate the process. It is not like if you could demonstrate the whole processing in slow motion... how they... how they could pronounce that word slowly... but accurately... and then afterwards they could like... make it more like... make it faster and standard? It's not easy (to show the process). (HS-E-M, 40)

Besides all five major challenges reported by the interviewees, also worth including are COVID-related challenges which hopefully will no longer be an issue soon, while for research, they are briefly mentioned here for a record. The challenges that interviewees mention are (i) incapable of demonstrating pronunciation over a mask, (ii) reduced volume for demonstration and interaction with the class, (iii) being forced to teach online without proper training, and (iv) reduced classroom activity and forced one-way teaching style. There are some possibilities mentioned by the interviewees as well, such as the progress made in blended learning, using break-out rooms to encourage virtual collaboration etc.

5.3.3.2 Challenges in learning spoken Chinese: teacher perspective

The 6 interviewees reflect on three main challenges in learning spoken Chinese among their students.

Challenge 1: Insufficient opportunity for oral practice

The first and the most common challenge as reported by all interviewees is insufficient opportunities to practise speaking Chinese outside of the classroom. This is in line with the results of the NA results (see Section 4.2.2) and is mentioned again here and will be further discussed later (see Section 6.2.1).

For some interviewees, it is a geographical issue, and it is about language exposure. Some schools are in areas where there are no Chinese community or any physical exposure to the language and culture in students' daily life. It is challenging to create authentic and meaningful tasks around the neighbourhood for students to practice speaking Chinese.

MS: And then... you know... I'm in (anonymous place). So we don't have... like... the boys... they have the very rare opportunity of speaking Chinese outside the classroom. (MS-E-E, 55)

For some other interviewees, it is more about the mechanism and methodology of managing this part of the learning process without the physical presence of the teacher. Their concern is that, if the practice itself is not mandatory, then students would not keep up in the long term. While it is compulsory or left as homework, they did not have a method to monitor not only the outcome but also the process of the practice.

MC: While other than that, the biggest problem is still they don't get a chance to practice it, and even if they do get the chance to practice, it's very difficult to monitor that process. So they're on their own. I think that's the biggest challenge so far. (MC-E-E, 165)

Some interviewees also mention the commitment of students. Due to the lack of Chinese language exposure and engagement with the local Chinese community, students would need to rely on each other to practice after class. However, it would require a commitment to do so and sometimes this could simply be not affordable for some students.

SC: You really had to make an effort to... to practice with... with your classmates, but... like... it requires... it requires basically a group of dedicated... interested peers to do this. Because

you... you need to find people to practice with you. (SC-E-E, 40)

Challenge 2: Perception and production of Mandarin Chinese tones

The second challenge is the perception and production of Mandarin Chinese tones (see Section 4.3.2 and Section 4.2.3). Half of the interviewees (n=3) reported that their students had difficulty perceiving the Mandarin tones and that some of the students could not distinguish the difference between the standard pronunciation and their own.

MC: Eh... I think for the students, learning the tones is the biggest issue. It's mainly about the perception as I told you... some of the students cannot see the difference (between their pronunciation and the standard ones), not to mention how to achieve the standard pronunciation. (MC-E-E, 165)

When students have difficulty with perception, that affects production as well. To students who are new to the concept of lexical tones, it is an extra layer of phonological information that needs to proceed when speaking. It slows down the learners' production and sometimes their speech seems to be breaking.

HS: They have difficulty connecting that... all the tones they pronounce are separated... well natural speech it's a flow... when they practice spoken Chinese, it's very slow for them. Because they need to mind the tones and pronunciation and I noticed that their talking speed is relatively slow... it's very slow actually... (HS-E-M, 125)

Challenge 3: Language confidence

The challenge with language confidence is that such performance at an early stage could affect learners' mentality and well-being, which leads to the third prominent.

HS: So I think, yeah... still I think to get them to talk a bit faster is quite challenging for me at this stage. Because that impacts their confidence, they just want to talk a little bit faster, so they seem to be more fluent with the stuff learned. But you could find them talk very slow and won't be able to speed up and that sometimes

would have a negative impact on their confidence. (HS-E-M, 135)

This is in line with Housen, Kuiken, & Vedder (2012), that in L2 studies sometimes students have this tendency to consider fluency as the primary or only indicator of proficiency, and the speed of speech as the primary or only indicator of fluency (Housen, Kuiken, & Vedder, 2012). In conjunction with the phenomenon described above, students might suffer from reduced self-confidence due to their misperception about their oral performance.

The challenge for students to maintain good language confidence is also related to the UDL issue mentioned in the previous section. UDL holds significant importance as it creates an inclusive and supportive environment that caters to the diverse needs of learners, ultimately boosting their language confidence. It empowers students to engage with language materials in ways that suit their individual strengths and preferences, contributing to greater language proficiency and self-assurance. Without proper UDL, Irish students in a mixed group could feel strong peer pressure from the heritage students due to their strong performance in class, which is not healthy for establishing their confidence in speaking Chinese.

WX: The problems these two groups have are actually the opposite. For the Irish students, they don't have an opportunity to practice the language after class. And with the presence of the heritage speakers, even in the class, there are very limited opportunities to practice the language as they felt the peer pressure. I need to really push them to speak so they get to practice and not to mention some of them already having issues with perceiving the tones and practising the pronunciation. (WX-E-M, 115)

One interviewee also mentions the phenomenon that young male learners may be more vulnerable at an early stage in building up their language confidence. It is reported that these learners may have a misperception in place that language study is not suitable, would be quite challenging, or appears to be feminine for boys. So it puts a demand on themselves to achieve good performance in learning to convince themselves of their efficacy. Otherwise, their language confidence will suffer. The interviewee reported that

for Mandarin Chinese as a high stake language subject, this phenomenon was particularly evident.

MS: Because... particularly in my school, boys are... they think themselves not quite good at languages, and they think studying languages could be girlish, that it's not quite a thing for boys... They are really concerned about losing their face... and they... some of them... a few... would be very stressed out because they think it's very difficult for them to achieve that. (MS-E-E, 80)

For heritage learners, the challenge could be completely different on some occasions, they could be over-confident which made it more difficult to objectively review their learning outcomes.

WX: And then the opposite side of that is the heritage speakers. Most of them are relatively fluent in the Chinese language but some of them have very strong accents... I only meet them twice in the week... most of the time they will spend with their family and their pronunciation is directed mainly by them instead of me. My time with them is not enough to correct their mistakes* because they like... the individual time I can allocate to each of these students is trivial in comparison to the time they spend talking with their family members in a dialect or accent that they think would be Mandarin, but it is not... I just felt like my strength is not strong enough to battle with that and they're not aware of that (they are speaking Chinese with a different accent). (WX-E-M, 120)

(Mistake here refers to not a standard Mandarin Chinese form, valid for communication.)

5.3.3.3 Challenges in assessing spoken Chinese: teacher perspective

The interviewees identified two main challenges in assessing spoken Chinese.

Challenge 1: Language control

Constructing questions at an appropriate level for beginner learners (A1) is particularly challenging for newly qualified teachers in assessing oral interactions. Due to the limited experience in teaching and the familiarity with the curriculum, as some of the

interviewees reported, it is challenging for new teachers to always manage their level and content of the target language to be in line with the corpus of the learners. Their language control could have various effects on the validity of the assessment, for example, they accidentally bring up content that would give away the answers or their language is too difficult or too easy for the conversation etc.

SC: It is a bit challenging for me to assess the conversation with students because sometimes I found it hard to continue a conversation in a way that is always manageable by my students. I sometimes need to look at the textbook or materials at hand, which tells me what I could say to... try to... you know... just try to control my language all the time so I can sustain that conversation with the students. (SC-E-E, 135)

Challenge 2: Multitasking

This mainly refers to the demand of teachers on the multi-tasking in assessing students' spoken interaction. According to the interviewees, if a teacher is doing an oral assessment through interaction with a student, the teacher needs to pay attention to continuing the conversation while keeping records on and assessing the student's pronunciation, accuracy, fluency, grammatical correctness and content etc. It is not very easy to manage even for experienced teachers while it is certainly overwhelming for newly qualified teachers.

WX: When we have a conversation... that type of assessment... I need to assess on... like the accuracy of the pronunciation... but also I need to be mindful of their content, and in general their performance... so I found it difficult to keep the focus on all these perspectives. (WX-E-M, 85)

Among the interviewees, three types of solutions are proposed for in-class assessment.

S1: Using alternative formats for formative assessments which would take over some elements in the assessment process to help teachers focus on necessary perspectives, such as live or recorded presentations. However, such methods fail to practice and assess oral interaction.

S2: Arranging pair work among students for conversation, while it works the least ideal for ab initio learners as they have not yet learned enough to cope with any disturbance in conversation. According to the interviewees, such a method would either end up constantly breaking with the teacher's interference for continuity or being artificial in that both students need to manually memorise the whole conversation instead of being spontaneous.

WX: If I ask them to prescribe the conversation, it's more like a reciting task rather than a communicative task, and they basically just decide what to write down and then memorise it together. So it's again it's not interactive. (WX-E-M, 90)

S3: On top of teachers maintaining the oral interaction with the student and also conducting the assessment, keeping everything recorded and marking the recording afterwards. It is in theory the best solution that emerged among the interviewees in terms of the effect, while it is also the least effective and practical solution proposed thinking of the overall workload of a school teacher. It adds up to teachers' workload and requires additional work to help students comprehend the feedback, in comparison to giving instant feedback right after the assessment. Some teachers also mentioned practical issues such as the quality of recording due to school infrastructure (e.g., noisy classrooms) and quality of teaching equipment (e.g., poor or no recording device). None above three types of solutions could meet the need to validly assess students' communicative competence.

WX: I could in theory record everything and go back and listen and give them feedback, but it is not always quiet if you are in the school so the quality of the recording would be poor... They also need to go back and listen and try to figure out what I am referring to, and it is time-consuming, and they cannot always find it. It just will not work. (WX-E-M, 95)

5.3.4 Treatment: implementation of the iCALL tools

After the teacher participants had been identified (see details in Section 3.6.1.2), they were all instructed to experience or implement the two iCALL tools. At the time of conducting the interviews, four teachers successfully implemented the two iCALL tools in their TCFL classes for up to two weeks. The tools were used throughout the teaching,

learning and formative assessment process of the classes. Two teachers failed to implement the tools in advance of the interview due to COVID-19 public health restrictions and schools' GDPR. To compensate, a full demonstration of the functionality of the iCALL tools was presented to the teachers before the interview.

5.3.5 Teachers' feedback on the iCALL tools

This section reports the answers to Part 2 Questions 2,4,6,7 and 8 of the semi-structured interview (see Appendix E). The interviewees were asked to comment on the impacts of the two iCALL tools on the teaching, learning and assessment of spoken Chinese in reflection of any challenges they identified in the same areas (see Section 5.3.4). This section reports on the results of the evaluation of the two iCALL tools.

5.3.5.1 Impact of the iCALL tools on teaching spoken Chinese: Teacher perspective

The two iCALL tools were designed with different perspectives on the teaching of spoken Chinese.

Engagement

For the first tool, *ViewTones*, when asked if the tools would benefit their teaching (see Appendix E, Part 2, Question 2), interviewees mentioned that from a motivational standpoint, as the *ViewTones* is gamified, it engages well with the students, so it takes over the class management burden from the teacher. If used in class, the teacher could focus on organising the activities and give guidance or additional help to students where needed, to ease the workload of teachers while improving the universal design of learning.

CT: It's fun itself so students tend to concentrate on the game by themselves, so I just need to monitor, but through that, you know and you can have the whole class practising and having feedback at the same time which is very efficient... I could direct my focus from correcting the pronunciation to managing the class. (CT-E-M, 90)

Pronunciation

Another benefit of *ViewTones* mentioned by teacher MS is that it visually reflects the process of pronunciation. From a linguistic point of view, it excels in instantly providing visual feedback for students' phonological performance, which helps with students' perception and production of Mandarin tones. Through the use of *ViewTones*, students could see every small step of their pronunciation through the feedback given by the tool in the format of having or losing the gold coins marked by the correct pattern of the pronunciations. It visualises directly where students need to change and improve to achieve the standard pronunciation as soon as practice is made.

MS: So, the first one, the Mario game. I think because... because it's implemented... I think it implemented the standard pronunciation without showing the standard pronunciation. So you have... like... the students could play the game and then you have this... the signs and you have those gold coins to guide them how to pronounce the words. But there is not showing a standard pronunciation. So I think it helps students to naturally get there without feeling excessive pressure...(MS-E-E, 80)

Classroom management

The feedback is also provided simultaneously to all participating students but also individually based on the different performances of each student. It helps with the universal design of learning, that students could progress at their own pace without feeling behind or not fully challenged, and the resource of teacher's face-to-face guidance could be distributed more precisely to students who would need them in time. In other words, the engagement with the *ViewTones* provides a baseline of guidance and feedback, while teachers were released from that basic responsibility, they could allocate their attention more strategically to students who need their help the most.

CT: And also I think the majority of the students, they get sufficient feedback or help from that app, so I could actually direct my attention to that a few students that do need my help, an extra push to get it right and then the whole class seems to be able to move forward on the same pace, so you know the more

advanced students could play a bit more, they are having fun, and then the slower students would be able to catch up and then they won't feel to be left out, which actually is very important for my students cause they're mostly beginners, the confidence is very important for them (CT-E-M, 95)

Enhanced/additional teacher input

The second tool, *Trip2China*, the tool simulates a native speaker and provides students with positive reinforcement. It engages students. It complements the teacher's feedback, and enhances low anxiety setting. And according to the interviewees, students may potentially view it as a more reliable one as the students perceive that AI would not intentionally favour them and exaggerate their performances, so their comments and reactions are 'genuine' and objective.

MC: It would be more convincing if there's a native person talking to them or something else... or just a second opinion... even this second opinion comes from a machine or AI as you presented. (MC-E-E, 50)

Enhance willingness to communicate

It is also interesting to see how *Trip2China* helps newly qualified teachers to develop a better understanding of the communicative approach, that students learn to conduct effective communication instead of primarily aiming to achieve a native speaker level of pronunciation.

SC: The AI... is something in between. It's... I think it's sort of... it's... it's not as pre-scripted, but also it's not totally random either... I think it has more tolerance for the input, that it could recognise what students say within a certain range of the language. This makes it much easier for students to learn the content and apply it in the conversation. And the pronunciation does not have to be perfect. As long as it is understandable, the conversation could happen. (SC-E-E, 100)

Similar to the above point about students, the teachers would also use the tool as a second opinion in determining whether students' oral production is effective at the level of

communication. In other words, if the tool could recognise students' pronunciation, then teachers would tend to consider it meets the learning outcome, instead of chasing them towards 'perfect' pronunciation.

HS: They will never... I said never sounds exactly the same as native speakers, but as long as that is acceptable... So I guess the second tool is kind of like a benchmark... I say if the artificial intelligence would be able to understand... maybe that's just a line (for acceptable pronunciation) (HS-E-M, 100)

5.3.5.2 Impact of the iCALL tools on learning spoken Chinese: Teacher perspective

Teachers report some aspects the iCALL tools have in common that could benefit the learning of spoken Chinese for their students.

Regarding *ViewTones*, interviewees first commented that the apps were easy to use and there was no technological barrier for both teachers and students. It does not require much instruction from the teacher to guide students and they could instantly get their hands on the tool while focusing primarily on playing and learning with it.

SC: The first one... that game... anyone played Mario or remotely saw people play Mario could instantly get how to play this game. I don't need to spend time explaining much on instruction. (SC-E-E, 115)

As a gamified tool, it creates an immersive learning environment in that students learn without being entirely aware of it. The guide and instruction for learning were integrated into the game mechanic which united the goals for learning as well as for playing, so students do not deviate from one another and it helps to keep the integrity of the immersive experience. Students could engage with the tool on an individual basis, so the feedback received is private to them. It helps students reduce learning anxiety and build up language confidence through positive feedback gained from engaging with *ViewTones*.

MS: I think it implemented the standard pronunciation without showing the standard pronunciation. So you have... like... the students could play the game and then you have this... the signs and you have those gold coins to guide them how to pronounce

the words. But there is not showing a standard pronunciation. So I think it helps students to naturally get there without feeling excessive pressure... I think that took a lot of pressure away from the boys at the beginning, and they would be more willing to practice. (MS-E-E, 75)

Four interviewees mentioned that visual feedback is quite effective in improving students' Mandarin tone perception. With the visualisation of the tones, students could receive feedback beyond phonological information and instruction. It helps them to better conceptualise the pitch and pattern of tones, understand the differences between their own and the standard pronunciation and guide themselves to progress towards the standard version. Also, the visual feedback covers the entire production process of each syllabus. In comparison with the conventional way of repetition or written feedback, it is easier for students to identify in detail where changes are needed to improve their pronunciation.

CT: I mean it could provide visual feedback, right? Look at how Mario moves, gives you feedback rather than just a sound, rather than just repeatedly hearing the standard pronunciation. It's easier to know you are higher or lower, short, or long enough... So they have more concrete ideas what are exactly the differences between their own pronunciation and the standard ones. And not only about the outcome but also about the process. (CT-E-M, 160)

About the second tool *Trip2China*, the most common benefit interviewees mention is the opportunities it provided for students to practice spoken Chinese after class which enhanced autonomous learning. As long as students have access to the tool, they can practice their oral production with the tool. It helps them to get more fluent and improve their pronunciation and overall oral competence. More importantly, it boosts their autonomy in learning, that they could take more responsibility in self-directing their own time and pace of learning and gain better confidence to conduct spoken interaction with their peers, the teachers and the target language community, as long as they perceive that their language content and competence is 'ASR approved'.

MC: It's somewhere in between after class practice and my assessment for the class. They will get to use this tool to practice

and check themselves before being checked by me... so just to prepare themselves. (MC-E-E, 115)

MS: They would have the opportunity to practice with the AI... and nobody would know other than themselves if they made an error. Nobody would know how much time they put into practice, so they would not appear to be left behind. Instead, they could all go back and practice, and come back with rather okay pronunciation. For some of them that I know are not very good at pronunciation and tones, they get the chance to make it up. (MS-E-E, 105)

Interviewees also reported that, in comparison with some new teachers who are still learning to adjust their use of target language to be suitable for teaching, the AI actually has better language control over the range and difficulty of the content and expressions used when engaging with the students.

The feedback and instruction the tool provided are always comprehensible for the students as they were programmed based on students' current level as well as their input when engaging with the tool. It is significant as firstly, it helps to create a feeling and perception in students that the AI is there to help, so it fosters a basic kind of trust between the student and the AI. Secondly, as the AI does not create new learning necessities and it copes with students' levels and input, students could focus on their oral production, which is the area they need the most practice as identified by the interviewees when discussing challenges in learning.

SC: The information returned by the AI is always... is always comprehensible for my students. They will always be able to understand what the AI is talking about, which is VERY VERY important.

HW: Why is it so important?

SC: Because we want them to practice what they've already learned. we don't want to add another layer of cognitive workload on top of the conversation. So they could focus on what they can say, instead of constantly trying to figure out what the other people are talking about. (SC-E-E, 100)

It is also interesting to notice that interviewees mention that *Trip2China* and the tool could offer more convincing comments for students as they perceive that the tool is always objective and not biased. According to the teachers, students would consider the feedback provided by the tool is always objective. It is a result of a comparison between students' performance and an inherited standard of the tool. It does not have an agenda to motivate the students and complement them, which they might experience with their teacher from time to time. It also does not give negative comments unintentionally due to the ignorance of their level of learning, which they might experience when engaging with native speakers.

MS: For example, when I was learning with a teacher, even if they are trying to encourage you, sometimes you really could see the disappointment in their eyes and faces (laugh) when they give you a compliment, you know you are not doing great, but they just give you compliment anyway...

HW: (laugh) so you know they are not sincere...

MS: Yes, and you can REALLY tell. And actually, I don't think that is very helpful... at all. But I'm just going to say, I think it's such huge pressure on the teacher as well. You can't... I mean... I probably wouldn't be able to do it... you know... keep being genuinely positive in a convincing way ALL THE TIME. So it's an advantage of the AI. It always had a smile on it and will only speak positive words back to you. It will not judge you but just tell you where you need to improve. (MS-E-E, 115)

5.3.5.3 Impact of the iCALL tools on assessing spoken Chinese: Teacher perspective

Teachers mentioned that the two tools could be used in self-assessment and formative assessment in various ways.

The first tool (*ViewTones*) is mainly used as a self-assessment tool to improve the perception and production of tones, while the second tool (*Trip2China*) is more commonly used as a formative assessment tool to assess the oral interaction competence of the students. As per interviewee comments about assessment, they mentioned more from a teacher standpoint about how both tools are used in formative assessments.

For the *ViewTones*, interviewees mentioned that it is a good tool to reflect and assess the process of pronunciation, whether in the format of formative assessment by a teacher or self-assessment, to inform teaching and learning with detailed and concrete information and instruction. Also as it is a gamified tool, when using it for assessment, it takes away the seriousness element of the assessment process, which helps particularly beginner learners to keep their motivation and maintain their language confidence.

CT: The assessment tends to become more summative if you only measure the outcome. And then with the tool... I could assess and monitor the process of their learning. And then, especially for the transition year, they are not, I mean the main purpose for them to learn the language is to build up their confidence and interest in that language rather than to achieve a certain level of proficiency. I mean, given time they will be there but the confidence and motivation... it's more difficult to achieve, and it is difficult to measure. (CT-E-M, 115)

Interviewees reported that implementing *Trip2China* in formative assessment improves the validity of the test. Conventionally when conducting a formative assessment for oral interaction, the teacher needs to play two roles simultaneously. The first role is the speaker who interacts with the students to maintain the conversation and the second is the examiner who keeps records and assesses students' oral competence.

When using *Trip2China* to conduct assessments for oral interaction, the tool could take over the speaker role so the teacher could focus more on the examiner role. It reduces teachers' workload while improving the validity of the assessment, which is particularly useful for newly qualified teachers who are still improving their control of the target language for teaching.

SC: I would prefer to use the second tool to build into assessments. I found it easier because that reduces my workload of managing the language I say. I could determine the range of the language returned beforehand, so I don't need to physically memorize it? So it is for me... so I think it's easier for me on that part (language control). (SC-E-E, 130)

5.3.5.4 Limitations and insights for future development of the iCALL tools: Teacher perspective

Besides the positive feedback gained from the interviewees, there are also several limitations to the current versions of the two tools. Bear in mind that the tools will not be the solution for everything while with the hope that the tools could be improved along with further development of the research and technology, interviewees provide their insights on further improving both tools.

There are two evident issues reported by the interviewees. The first issue is about heritage students particularly, that they generally do not engage well with both tools. As identified by the teachers, the reason seems to be that they do not share the needs and challenges both tools aim to address for the CFL learners.

WX: For the heritage learners, I don't think they engage quite well with the tools. They might tend to think it is a little bit childish, as their level of the language is beyond that. Also, for the second tool, it is a good opportunity to practice oral for the Irish students. But for the heritage students, they probably have some native speakers that could talk to at home. (WX-E-M, 70)

The second issue, on the surface, is the balance between the entertaining and educational design of the *ViewTones*. It is reported by an interviewee that students in the class engaged particularly well with the *ViewTones*. They are actively playing the game while the interviewee trailed the tool in class. However, the focus of their engagement is more on playing rather than studying.

WX: Sometimes they just focus too much on the playing side of it. They will find strange ways of playing the game... sometimes they would try to make funny noises and see how they could get away with the game. So they're playing with it rather than... like... use it as a tool for study. (WX-E-M, 60)

While looking deeper at the issue, the core is the technical configuration in restricting users to controlling the character of the game by using the correct combination of pronunciation instead of relying solely on the pitch. As the research designed the

mechanic of the game is to use the tool (human-simulated AI) to recognise pitch contour and reflect its changes in the movement of the game character, there was a bug that the user could use any pitchy sound, regardless of whether in Mandarin pronunciation or not, to manoeuvre the game character. It is hoped that with the advancement of Mandarin ASR, the complete design could utilise a combined code of recognising not only the tone or pitch contour but also the syllable pronunciation to enable and restrict the control of the game character.

Besides the issues reported, the interviewees also provided their insights on where and how to improve both tools. Some suggestions could be useful but are not evidence-based, for example, one interviewee mentions that for *Trip2China*, real-person avatars could provide a better immersive experience for students while this is only based on personal opinion instead of feedback from students. Also, some suggestions are purely technical, such as making the tools accessible for multiple platforms (e.g., PC, tablet, smartphone). As for the research, the two suggestions mentioned below keep a focus on the pedagogical indication of the whole implementation model of iCALL.

For the *ViewTones*, two suggestions are mentioned. The first suggestion is to add a competition element to assist its role in teaching and learning.

SC: You know for the first tool, it's all fun playing it. If... last time I try to use this, I try to use this in the context of a competition. Because it happened very naturally among the students. They will compare and see who beat the game in the shortest amount of time. I was thinking... I don't know whether it would be very difficult to make... but if there could be a mechanism to record how many gold coins you get in one game run or you have a time calculator on top of the screen, would it contribute towards a competition mechanic? (SC-E-E, 180)

The second suggestion is mutual for both *ViewTones* and *Trip2China*, which is to add a built-in recording function. The rationale is that, if the tools were used as a self-practice tool after class, then teachers no longer have access to the data on students' performance. When in the circumstances that the tool itself is not sufficient to guide students, audio or video recording of students' performance could provide a reference for teachers to give more detailed instruction and feedback. For *Trip2China*, it could also be a recording of

the scripts between the student and the AI, which might be useful for both teaching and assessment purposes.

5.4 Results: Students

This section reports on the findings of the quantitative questionnaires and the empirical experiment, which aimed to investigate students' perception and the actual effects of both iCALL tools in assisting the learning of spoken Chinese. Data from the quantitative questionnaires were collected over five weeks. A pre-test questionnaire and a phonological error analysis were carried out in the first week, and then the post-test questionnaire and another phonological error analysis were administered at the end of the five weeks. Comparisons were made between pre-test and post-test data as well as objective learning outcomes and learners' perceptions of their progress in learning spoken Chinese. At the end of the experiment, data about the evaluation of the two iCALL tools were also collected through a questionnaire from participants who used them during the period of the experiment (see Section 3.6.2).

Section 5.4.1 first introduces the demographic information of the student participants. Section 5.4.2 then reports on the findings of the pre-test questionnaire, including the impact of language learning experience and current target language proficiency in various aspects of participants' foundation status (e.g., motivation, confidence). Section 5.4.3 reports on findings based on the comparison of the pre-test and post-test questionnaires. Section 5.4.4 reports on the results of the error analysis and Section 5.4.5 reports on the findings of the post-game evaluation by students.

5.4.1 Participants

The participants of the quantitative questionnaires consisting of the empirical experiment are 101 post-primary students from three mixed schools (see Table 12). The schools are located in different areas around the country where clusters of Mandarin Chinese learners are comparatively evident. All the participants are studying Mandarin Chinese at ab initio level in Transition Year, intending to continue studying the language in their fifth year as a Leaving Certificate subject (see Section 3.6.2.2).

Table 12 Demographic information of student participants

Groups	Number of participants
Control group A	35
Control group B	32
Experiment group	34
Total	101

At the time of the research, all the participants had formally studied Chinese for about one month. In terms of their oral competence (Appendix H, Section 1, Question 6), 60.4% of the participants could speak only a few words in Chinese, 17.8% of them could speak some simple phrases and the rest 21.8% could conduct some simple conversations while talking slowly.

Beyond the current study of Mandarin Chinese (Appendix H, Section 1, Question 3), 25.7% of the participants studied an additional foreign language, 23.8% studied an additional two foreign languages and 29.7% studied an additional three or more foreign languages. About a quarter of the participants also had some experience in learning Asian languages (mainly Japanese in this context) before or at the time of the research.

As mentioned in the previous chapter (see Section 3.6.2.3 for research design), to investigate the effect of the two iCALL tools, in this study, students are divided into groups. The schools were assigned so that every student in a particular school was assigned the same approach. For the EG (n = 34), *ViewTones*, the full immersive game was implemented to assist with the perception and production of Mandarin tones, and *Trip2China* was introduced as a routine after-school activity to assist the practice and exposure of spoken Chinese. Control group A (n = 35) adopted conventional teaching and learning without the assistance of both tools, while additional asynchronous visual feedback generated by *Praat* was provided by the teacher to assist the tone acquisition (See Figure 23). Control group B (n = 32) used the same approach for teaching and learning as control group A, while the feedback provided by the teacher was only in a written manner (See Figure 24).

Chinese tones analysis ~~Amanda~~

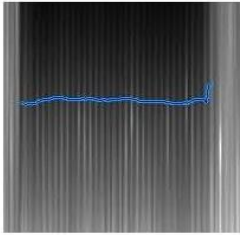

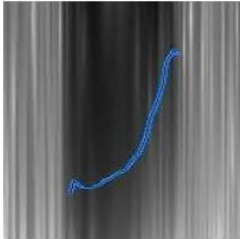
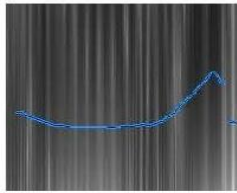

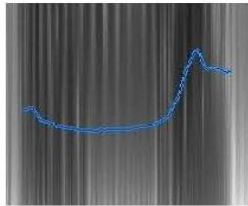
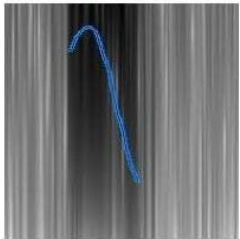
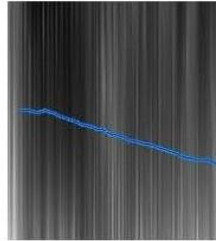
Tones	Description	Pitch contours _ Standard pronunciation of the 4 tones	Pitch contours _ Amanda's pronunciation of 4 tones
First tone	High and level sound, naturally prolonged.		
Second Tone	Rising tone, from low to high, just like the pitch in question		
Third Tone	First falling and then going up again		
Forth Tone	Total falling tone which starts out very high and falls short and strong		

Figure 23: Example of Praat report to the students of Control group A

Chinese tones analysis

Hi ~~Anna~~

Generally, your pronunciation of the four tones was good. The second tone could be improved with more practices.

Here I attached a description of the four tones and wish this could help you to improve.

Tones	Description
First tone	High and level sound, naturally prolonged.
Second Tone	Rising tone, from low to high, just like the pitch in question
Third Tone	First falling and then going up again
Fourth Tone	A total falling tone which starts very high and falls short and strong

Figure 24: Example of feedback to the students of Control group B

5.4.2 Findings of the pre-test questionnaire

This section reports on the result of statistical tests performed to examine the potential relationship between the 7 questions in Section 1, factors (i.e., previous language learning experiences, current Chinese language competence) on participants' answers to the 5 questions in Section 2 of the pre-test questionnaire (see Appendix H). For example, the self-evaluation of their familiarity with tones and spoken Chinese. It is to establish a foundational understanding of the participants and their performance as a baseline at the beginning of the five-week experiment.

SPSS was used for the data analysis. For all items written on five-point Likert scales, a larger value represents better performance (Appendix H). To keep the consistency, the item about anxiety is reversely coded, that a larger value represents a lower level of

anxiety. The main statistical tests performed are t-test and ANOVA. For the t-test, the Welch readout is adopted, and the results of the Mann-Whitney test are consulted when the violation of equal variance occurs. For the ANOVA, the Kruskal-Wallis test is performed when assumptions about the normal distribution of data and residuals were violated (see Section 3.6.1.4).

5.4.2.1 Impact of language learning experiences

To investigate the potential influence of previous language learning experiences on the pre-test questionnaire results, participants are divided into four groups. Besides Mandarin Chinese, the first group studies one additional foreign language ($n = 21$), the second group studies two additional foreign languages ($n = 26$), the third group studies three additional foreign languages ($n = 24$) and the fourth group studies more than three additional foreign languages ($n = 30$).

A one-way ANOVA is performed initially to look at the potential differences between groups. However, neither the ANOVA nor the post hoc pairwise comparisons return any statistically significant results, which indicates that the previous experiences in learning foreign languages do not have a significant impact on participants' pre-test results.

In the context of the present research, foreign language study usually refers to the study of European languages. The scripts of the languages students were exposed to are usually phonetic-based. The experience of studying Asian languages, particularly those that are similar to Mandarin Chinese with a logographic writing system, may have a more significant impact on the pre-test results.

To further scrutinise this topic, a follow-up independent sample t-test is performed to explore potential differences between participants who have experiences in learning Asian languages ($n = 24$) and those who do not have such experiences ($n = 77$). It should be noted that according to the information provided by the gatekeepers, the Asian languages normally refer to Japanese in the context of the current research. Four out of five dependent variables yielded significant results. A summary of the results is presented below (see Table 13).

Table 13 Influence of experiences in learning Asian languages

Item	Mean		Mean difference	t	Sig. (2-tailed)
	Have Exp	No Exp			
Perception	3.750	2.649	1.101	3.373	0.002*
Production	3.542	2.519	1.022	3.144	0.003*
Confidence	3.167	1.844	1.323	4.430	0.000*
Anxiety	3.042	3.338	-0.296	-0.859	0.396
Motivation	4.083	2.649	1.434	4.608	0.000*

Note: * = $p < 0.05$

It shows that in general, participants who have experience in learning Asian languages have better initial performance in spoken Chinese perception and production while also being significantly more confident and motivated in learning spoken Chinese, in comparison with participants whose Chinese learning experience was their initial exposure to the study of Asian languages. It is also interesting to note that, though statistically not significant, participants who studied Asian languages before appeared to be mildly more anxious about learning Chinese, which might reflect that they have a more concrete understanding of the challenges in learning Chinese through their previous experiences in learning other Asian languages.

5.4.2.2 Impact of Chinese language competence

This section reports the impacts of Chinese oral competence (Question 6, in Appendix H) on students' perception, production, confidence, anxiety and motivation (Questions 8-12, in Appendix H).

In terms of participants' Chinese language competence, they identified themselves to be at different stages of being able to (i) speak a few words ($n = 61$), (ii) speak a few simple phrases ($n = 18$) and (iii) hold a simple conversation ($n = 22$).

To investigate whether their self-reported current level of target language competence would have any impact on the results of the pre-test questionnaire (Section 2), an ANOVA test is initially performed, followed by the Kruskal-Wallis Test due to violation of assumptions. All the items yielded significant results, which are differences

respectively in oral perception ($H(2) = 21.474, p = 0.000$), oral production ($H(2) = 21.358, p = 0.000$), confidence ($H(2) = 27.621, p = 0.000$), anxiety ($H(2) = 7.522, p = 0.023$) and motivation ($H(2) = 31.315, p = 0.000$).

After consulting the results of post hoc tests, the patterns of behaviour for the dependent variables were identified in relation to participants' level of proficiency, which is summarised below.

Figure 25 illustrates the general trends of behaviour for each item, while the changes in value were not all statistically significant. From left to right, the three sets of data represent the increasing level of Chinese proficiency from being able to speak a few words (left column, below abbreviated as 'words') to being able to speak a few simple expressions (middle column, below abbreviated as 'phrases') and then the last set stands for participants who could hold a very simple conversation (right column, below abbreviated as 'conversation').

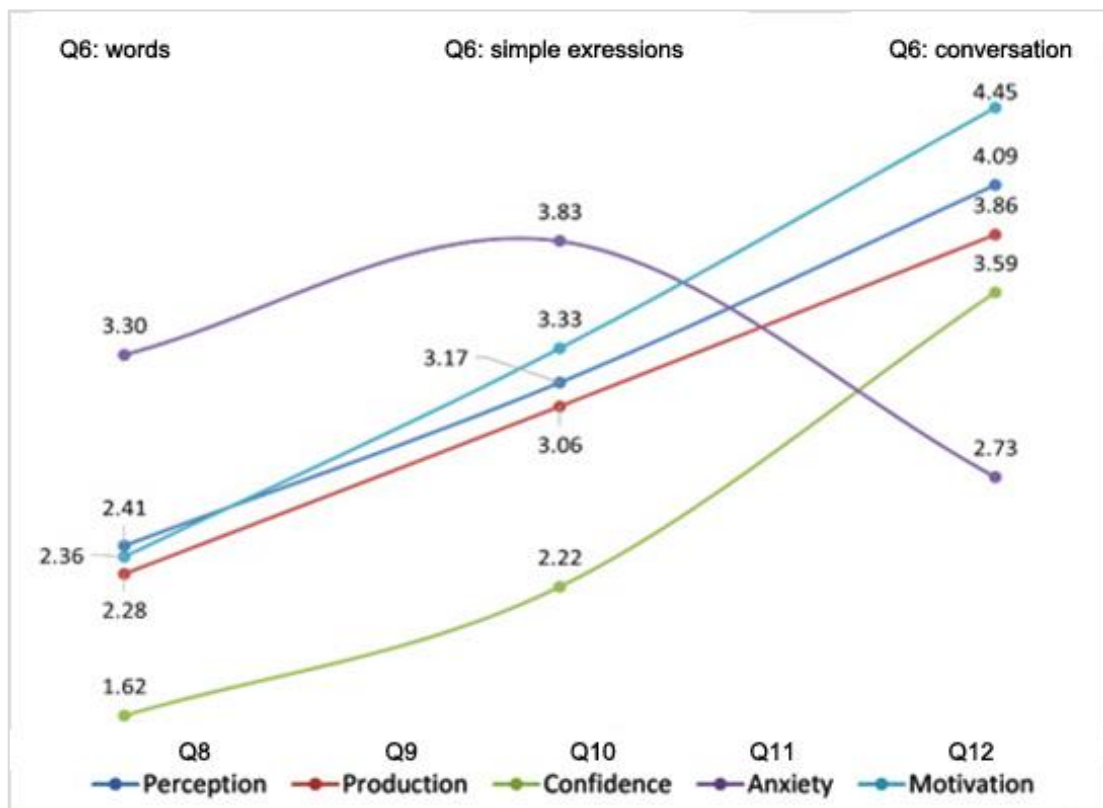


Figure 25 Patterns in pre-test results

First of all, when looking at the general trends of the data, only motivation appears to be increasing steadily across the three stages of words ($M = 2.361$, $SD = 1.415$), phrases ($M = 3.333$, $SD = 1.283$) and conversation ($M = 4.455$, $SD = 0.963$). Secondly, improvement of capacity in oral perception ($MD = 1.681$, $CI = [0.978, 2.384]$, $p = 0.000$, $d = 0.525$) and oral production ($MD = 1.585$, $CI = [0.856, 2.314]$, $p = 0.000$, $d = 0.526$) are only viable between the words stage and the conversation stage. In comparison, improvement of perception in confidence is only evident between the phrases stage and the conversation stage ($MD = 1.369$, $CI = [0.327, 2.410]$, $p = 0.008$, $d = 0.693$). While for the same period between the phrases stage and the conversation, the anxiety among participants seemed to be increasing as well ($MD = -1.106$, $CI = [-2.097, -0.115]$, $p = 0.026$, $d = 0.264$).

5.4.3 Findings of the pre-test and post-test comparison

This section compares the pre-test and post-test on students' perception, production, confidence, anxiety and motivation (Questions 8-12, in Appendix H).

As mentioned in Section 5.4.1, participants are arranged into three groups according to different treatments received about oral Chinese provision and practice. To summarise, the experimental group was the only group that implemented the iCALL tools ($n = 34$), control group A was provided with asynchronous teacher-generated visual feedback ($n = 35$) and control group B was provided with written feedback ($n = 32$). A pre-test questionnaire (Appendix H, Section 2) and a post-test questionnaire (Appendix H, Section 2) were administered among participants in each group, and the results were analysed by a series of paired sample t-tests to investigate and compare the achievement of each group in learning spoken Chinese. This section reports on the results of these comparisons among the three participating groups.

5.4.3.1 General comparisons

To explore participants' perception of the five investigated areas and the differences between groups, paired-sample t-tests are conducted and the results are outlined below (see Table 14). In general, most comparisons among the three groups between the pre-test questionnaire and post-test questionnaire yield statistically significant results. This

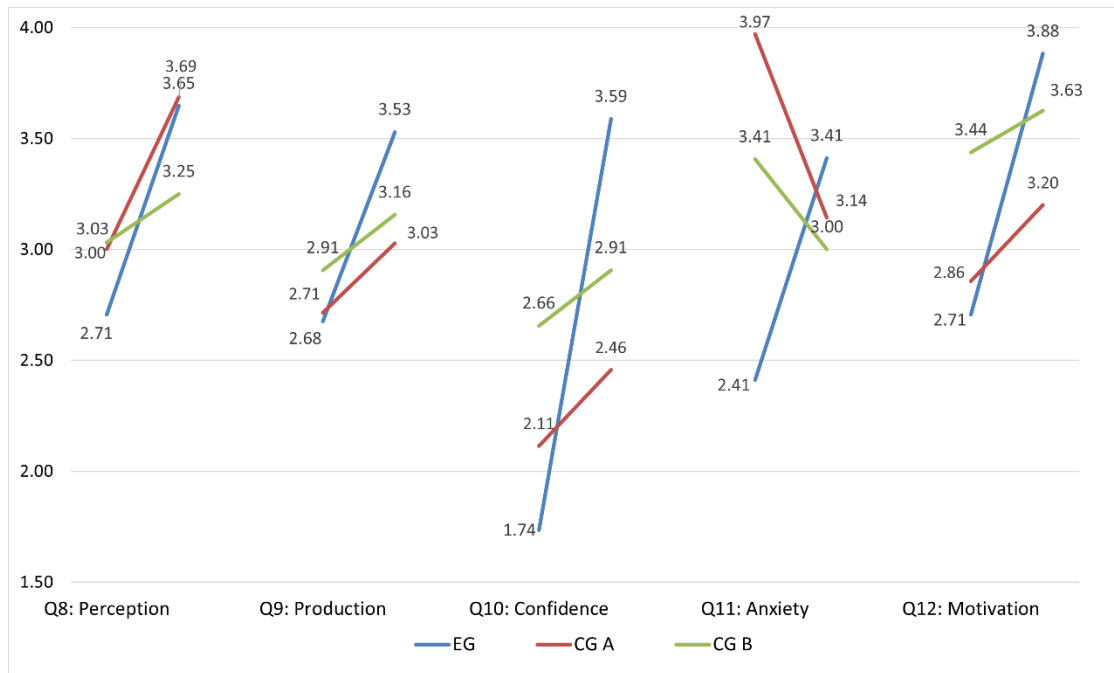
result indicates that the different treatments have made an evident impact on the five key areas of investigation. The only exception is the motivation item for control group B ($p = 0.447$), which indicates no self-perceived changes in the motivational status of the participants in control group B.

Based on Figure 26, for the experimental group, participants perceived an improvement in all five areas. Their perception of competence in oral perception and oral production as well as their level of motivation and anxiety have all changed from a relatively neutral level to moderate positive (average MD = 0.993). In particular, their level of confidence starts relatively low ($M = 1.735$, $SD = 0.963$) but improves quite dramatically (MD = 1.853, CI = [1.487, 2.219], $p = 0.000$, $d = 1.048$) with the implementation of the two iCALL tools.

Table 14 Paired wise comparisons between groups

Group	Item	Mean		Mean difference	SD	t	Sig. (2-tailed)
		Pre-test (Q8-Q12)	Post-test (Q8-Q12)				
EG (with iCALL tools)	Perception	2.706	3.647	0.941	0.814	6.739	0.000*
	Production	2.676	3.529	0.853	1.019	4.881	0.000*
	Confidence	1.735	3.588	1.853	1.048	10.307	0.000*
	Anxiety	2.412	3.412	1.000	0.853	6.837	0.000*
	Motivation	2.706	3.882	1.176	1.141	6.014	0.000*
CG A (with visual feedback)	Perception	3.000	3.686	0.686	0.867	4.680	0.000*
	Production	2.714	3.029	0.314	0.676	2.750	0.009*
	Confidence	2.114	2.457	0.343	0.765	2.652	0.012*
	Anxiety	3.971	3.143	-0.829	1.200	-4.084	0.000*
	Motivation	2.857	3.200	0.343	0.725	2.797	0.008*
CG B (with written feedback)	Perception	3.031	3.250	0.219	0.420	2.946	0.006*
	Production	2.906	3.156	0.250	0.508	2.784	0.009*
	Confidence	2.656	2.906	0.250	0.440	3.215	0.003*
	Anxiety	3.406	3.000	-0.406	0.911	-2.523	0.017*
	Motivation	3.438	3.625	0.188	1.378	0.770	0.447

Note: * = $p < 0.05$



Note: for each item, left = pre-test data, right = post-test data

Figure 26 Pre-test and post-test changes between groups

For control group A, a mild increase is discovered in the results of oral production, language confidence and learning motivation. With the assistance of asynchronous visual feedback, there is an evident improvement in oral perception competence as recognised by the participants (MD = 0.686, CI = [0.388, 0.983], $p = 0.000$, $d = 0.867$). However, such a measure also appears to cause a significantly higher level of anxiety (MD = -0.829, CI = [-1.241, -0.416], $p = 0.000$, $d = 1.200$).

For control group B, moderate improvements are seen in oral perception, oral production, and confidence (average MD = 0.240), while the positive change in motivation is not significant statistically. Similar to control group A, there is also an increase in participants' level of anxiety (MD = -0.406, CI = [-0.735, -0.078], $p = 0.017$, $d = 0.911$), but the increase is much less significant.

5.4.3.2 Impact of language learning experiences

This section reports the impacts of language learning experiences (Question 3, in Appendix H) on students' perception, production, confidence, anxiety and motivation (Questions 8-12, in Appendix H) in the pre-test & post-test after the 5-week treatment.

According to the number of foreign languages participants studied or currently studying, the experimental group is divided into four sub-groups studying one additional language ($n = 4$), two additional languages ($n = 7$), three additional languages ($n = 12$) and more than three additional languages ($n = 11$).

As reported earlier, these experiences in learning other foreign languages do not seem to benefit the learning of spoken Chinese evidently. To test whether this finding is consistent with the implementation of the iCALL tools, paired-samples t-tests are conducted and the results are reported below (see Table 15).

Based on the results of the tests, it appears that if only one additional foreign language is studied, which is also all European languages, then no positive changes could be identified by the test to be statistically significant. However, as far as the additional languages being studied are plural, an evident positive impact could be discovered on the implementation of the iCALL tools.

In general, the effect of the iCALL tools in improving Mandarin tone perception ($MD = 1.286$, $CI = [0.406, 2.165]$, $p = 0.012$, $d = 0.951$) and reducing learning anxiety ($MD = 1.429$, $CI = [0.380, 2.477]$, $p = 0.016$, $d = 1.314$) appears to be particularly useful for participants who study two additional languages. With more additional languages studied, such experiences could synchronise the implementation of the iCALL tools in improving oral production ($MD = 1.000$, $CI = [0.264, 1.736]$, $p = 0.013$, $d = 1.095$). Participants' language confidence could also be further strengthened by taking on Mandarin Chinese as an Asian language after studying multiple European languages through the feedback provided by the iCALL tools ($MD = 2.273$, $CI = [1.595, 2.951]$, $p = 0.000$, $d = 1.009$).

Some more interesting trends could be found when comparing the impacts of language learning experiences among the three groups (exclude the first group as impacts were not significant). See Figure 27 below. The implementation of the two iCALL tools could help with the tone perception more for participants who studied fewer foreign languages while its effect for assisting production was relatively the same regardless of how many languages participants studied. Also in line with the results of the pre-test questionnaire (see Section 5.4.2.1), the more languages participants studied, the more anxious they tend

to be when studying spoken Chinese, even though they might also have more confidence in learning the language.

Table 15 Language learning experiences in the experimental group

Group	Item	Mean		Mean difference	SD	t	Sig. (2-tailed)
		Pre-test (Q8-Q12)	Post-test (Q8-Q12)				
Additional language = 1	Perception	2.250	3.250	1.000	0.816	2.449	0.092
	Production	2.250	3.000	0.750	0.957	1.567	0.215
	Confidence	1.500	3.250	1.750	1.258	2.782	0.069
	Anxiety	2.500	3.250	0.750	0.957	1.567	0.215
	Motivation	3.000	4.250	1.250	1.258	1.987	0.141
Additional language = 2	Perception	2.286	3.571	1.286	0.951	3.576	0.012*
	Production	2.429	3.286	0.857	1.069	2.121	0.078*
	Confidence	1.429	3.286	1.857	0.900	5.461	0.002*
	Anxiety	2.571	4.000	1.429	1.134	3.333	0.016*
	Motivation	2.857	4.143	1.286	0.951	3.576	0.012*
Additional language = 3	Perception	3.167	4.000	0.833	0.835	3.458	0.005*
	Production	3.083	3.833	0.750	1.055	2.462	0.032*
	Confidence	2.167	3.667	1.500	1.087	4.780	0.001*
	Anxiety	2.417	3.667	1.250	0.622	6.966	0.000*
	Motivation	2.750	3.750	1.000	1.279	2.708	0.020*
Additional language >3	Perception	2.636	3.455	0.818	0.751	3.614	0.005*
	Production	2.545	3.545	1.000	1.095	3.028	0.013*
	Confidence	1.545	3.818	2.273	1.009	7.470	0.000*
	Anxiety	2.273	2.818	0.545	0.688	2.631	0.025*
	Motivation	2.455	3.727	1.273	1.191	3.545	0.005*

Note: * = $p < 0.05$

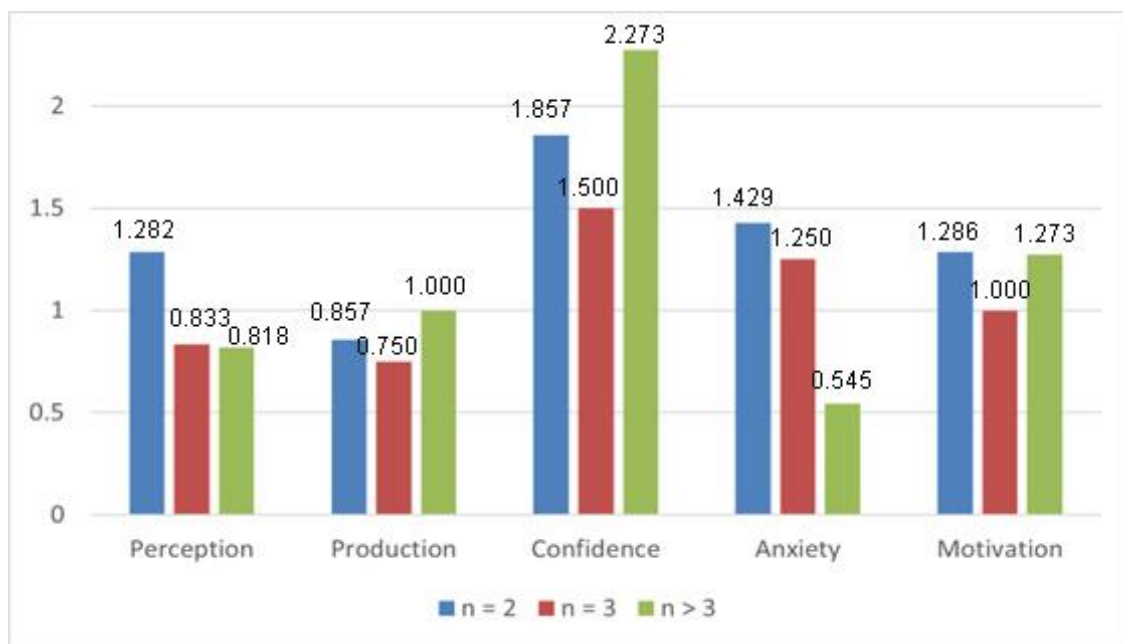


Figure 27 Impact of language learning experiences (Mean differences)

The research also intends to compare the results of participants with different language competencies. However, the majority of participants in the experimental group are at the level of being able to speak a few words ($n = 27$) while the rest could speak up to some simple phrases ($n = 5$). The group distribution could not meet the requirement to perform meaningful statistical analysis.

To investigate the potential impact of prior experience in learning Asian languages, particularly Japanese in the context of this research, comparisons were made between pre-test and post-test results among participants grouped by their experience. The results indicate that the iCALL tools (EG) did not appear to significantly benefit participants with prior Asian language experience, except for an increase in language confidence (MD = 2.667, CI = [1.232, 4.101], $p = 0.015$, $d = 0.577$). No statistical significance was observed in the other four areas.

In comparison, the two tools appear to be quite helpful for participants who do not have experience in learning Asian languages, and all five areas yield significant results of improvements between the pre-test and post-test questionnaires (See Table 16).

Table 16 Mean differences of participants with no Asian language learning experiences

Item	Mean difference	SD	Interval of the		t	Sig. (2-tailed)
			Lower	Upper		
Perception	1.000	0.816	0.701	1.299	6.819	0.000*
Production	1.774	1.055	1.387	2.161	9.359	0.000*
Confidence	1.065	0.854	0.751	1.378	6.942	0.000*
Anxiety	0.935	1.031	0.557	1.314	5.053	0.000*
Motivation	1.290	1.131	0.875	1.705	6.351	0.000*

Note: df = 30, * = p < 0.05

This contrast in results could be potentially explained that students with previous Asian language learning experiences have already benefited from such experience, so the effect of the relatively short-term and later experience with the tools was no longer in the designated areas as significant as it was for the other cohort of students. Their perception and production skills were improved over the course of the previous study and their motivation in learning this cohort of languages has been stabilised already. However, it is interesting to note that students may take the feedback of the tools as an additional reflection of their performance in learning and communication, to explain the increase in language confidence.

5.4.3.3 Impact of game experiences

This section reports the impacts of game experiences (Question 5, in Appendix H) on students' perception, production, confidence, anxiety and motivation (Questions 8-12, in Appendix H) in the pre-test & post-test after the 5-week treatment.

To investigate whether participants' experiences of playing video games have an impact on the effect of the implementation of the iCALL tools, participants of the experimental group are further divided into four sub-groups based on their frequency of playing video games. These four groups refer to participants who (i) play games on a daily basis (n = 15), (ii) play at least weekly (n = 11), (iii) rarely play games (n = 4) and (iv) never play games (n = 4). Paired samples t-tests were administered while results of the Wilcoxon test were also consulted due to violation of assumptions (see Table 17).

Table 17 Impact of game experiences in iCALL implementation

Item	Daily		Weekly		Rarely		Never	
	Z	Sig.	Z	Sig.	Z	Sig.	Z	Sig.
Perception	55.0	0.004*	36.0	0.008*	3.0	0.180	6.0	0.109
Production	28.0	0.016*	10.0	0.066	3.0	0.180	10.0	0.066
Confidence	105.0	0.001*	36.0	0.010*	10.0	0.063	10.0	0.066
Anxiety	45.0	0.006*	36.0	0.008*	10.0	0.059	3.0	0.180
Motivation	36.0	0.010*	36.0	0.010*	10.0	0.059	6.0	0.109

Note: * = $p < 0.05$

Results of the Wilcoxon test indicate that participants who rarely or never play video games do not perceive the implementation of iCALL tools to help improve any concerning perspectives in learning spoken Chinese. Participants who are more used to playing video games seemed to perceive more benefits for the implementation of the two tools.

5.4.4 Findings of the error analysis

To look beyond the subjective perceptions of the student participants on the effect of the iCALL implementation, two phonological error analyses (Pre-test: stage 1 and Post-test: stage 2) are conducted to collect empirical data in comparison with the inferential data acquired from the statistic analysis (see administration process and syllable items used for error analyses in Section 3.6.2.1). Both error analyses were collected and analysed using *Praat* and the results are reported below.

Figure 28 illustrates the error rates of the four Mandarin tones produced by the three groups in the pre-test. To recap, the experimental group is the only group that used the two iCALL tools ($n = 34$), control group A is provided with asynchronous visual feedback ($n = 35$) and control group B is provided with written feedback ($n = 32$).

The pre-test results reflected the foundation of and challenges for each group in learning spoken Chinese. Among the four Mandarin tones, the first tone appears to be the least challenging for oral production while the second tone is the most challenging one for the

participants. This trend was consistent with the experimental group and the control group B.

For the experimental group, the highest error rate is generated by the second tone (52.94%), followed by the third tone and fourth tone (both are 44.12%) and the first tone is the least challenging (27.45%). For control group B, the second tone is also the most difficult one for the participants (51.56%). The third tone (37.5%) and fourth tone (34.38%) are moderately challenging and the first tone is the least challenging (21.88%).

While for the control group A, the trend is slightly different. The fourth tone is the most difficult one for the group (47.15%), then the second tone (45.71%) and the third tone (40%), while the first tone is also the easiest one for oral production (27.62%).

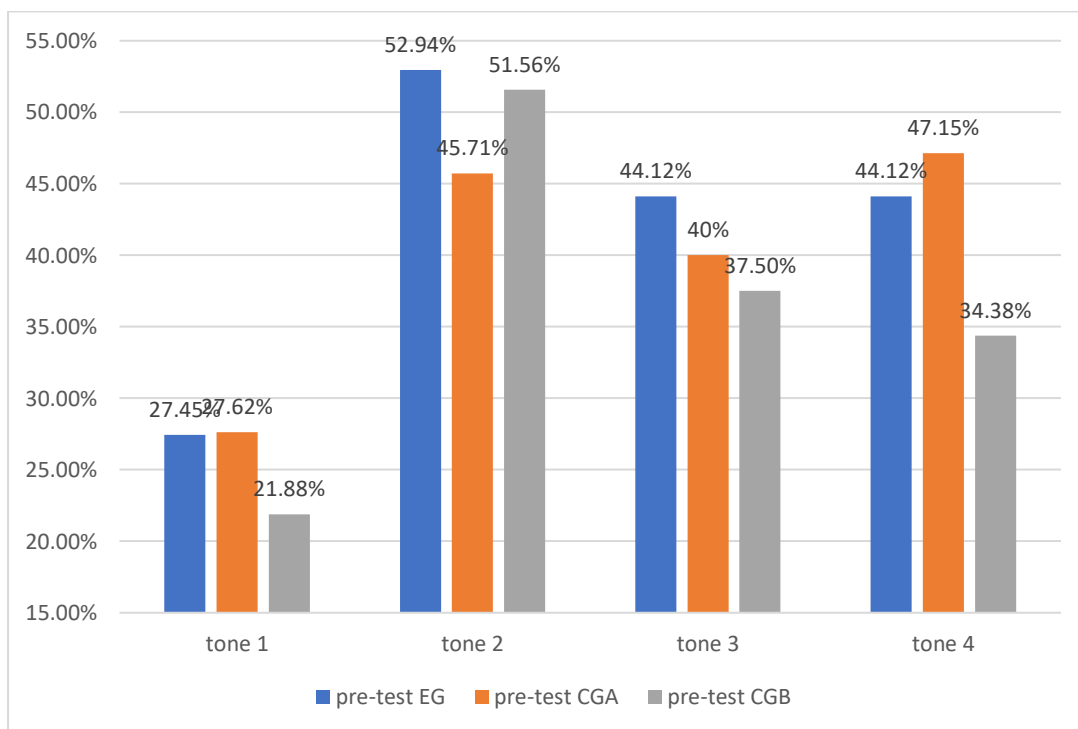


Figure 28 Pre-test error rates: Stage 1

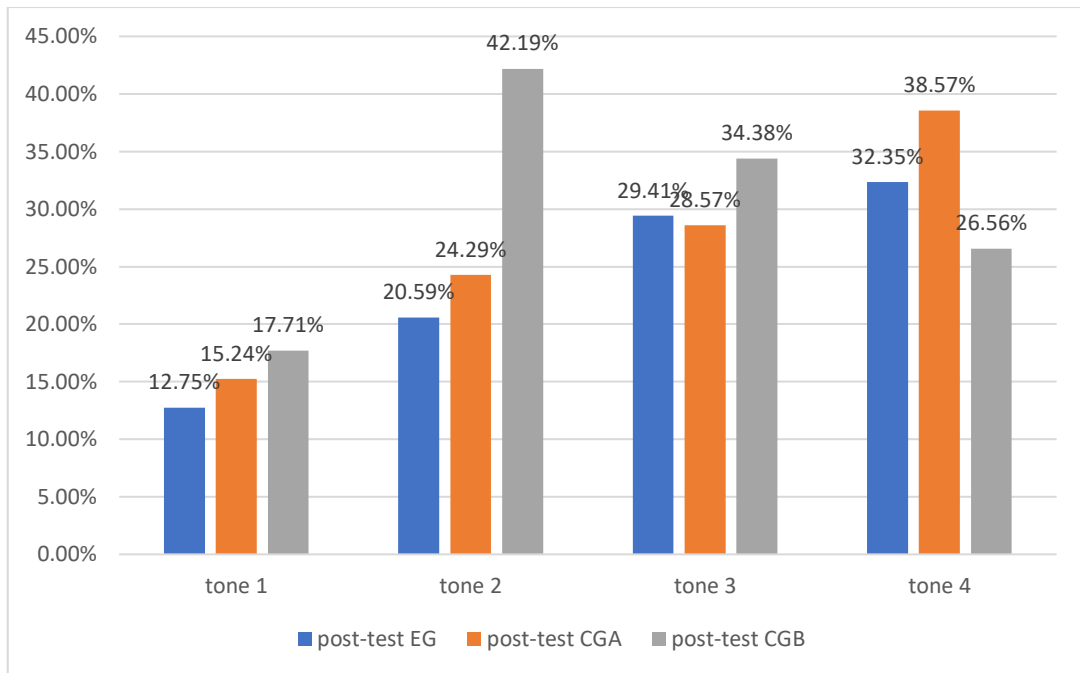


Figure 29 Post-test error rates: Stage 2

Figure 29 illustrates the error rates of the four tones produced by the three groups in the post-test. It is interesting to note that, the grouping of error trends is changed. In the pre-test, the error trend of the experimental group is the same as the control group B, while in the post-test the trend of the experimental group is more in line with the control group A. It could be a reflection of the impact of the same tone visualisation approach adopted by the two groups.

In the post-test, for the experimental group, error rates are evidently reduced while there is an increasing trend of difficulty from the first tone (12.75%) and second tone (20.59%) to the third tone (29.41%) and fourth tone (32.35%). Such a trend, as mentioned above, is the same for control group A that the error rates are increasing by the first tone (15.24%), second tone (24.29%), third tone (28.57%) and fourth tone (38.57%).

For the control group B, the trend of error in the post-test was consistent with the pre-test result. To be specific, the second tone is still the most challenging one (42.19%), followed by the third tone (34.38%) and the fourth tone (26.56%), while the first tone is still the least difficult to produce (17.71%).

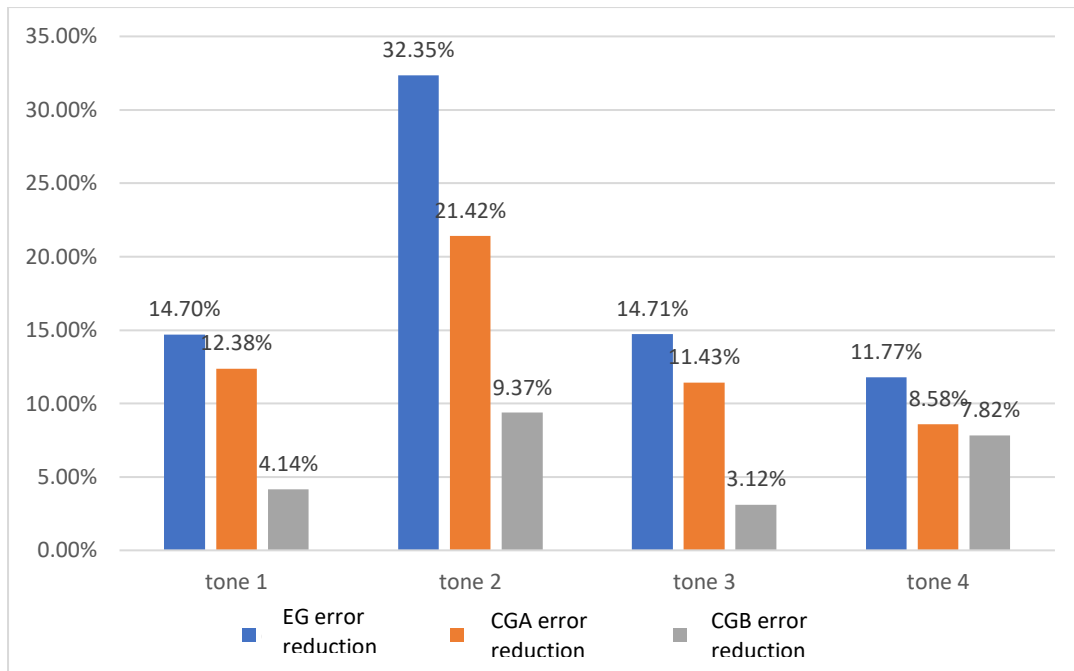


Figure 30 The error reduction rate between Stages 1 & 2 (fig. 28 &29)

Figure 30 illustrates the change in the error rate of the four tones in each group. The implementation of the two iCALL tools appeared to be the most robust method to reduce errors in tone production among the three approaches. It has an average of about 14.7 percentage points reduction rate of errors for the first and third tones, a little bit lower than the 11.77 percentage points reduction rate for the fourth tones, while it is quite effective in reducing the error for the second tone with a reduction rate of 32.35 percentage points.

Adopting the same visualisation approach but asynchronously, the error-dropping rate of control group A is reasonably similar to the experimental group. It has an average of about 12% dropping rate of errors for the first and third tones, while similarly, the approach was slightly less effective for the fourth tone (8.58%). However, the asynchronous approach seemed much less effective in tackling the errors in producing the second tone (21.42%) in comparison with the effect of the iCALL tools (32.35%).

While for the conventional written feedback approach adopted by the control group B, in comparison its effect in reducing tone production errors was much less significant. The drop rates for the four tones were 4.14% for the first tone, 9.37% for the second tone, 3.12% for the third tone and 7.82% for the fourth tone.

5.4.5 Findings of the post-test evaluation-Experimental Group

At the end of the treatment period, participants in the experimental group ($n = 34$) used both iCALL tools for five weeks. Two questionnaires were administered at the end of the research to collect their evaluation of the two iCALL tools. The descriptive data of both questionnaires were reported below (see Table 18 and Table 19). The questionnaires (see Appendix I) adopted the five-point Likert scale, the greater the value the more positive comments on the evaluation item.

In general, participants enjoyed using both the ViewTones ($M = 4.35$) and the Trip2China ($M = 3.85$), while in comparison the enjoyment of the gamified tool is more than the virtual world immersion.

Table 18 Descriptive data of post-test evaluation for ViewTones

	N	Minimum	Maximum	Mean	SD
1. Enjoyment	34	3	5	4.35	0.691
2. Instruction	34	3	5	4.26	0.511
3. Interface	34	3	5	4.21	0.641
4. Technical	34	3	5	4.06	0.600
5. Opportunity	34	1	5	4.29	0.799
6. Immersion	34	1	5	4.26	0.931
7. Reflection	34	2	5	4.18	0.758
8. Outcome	34	2	5	4.03	0.797
9. Progress	34	2	5	4.12	0.808
10. Confidence	34	2	5	4.15	0.821
11. Anxiety	34	2	5	3.74	0.963
12. Motivation	34	1	5	4.15	0.857

Table 19 Descriptive data of post-test evaluation for Trip2China

	N	Minimum	Maximum	Mean	SD
1. Enjoyment	34	2	5	3.85	0.821
2. Instruction	34	2	5	4.03	0.758
3. Interface	34	2	5	3.85	0.610
4. Technical	34	2	5	3.82	0.626
5. Perception	34	2	5	4.21	0.729
6. Production	34	2	5	4.03	0.758
7. Reflection	34	2	5	3.88	0.769
8. Outcome	34	2	5	3.94	0.736
9. Progress	34	2	5	3.97	0.627
10. Confidence	34	2	5	3.94	0.600
11. Anxiety	34	1	5	3.68	0.976
12. Motivation	34	2	5	3.91	0.793

First looking at the evaluation for the ViewTones, items two, three and four investigate the technical side of the evaluation. According to the results of the questionnaire, participants consider the instructions is easy to follow ($M = 4.26$), the interface is easy to use ($M = 4.21$) and the technical difficulty is suitable ($M = 4.06$).

Item five to seven is to evaluate the effect of ViewTones in improving linguistic performance and Mandarin tone acquisition. According to the results, participants consider that the tool is helpful in the perception ($M = 4.29$) and production ($M = 4.26$) of Mandarin tones, and it made learners more aware of their own mistakes ($M = 4.18$). While these results are not quite unified about the effect on perception and production, which may be subject to individual differences among the participants as reflected in both the range of score (range of score = 1-5) and the relatively large standard deviation for item five ($SD = 0.799$) and item six ($SD = 0.931$).

Item eight and item nine look at the learning strategy side of evaluation. Participants perceived that the ViewTones could help assess both the learning outcome ($M = 4.03$) and the learning progress ($M = 4.12$) of their Mandarin tone acquisition.

Items ten to twelve investigate the mentality and well-being of users when engaging with ViewTones. According to the results, participants could gain confidence ($M = 4.15$) and motivation ($M = 4.15$) in learning Mandarin tones through the use of the ViewTones. It also seemed to be able to reduce learning anxiety ($M = 3.74$) but the effect may vary among individuals ($SD = 0.963$).

When it comes to Trip2China, for the technical evaluation, results are still positive but not as pronounced as for the ViewTones. Participants considered the instructions are clear ($M = 4.03$), while the interface ($M = 3.85$) and technical learning curve ($M = 3.82$) scored lower. The fact that ViewTones adopted the classic visual representation and some gaming elements of Super Mario would contribute to a better technical evaluation result for ViewTones.

For assisting in learning spoken Chinese, participants generally consider that Trip2China provides opportunities (item 5, $M = 4.29$) and immersive experiences (item 6, $M = 4.26$) out of class to practice spoken Chinese. It also helps participants to be more aware of their mistakes when conducting oral interactions (item 7, $M = 4.18$). While for the immersive experience, some participants did not think it was convincing (minimum score = 1, $SD = 0.931$). This result is in line with the findings of the interviews (see Section 5.3.3.2), that some teachers mentioned this opinion among students, in particular those with heritage language background.

For strategy and assessment, Trip2China is perceived to be effective in assessing both the learning outcome ($M = 4.03$) and the learning progress ($M = 4.12$). As for mentality, participants also gained confidence ($M = 4.15$) and motivation ($M = 4.15$) in learning and using the language through interaction with the iCALL tool and the AI, while its effect on reducing learning anxiety was less significant ($M = 3.74$).

5.5 Summary

This chapter reported on the findings of the third and final phase of the research project, which is the evaluation of both teachers' and learners' experience with the perception of iCALL tools. The whole chapter was split into two parts. The first part reports on the findings of the qualitative investigation with the teachers. It begins by briefly introducing

the demographic information of the teacher participants and how the iCALL tools are used., then it reports on findings of the existing challenges participants identified and the impact the iCALL implementation had on the three perspectives of the teaching, learning and assessment of spoken Chinese in the context of the present research.

The second part of the chapter reports on the findings of the quantitative research and empirical experiment with the student participants. It also begins by introducing the participants' background, then the report follows the sequence of the research by outlining the findings in the pre-test and post-test questionnaire, the empirical error analyses and the post-test evaluation of both iCALL tools by the student participants.

After reporting on the findings of both phase one (Chapter 4 needs analysis) and phase three (chapter 5) of the research, chapter 6 discusses the findings in conjunction with the literature review to answer the research questions and further summarise and conceptualise the outcome of the overall research project.

Chapter 6 Summary of Findings and Discussion

6.1 Overview

In the final chapter of this thesis, key findings of the present research are summarised, presented and further discussed with a more holistic view of the overall research project and the aims intends to achieve. Section 6.2 summarises the key findings for the relevant research questions and makes further discussions. Section 6.4 outlines the contribution of the present research in the field of TCFL and iCALL. Section 6.5 as the final part of the thesis, reviews the limitations and envisages the future directions for the present research project.

6.2 Summary and discussion of key findings

This section summarises the key findings of the present research projects to answer the research questions and make discussions that engage with the previous research in the field where appropriate. Section 6.2.1 and Section 6.2.2 discuss findings on challenges identified for teachers and learners in the areas of teaching and learning spoken Chinese. Section 6.2.3 reviews the design of the two iCALL tools while the following two sections discuss the impact of the tools in assisting the teaching, learning and assessment of spoken Chinese from the standpoint of teachers and learners respectively.

6.2.1 Challenges for teachers in teaching spoken Chinese

This section answers the first research question and discusses relevant findings.

RQ1: What are the challenges for teachers in teaching spoken Chinese
in the context of Irish post-primary education?

Both the first phase of the research (needs analysis) and the third phase of the research (iCALL evaluation) have identified several challenges for teachers in teaching spoken Chinese in the context of Irish post-primary education. Some of these challenges were common among all the teacher participants, while some challenges were also discovered to be exclusive to native and non-native Chinese teachers.

Table 20 Challenges in teaching spoken Chinese

Challenges identified	Category	Phase 1	Phase 3
1. Inappropriate teaching methods	Common challenges	√	√
2. Universal Design for Learning			√
3. Inadequate digital resources for teaching spoken Chinese		√	√
4. Limited access to suitable digital tools and resources			√
5. Insufficient ICT skills		√	
6. Sustain and further develop learner confidence			√
7. Classroom language (English)	Native Chinese teachers	√	√
8. Instruction and feedback for pronunciation		√	
9. Empathy for students and awareness of their needs		√	
10. Classroom language (Chinese)	Non-native Chinese teachers	√	
11. Demonstration of standard Chinese pronunciation		√	√

According to Table 20, a total of eleven challenges were mentioned by the research participants throughout the initial and final stages of the research. Among them, six challenges were found to be common among all the teacher participants, three challenges appeared to be more significant among native Chinese teachers and two challenges were more severe for non-native Chinese teachers.

In terms of the common challenges, the most significant and most common challenge, identified by both cohorts of teachers and throughout the first and third stages of the research, is the inappropriate teaching methods, especially the inadequate scaffolding methods to help students perceive and produce Mandarin pronunciation. This challenge was identified in previous research carried out in the Irish context (Zhang, 2020) as well as TCFL research from other jurisdictions (Jin, 2013; Orton, 2013; Zhang & Li, 2019).

6.2.2 Challenges for students in learning spoken Chinese

This section answers the second research question and discusses relevant findings.

RQ2: What are the challenges for learners in learning spoken Chinese in the context of Irish post-primary education?

Six identical challenges were reported by both teacher and student participants about learning spoken Chinese in the first phase as well as the final phase of the research. Among them, four common challenges were identified for students on a general level, with one additional challenge being reported to be exclusive for heritage Chinese learners and non-heritage Chinese learners respectively.

Table 21 Challenges in learning spoken Chinese

Challenges identified	Phase 1	Phase 3
1. Perception of Mandarin tones	√	√
2. Production of Mandarin tones	√	√
3. Insufficient opportunity to practice Chinese outside of class	√	√
4. Motivation to use Chinese in an English-dominant environment	√	√
5. Low level of confidence (non-heritage speakers)	√	√
6. The negative L1 transfer (heritage speakers)	√	√

According to Table 21, among the many linguistic components, the Mandarin tone was perceived as the greatest challenge for CFL learners in the current research in Ireland. Both the perception and production of Mandarin tones were proven to be challenging when learning spoken Chinese. Based on the results of the error analysis in phase 1, tone 2 and tone 3 were the most difficult ones for oral production.

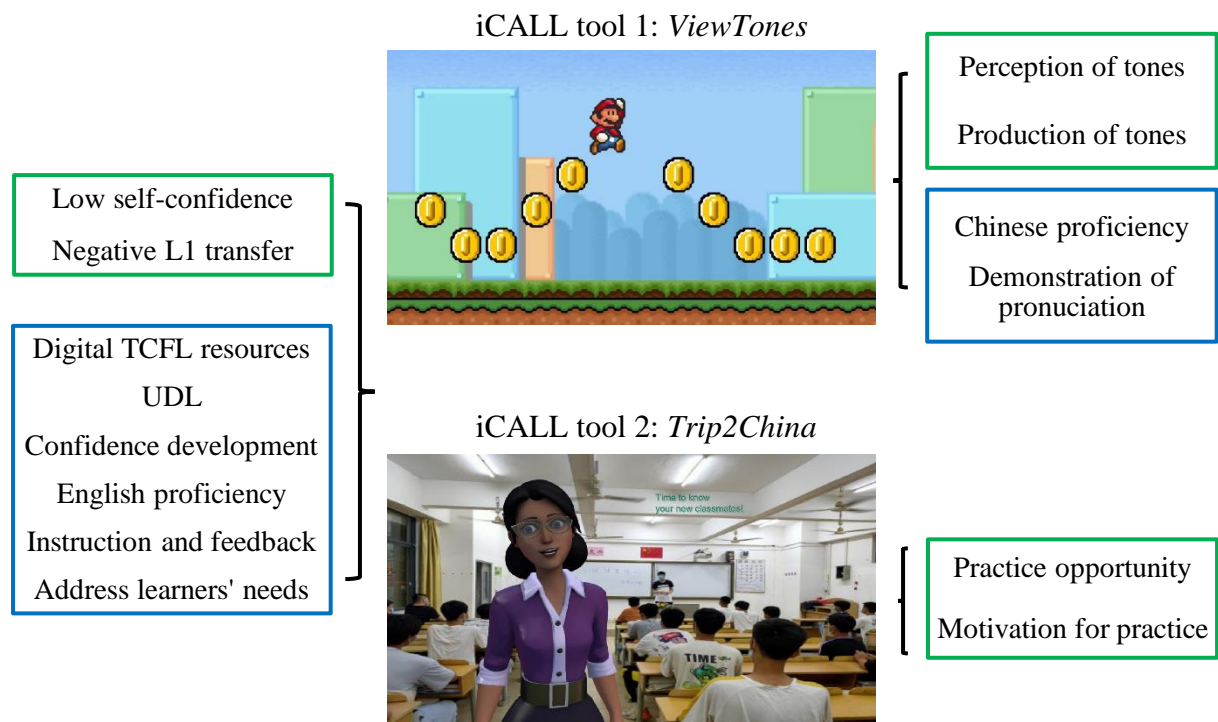
For most non-heritage students, lexical tones are something they never came across in learning either the native language or some other foreign languages (Elliott, 1991). This has significantly contributed to a lower level of confidence in learning spoken Chinese, which was identified to be a particular challenge for non-heritage students.

However, even for heritage speakers, learning the Mandarin tones was not as easy as they perceived. Many of them were not necessarily aware that they or their families spoke a different variation of the Chinese language or a regional dialect instead of Mandarin. This

negative L1 transfer not only affected their acquisition but also their mentality. If the misperception was shared by other family members, the more they practice self-perceived ‘Mandarin’ at home, the more errors they need to amend when coming back to class.

6.2.3 The design of two iCALL tools to address the challenges

Before discussing further the other two research questions about the iCALL evaluations, this section briefly reviews the two iCALL tool prototypes developed for this research. Below summarises the role of the two prototypes in teaching and learning spoken Chinese (see Figure 31)



* Challenges in blues frames are for teaching and challenges in green frames are for learning.

Figure 31 Challenges addressed by iCALL tools

From a learner perspective, *ViewTones* is designed purposefully to address the challenges in the perception and production of Mandarin tones. The visualised process is intended to help learners better perceive the changes in pitch contours through additional visual feedback, and the instant feedback is to guide learners to achieve better oral production. For the teachers, the approach of the tool no longer relies on or is centred around the demonstration of standard pronunciation, which was proven to be one of the challenges in teaching, especially for newly qualified non-native teachers.

The second iCALL tool prototype is named as *Trip2China*. It is a virtual Spoken Dialogue System that aims to provide immersive experiences in a virtual world and provide opportunities for learners to interact with virtual language partners equipped with a simulated AI. Details of the description of this tool, its developing progress and its working mechanics are presented in the previous chapter (see Section 3.5.2).

This iCALL tool is designed to primarily address the issue of insufficient opportunities to practise and use Chinese outside of the class. The exploration of the virtual world provides an immersive and purposive experience for learners to fulfil communicative tasks, which also aims to help motivate them to be more active in practising the language outside of their Chinese classes.

6.2.4 The impact of the iCALL tools in assisting teachers

After reviewing the design of the two iCALL tools, this section answers the third research question and discusses relevant findings.

RQ3: To what extent can iCALL tools aid teachers in teaching and assessing learners' spoken Chinese in the Irish post-primary context?

The effect and impact of the two iCALL tools were evaluated based on the TATL framework of Ní Chiaráin and Ní Chasaide (2015). In the context of assisting teachers, the positive impacts of the two tools were mainly reflected in five areas including (i) technological experience, (ii) in-class teaching, (iii) student engagement, (iv) formative assessment and (v) teacher training.

In the area of technological experience, both tools were reported to be very user-friendly. The two technological tools do not require many ICT skills as a prerequisite. The tools are straightforward with a very short learning curve for navigation and effective usage. This makes them easier to implement in teaching and learning.

In the area of in-class teaching, the integration of both tools could help with classroom management and further improve Universal Design for Learning. While students engage with the tools, teachers can be liberated to focus more on classroom management and direct attention to attend to individual needs timely during class hours.

In the area of student engagement, the gamification mechanic helped better engage students in immediate instances. Games and competitions using both tools can stimulate teaching. Meanwhile, the learning support both tools could provide was the deciding factor for motivating students in the long run, which will be further discussed in the next section (see Section 6.2.5).

In the area of assessment, both tools could be used for formative assessment to inform students' performance on Mandarin tones acquisition and oral interaction. The use of the two tools could take over largely the administration work of the formative assessment, so the teacher could focus more on the evaluation of tasks and performance, which would increase the validity of the assessments. In the meantime, participants also commented that both tools have good potential to be further developed to assist or conduct summative assessments as well.

In the area of teacher training, the use of the iCALL tools could help newly qualified teachers to better comprehend suitable educational theories and pedagogy through actual teaching practice. For example, it is reported that *ViewTones* helps new teachers perceive and understand the challenges students face in learning Mandarin tones and the need to scaffold their teaching. *Trip2China* made some new teachers realise the importance of language control in reducing learning anxiety and increasing meaningful input of the target language (see Section 5.3.5.2).

6.2.5 The impact of the iCALL tools in assisting learners

This section answers the fourth research question and discusses relevant findings.

RQ4: To what extent can iCALL tools aid beginner learners in learning and assessing their spoken Chinese in the Irish post-primary context?

In the context of assisting learners, the positive impacts of the two tools were mainly reflected in four areas including (i) Mandarin tones acquisition, (ii) learner autonomy, (iii) language confidence and (iv) self-assessment.

In the area of Mandarin tones acquisition, *ViewTones* with its instant visual feedback had an evident effect in improving the perception and production of Mandarin tones in comparison with the other two measures (i.e., the written feedback and the asynchronous visual feedback). Based on the results of the experiment, with the implementation of the tool, the error rate in tone production dropped about 15 percentage points on average for all four Mandarin tones, in comparison with the average 5 percentage points reduction rate for the other two measures.

In the area of learner autonomy, both tools provided more opportunities to practice spoken Chinese outside of class hours and learners could be supported with AI. *Trip2China* provided immersive experiences for students to use Chinese to fulfil communicative tasks which encouraged self-directed learning and evaluation. The learning outcomes were designed to reflect the needs of learning and the pace of progress was also determined by learners to cater for individual differences. Personalised feedback could be given in privacy to reduce learning anxiety. All these contributed to a high level of achievable learner autonomy.

In the area of language confidence, the feedback provided by the tools and the (simulated) AI was taken by students as reassurance about their competence and progress made in learning the language. The result was consistent with the findings of Lu (2018), that a dialogue system aided by natural language processing would help increase target language exposure and motivation for the learner. In the current study, student participants perceived the tools to be objective evaluators in addition to their teachers. They considered the evaluation results by the tools with high validity, despite the limitation of technology at the time of the research (e.g., speech recognition for Mandarin tones). Such positive perceptions of participants along with the feedback they received from the tools helped demystify the difficulty in learning spoken Chinese and strengthen their confidence in self-efficacy. According to the results of the experiment, students who have more experience in playing video games gain more confidence but less motivation

than those with less experience, both of which were likely because they were more used to the format of the gamification adopted by the research project (see Section 5.4.3.3).

In the area of assessment, it was reported that both tools could be used by students for ongoing self-assessment. Other than the benefits mentioned earlier in Section 6.2.4, the protected privacy in using the tools and the gamified mechanics also significantly reduced students' anxiety in conducting self-assessment, which has also contributed to a better validity of the assessment. This phenomenon was also mentioned by Sindoni (2014) as a 'side effect' of what an online immersive environment could provide for learners.

An additional interesting finding is that, in terms of the improvement of tone perception and language confidence, both tools were proved to be more effective for students who studied fewer European languages as well as Asian languages, in comparison with peers who have more experiences or exposure of different languages before the time of the research. This finding echoes the contrast between the positive feedback from the non-heritage learners and the heritage speakers to a certain extent. It is also similar to what Chapelle (2001) discovered about Computer-Aided Pronunciation Training, that the effect was stronger for learners who have a stronger foreign accent in comparison to those with better pronunciation already.

6.3 Summary of contribution

The present research is a mixed-method study on identifying the needs and challenges in teaching and learning spoken Chinese in the context of Irish post-primary education and exploring iCALL solutions to address the identified areas in need.

About the contribution made to the groundwork of Chinese teaching and learning, the research itself is a vision of further developing Chinese language education at the post-primary level in Ireland. It is with great pleasure to see the introduction of Leaving Certificate Mandarin Chinese in the middle of progressing the present research, which has made the current project a timely contribution to the further development and support of this initiative.

The present research is the first one to analyse and address the needs for beginner-level teaching and learning of spoken Chinese in the context of post-primary education in Ireland. Some of the key findings in this area echoes TCFL research carried out in the global context over the years, for example, the need to increase target language exposure in overseas teaching contexts (Li et al. 2018) and the ineffective pedagogy in teaching spoken Chinese without proper scaffolding (Liang, 2014).

The research provides some fresh insights into the common and distinct challenges of heritage and non-heritage students in spoken Chinese acquisition in Ireland. The analysis of some of these challenges, for example, the acquisition of tone 3 by heritage learners under significant L1 transfer and the production of tone 2 by non-heritage learners with various European language learning experiences, sheds light on the universal design for learning in teaching practice and urges teachers and educators to be aware of the challenges learners may face in their learning journey. The results of needs analysis and comparisons of different models of teaching and learning spoken Chinese also provide references for initial teacher education to be more targeted to the post-primary teaching and learning context in Ireland.

The introduction of iCALL helps to address some fundamental challenges in TCFL in Ireland. Through the implementation of the two designed iCALL tools and the research process itself which involves in-depth communication with the local TCFL researchers and practitioners, it helps to raise awareness of the benefit and feasibility of iCALL implementation in TCFL. As Leaving Certificate Mandarin Chinese is still in its early stage of implementation in the Irish post-primary education system, all the post-primary Chinese teachers would be new to the curriculum. The tools could help to build up teachers' confidence by assisting classroom management, demonstration of Chinese pronunciation (particularly for non-native Chinese teachers) and the use of classroom language (particularly for native Chinese teachers). They also help novice teachers to create immersive experiences and meaningful communicative tasks to improve and sustain students' motivation and confidence. As a cross-discipline research project, it brings together the educational pedagogy and the technology and further implements iCALL in the context of TCFL.

6.4 Limitation and future direction of the research

There are several limitations of the present research project. From the perspective of the research design, several challenges identified by the needs analysis and iCALL evaluation were not able to be addressed by the two iCALL tools developed for the research. These challenges are (i) the inappropriate pedagogy in teaching spoken Chinese, (ii) the incapability to identify and adapt quality resources for teaching and learning and (iii) the demand for ICT skills for teachers in utilising digital technology for language education. It is hoped that these findings of challenges and needs could be reflected and addressed by future research in the field.

In the meantime, though the current research involved both heritage and non-heritage Chinese learners as research participants, the design and application of both iCALL tools focused more on the needs of non-heritage learners. The results of the research indicated strongly that these two cohorts of learners have different needs in learning spoken Chinese. As a result, heritage learners in the present research did not engage well with the two iCALL tools on a general level, which urged for research to be carried out in this direction to further unveil and tackle their needs.

Also, Chinese language education is still in the process of development in the Irish context. The population of potential teacher and student participants were quite limited at the time of the research. This had a deciding impact on the sample size when it came to the present research, that it was not feasible to utilise research tools that require a relatively large sample size to yield meaningful data. It was envisaged that with the introduction of Leaving Certificate Mandarin Chinese, further development of Chinese language education at the post-primary level and an increasing amount of early career TCFL researchers in Ireland, some if not all of the above limitations will be resolved gradually in the future.

The research was also limited by some practical issues at the time of the research. For example, some of the technology that was envisaged to be implemented into the iCALL tools was either not applicable at the time (e.g., Automatic Speech Recognition factoring in Mandarin tones) or was being commercialised and simply not affordable by the researcher (e.g., AI-powered Spoken Dialogue System). The research was forced to adapt

and use some alternative solutions to achieve the aimed research outcomes, such as inviting human-being TCFL colleagues to simulate the AI for the research.

Also, there was, and persisted at the time of writing this final part of the thesis, a COVID-19 pandemic which has caused a significant negative impact on the research. For example, volunteers recruited in the field of Computer Science had to give up work in creating parts of the iCALL tools in the middle of the research process just to sustain livelihood. Some of the post-primary schools that were approached by the researcher and have agreed to become sites for data collection were forced to cease the collaboration due to the public health guidelines or a change of mentality during the term of the research.

In terms of the future directions for the research, the two proposed iCALL tools have the potential to make a difference in the field of TCFL and feedback has already been collected to make further improvements. Meanwhile, further investigation needs to be made to address the needs of students who have less interest in using the iCALL tools, for example, due to a lower level of ICT skills. There are questions to be answered about this cohort of students. Would iCALL be the appropriate solution for their needs and challenges? Should researchers and practitioners cultivate their ICT skills and raise their interests toward a more robust iCALL solution, or should a more comprehensive approach be developed, incorporating iCALL and other elements in education, to address the needs and backgrounds of these learners?

At the time of the research, due to the dominant role of English as the current lingua franca, the outcome of research in the field of iCALL in language education still primarily features English. It is hoped that through the present research as well as previous and future research in languages including and beyond English and iCALL, more light will be shed on the true nature of language teaching and learning in this digital age.

Conclusion

The purpose of this thesis is threefold. Firstly, it aims to analyse the challenges and requirements of students and teachers in the teaching and learning of spoken Chinese within the context of post-primary education in Ireland. Secondly, it seeks to design iCALL prototypes that can effectively address these challenges, meet the identified needs, and enhance the overall quality of education provision. Finally, the thesis aims to evaluate the impact of these iCALL prototypes and investigate the extent to which they can fulfil their intended design goals, while also exploring their implications for teaching, learning, and research

The investigation uncovered a multitude of challenges faced by teachers in teaching spoken Chinese in an Irish context. Universal Design for Learning, a pedagogical framework aimed at accommodating diverse learners, posed a substantial challenge for Chinese educators. Teaching mixed-level classes consisting of both native and non-native speakers raised the complex issue of pacing, with the use of standard pronunciation as a means of instruction failing to effectively bridge the gap between learners of different proficiency levels.

Language barriers further compounded these challenges. In an Irish educational setting, proficiency in Irish and English was found to be fundamental for effective communication both inside and outside the classroom. The predominance of English as the language of instruction in Chinese as a Foreign Language classrooms, while a common practice, limited exposure to the target language and eroded the confidence of both novice teachers and their students.

Non-native Chinese teachers, lacking a strong command of the language, struggled to demonstrate accurate pronunciation, judge pronunciation errors accordingly, and provide effective feedback. The retention of phonological knowledge in Chinese was shown to rely heavily on the learner's native language or dominant second language, particularly at lower proficiency levels. Additionally, the challenges of managing both lexical tones and intonation concurrently contributed to difficulties in oral demonstration for non-native teachers.

Inadequate access to suitable teaching materials further hindered effective instruction. The limited availability of digital resources tailored for teaching spoken Chinese in an Irish context, often outdated or lacking real-life relevance, posed a significant obstacle. Language and ICT skills were critical for educators to identify and employ quality materials, navigate the online landscape, and source resources suitable for teaching and learning. The convergence of language barriers and insufficient ICT skills compounded the challenge of accessing suitable digital resources for teachers.

Moreover, maintaining students' motivation to learn and practice spoken Chinese, both in and outside the classroom, emerged as a formidable task. Beginner learners faced strong anxiety when learning Chinese phonetics, which persisted until they engaged in meaningful communicative tasks for self-reflection. Native Chinese teachers, lacking experience in learning Chinese as a foreign language, struggled to understand the challenges and needs of their students, making it challenging to design motivating tasks and maintain student engagement.

The challenges identified above were compounded by the unforeseen disruption of a pandemic during the research, leading to additional hurdles in teaching spoken Chinese, including difficulties related to face coverings and the transition to emergency remote teaching. However, the resolution of these challenges was anticipated with improvements in public health conditions.

In terms of a student perspective, they confronted their own set of challenges when learning spoken Chinese in the Irish context. A primary concern was the scarcity of opportunities to practice or use Mandarin Chinese outside the classroom. Several factors contributed to this limitation, including isolated geographic locations with no access to a Chinese community, a lack of interest within the Chinese community to engage in the language, and the pervasive dominance of English in the environment.

Moreover, the socio-cultural aspect posed a unique challenge. In an English-dominant setting, students struggled to find suitable partners for practising a language other than English. Even native Chinese speakers tended to communicate with learners in English, minimising opportunities to practice the target language.

Additionally, good language control was essential to engage with beginner-level learners, yet this skill was found to be lacking among many Chinese speakers, including some teacher participants. Communication that lacked empathy for Chinese learners often eroded students' confidence, further challenging the learning process.

To address these challenges, two innovative iCALL prototypes were designed, aiming to offer instant feedback, enhance learner autonomy, and boost confidence. For teachers, these tools presented valuable additions to the digital resources available in the context of teaching Chinese as a foreign language. The instant multimedia feedback system and flexibility in integrating the tools into teaching and assessment improved Universal Design for Learning and sustained learners' motivation.

The iCALL prototypes were found to be user-friendly and straightforward, requiring minimal ICT skills. They facilitated classroom management and improved Universal Design for Learning, allowing teachers to focus more on individual student needs during class hours. The gamification elements heightened student engagement, while the learning support provided by the tools played a pivotal role in motivating students over the long term. Moreover, the tools were valuable for formative assessment, reducing administrative work and allowing teachers to focus on task evaluation.

In the realm of teacher training, the iCALL prototypes helped newly qualified teachers better understand educational theories and pedagogy through practical teaching experience. These tools provided insights into the challenges and needs of students, fostering empathy and enhancing teaching outcomes, assisting newly qualified teachers in developing appropriate pedagogy and addressing language barriers, ultimately enhancing the teacher-student professional relationship and well-being on both sides.

In terms of Mandarin tones acquisition, the instant multimedia feedback provided by the prototypes significantly improved the perception and production of Mandarin tones. Learner autonomy was bolstered as students were provided with opportunities for self-directed learning and evaluation. The prototypes also contributed to increased language confidence, offering students objective evaluations and validation of their competence and progress in learning the language. Assessment, including self-assessment, was enhanced, reducing anxiety and improving the validity of the assessments. A notable

finding was that the tools were particularly effective for students with fewer prior language learning experiences, underlining their significance in addressing challenges for a wide range of learners.

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Appendix

Appendix A Consent form for teachers

TRINITY COLLEGE DUBLIN
SCHOOL OF LINGUISTIC SPEECH AND COMMUNICATION SCIENCES
Consent Form (for teachers)

*The Design and Evaluation of an Intelligent Computer-Assisted Language Learning
Tool for Beginner Level Chinese Learners in Ireland,
Hongfei Wang, PhD Student in Applied Linguistics at Trinity College Dublin*

The study is designed to create and evaluate an intelligent Computer-Assisted Language Learning Tool for Beginner Level Chinese Learners in Ireland. If I agree to participate, this will involve me taking one or more interviews for 15-20 minutes each, regarding the experience of teaching/learning spoken Chinese. The audio of the interviews will be recorded.

Any information or data which is obtained from me during this research will be treated confidentially. This will be done by avoiding any personal information during the interview and use code to name the interview recording files. Portions of the recording may be played during conference presentations, or written transcriptions may be made for teaching purposes or for linguistic analysis. Data from this research project may be published in future. The original recordings and all copies will be available only to the present investigators.

Materials that are sensitive will be kept in a secure location in the School of Linguistic, Speech and Communication Sciences which will be inaccessible to any third parties.

If I have any questions about this research, I can contact *Ms Hongfei Wang* at *wangh5@tcd.ie* or her supervisor *Professor Neasa Ní Chiaráin* at *Neasa.NiChiarain@tcd.ie*.

Signature of researcher

I believe the participant is giving informed consent to participate in this study.

Signature of researcher

Date

Signature of the research participant

I understand what is involved in this research and I agree to allow my children to participate in the study. [*I have been given a copy of this consent form to keep.*]

Signature of the research participant

Date

Appendix B Semi-structured interview (teacher needs analysis)

Part 1 Background information

1. What is your current Chinese proficiency?
2. How long have you been teaching Mandarin Chinese?
3. What other school subjects do you also teach?

Part 2 Questions regarding spoken Chinese teaching & the implementation of technology

4. Do you have any difficulties in teaching spoken Chinese to beginners?
 - Do you have difficulty in demonstrating Chinese pronunciation?
 - Do you have difficulty in providing feedback and correcting students' pronunciation?
5. Do you think the students have sufficient opportunities to practise spoken Chinese out of class?
6. Compare to the Irish/native Chinese teachers, what is your advantages and weakness in teaching spoken Chinese?
7. Have you ever used any digital tools to assist your teaching of spoken Chinese? Were they helpful? How did you use them?
8. Have you ever recommended any digital tools to your students to help them learn spoken Chinese? Were they helpful? How did they use them?
9. What other helps do you or your students need for the teaching and learning of spoken Chinese, that were not mentioned so far?

Appendix C Consent form for parents

TRINITY COLLEGE DUBLIN
SCHOOL OF LINGUISTIC SPEECH AND COMMUNICATION SCIENCES
Consent Form (for parents)

*The Design and Evaluation of an Intelligent Computer-Assisted Language Learning
Tool for Beginner Level Chinese Learners in Ireland,
Hongfei Wang, PhD Student in Applied Linguistics at Trinity College Dublin*

The study is designed to create and evaluate an intelligent Computer-Assisted Language Learning Tool for Beginner Level Chinese Learners in Ireland. If I agree to allow my children to participate, this will involve them taking a 3-5 minutes anonymous audio recording. No personal information will be recorded. During the process, the children will repeat some selected words, phrases and sentences in Mandarin Chinese after the recorder (the present investigator). It is to compare the recording with the standard demonstration of Mandarin Chinese pronunciation, so to help identify learners' needs and difficulties in the phonetic acquisition of Mandarin Chinese.

Any information or data which is obtained from the children will be treated confidentially. Data from this research project may be published in future. The original data and all copies will be available only to the present investigators. Materials that are sensitive will be kept in a secure location in the School of Linguistic, Speech and Communication Sciences, Trinity College Dublin, which will be inaccessible to any third parties.

If I have any questions about this research, I can contact Ms Hongfei Wang at wangh5@tcd.ie or her supervisor Professor Neasa Ní Chiaráin at neasa.nichiarain@tcd.ie.

Signature of researcher

I believe the parent/s of the participant is giving informed consent to participate in this study.

Signature of researcher

Date

Signature of parent/s of the research participant

I understand what is involved in this research and I agree to allow my children to participate in the study. [*I have been given a copy of this consent form to keep.*]

Signature of parents

Date

Appendix D Recording items for students (needs analysis)

Category	single-syllable word		Disyllable		
1	Tone 1	家	Tone 1+2	花园	
2	Tone 2	词	Tone 2+1	昨天	
3	Tone 3	火	Tone (1+3)	喝水	
4	Tone 4	课	Tone 4+1	面包	
5	Tone 1	心	Tone 1+3	机场	
6	Tone 2	羊	Tone 2+3	厂长	
7	Tone 3	姐	Tone (2+3)	明晚	
8	Tone 4	大	Tone 4+2	大学	
9	Tone 1	三	Tone 1+4	商店	
10	Tone 2	员	Tone 2+4	牛肉	
11	Tone 3	小	Tone (4+3)	问好	
12	Tone 4	日	Tone 4+3	电影	
13	Tone 1	翁			
14	Tone 2	云			
15	Tone 3	我			
16	Tone 4	弟			
17	Tone 1	波			
18	Tone 2	厨			
19	Tone 3	广			
20	Tone 4	快			
Tone 1	5		6		11
Tone 2	5		6		11
Tone 3	5		6		11
Tone 4	5		6		11

Appendix E Semi-structured interview (teacher evaluation)

Part 1 Background information

1. As a native Chinese teacher/ Irish Chinese teacher, how long have you been teaching Chinese in Irish schools?
2. (To Irish Chinese teachers) How long have you been learning Chinese and what is your current Chinese Proficiency? (HSK / CEFR)
3. What type of Chinese module/s do you teach at school?
4. At present, what language levels are most of your students at?
5. Have you used any Tool/App/Web to facility your teaching of spoken Chinese? How does it work?
6. Have you recommended any Tool/App/Web to your students to help them learn spoken Chinese? How does it work?
7. (If not mentioned above) Are there any game-based spoken Chinese teaching and learning Tool/App/Web?

Part 2 Evaluation on the tools

1. At the moment any challenges for you in teaching spoken Chinese?
2. Could the tools benefit your teaching? How?
3. At the moment any challenges for you in assessing spoken Chinese?
4. Could the tools help assess spoken Chinese? How?
5. At the moment any challenges for students in learning spoken Chinese?
6. Could the tools help students learn spoken Chinese? How?
7. Any remaining challenges or areas of improvement for the tools?
8. Are you willing to use the tools in the future?

Appendix F Interview transcriptions (teacher needs analysis)

Transcribed using a simplified version of Neuendorf (2017)'s marking system.

KEY:

(.)	short untimed pause
()	inaudible or unclear speech
(information)	guess at unclear speech
((gestures))	descriptions for movements
please	louder speech
PLEASE	much louder speech
[and then [it was	overlapping speech
(an anonymous ...)	altered information in consideration of privacy and anonymity

Note: The reference codes used to identify transcripts are written in the format of 'initials of the interviewees – code for text (N for Needs Analysis, E for Evaluation) – code for language background of interviewees (M for Mandarin, E for English), number of lines in the transcript'.

Transcript of Audio Interview 01 (CZ-N-M-M)

Present: CZ

Location: coffee place

Date: 28/05/2019

Interviewer: Hongfei Wang

Duration: c. 15 minutes

HW: Well, can I confirm that you are a native Chinese speaker?

CZ: Yes, I could.

HW: How long have you been teaching Mandarin Chinese?

CZ: I have a little bit over two years' experience in teaching Mandarin Chinese in secondary schools.

5 HW: What other school subjects do you also teach?

CZ: Currently, just Chinese, no other subjects.

HW: Based on your teaching experiences... .. Do you have any difficulties in teaching spoken Chinese to beginners?

10 CZ: For beginners, I guess one of the difficulties is the materials we have is still old, so sometimes it is not that easy to let the kids understand how to pronounce the words. Cause we have some of, you know, the recording of the words, the vocabulary. Occasionally we have a video demonstration on how to pronounce the word, how to put your tongue, how to shape your mouth. But sometimes that is not really helpful to kids don't understand it.

HW: Do you think the students have sufficient opportunities to practise spoken Chinese out of class?

15 CZ: No definitely not. In here, they don't, I guess very few of them would have Chinese friends or family members or something like that. The majority of the kids, they don't have any people to practice with, other than classmates after class. So definitely short of opportunities. Maybe sometimes online, but you know there is still quite young adult that would be possible for them. So probably just homework that I left.

20 HW: Well, in regarding to the Chinese pronunciation teaching and learning, do you have difficulty in providing feedback and correcting students' pronunciation?

25 CZ: Feedbacks, let me think about it. It is sometimes, yeah, it is a little bit difficult, like, em, It is normally like I pronounce and they follow, And sometimes I could point out like, I would have a good hunch where they did it wrong, like, they probably put the tongue a little bit too forward where they should relatively behind. But I really don't think I could always do that. Sometimes you know, you don't really know how to instruct the kids to pronounce as you do. And you definitely know that repeating yourself is not gonna be helpful because they don't really know how to do it. So I guess, what we could do is, as I said we could provide them some videos, audios for the correct demonstration. But again, even if you told them, like to put your tongue behind your upper teeth or something like that, or round your lips, sometimes. Again, the instruction itself might not be very clear, and even if it is clear, for the kids it is still not that easy to, to understand. Like we could only, we could only compare, for example, there are 30 10%, If the scale is 1 to 100, sometimes they gave a pronunciation of 10, but we could only repeatedly give a 100% correct pronunciation. But in between how to get from 10 to 100 is very difficult to provide this information. Do you understand what I am talking about? (Yes.) I could only give correct examples and instructions, but how to improve based on the learners' standard, it is not easy.

35 HW: Does the students have difficulty to perceive your pronunciation?

40 CZ: We always have this kind of kids that, sometimes you could hear the differences, sometimes the other kids could hear the differences. But they can't. They think they pronounce exactly what you are pronouncing, but everybody know that is not the way it is. Sometimes it might be only me could tell the difference. Well, even the other kids won't be able to tell the differences. And sometimes you know, for some of the pronunciation, that is really similar to their native language, I guess in English, in Chinese, they would always pronounce very similar to that word in English or Irish. And it is very difficult to drag them to the standard Chinese pronunciation. Like, 'good, hao3', they would always try to pronounce as 'how'. And it is not easy to drag them from 'h-o-w' to 'h-a-o' in Chinese, and even me sometimes it is

45 not that easy, like, that I don't really know how to tell them how to change their pronunciation from 'how' to 'hao'. For the tones, for everything. That's my difficulty.

HW: Compare to the Irish Chinese teachers, what is your advantages and weakness in teaching spoken Chinese?

CZ: I think the advantages would be... I think I could always give, sort of standard pronunciation, so whatever the kids asking for demonstration, I could always give it to them. I don't need to postpone it ... Because I see some of my colleagues, they need to go back to and find some audio online, and give it to the kids, Well I could just give it spontaneously. And also, a little bit more, I guess, linguistic knowledge, because we trained to teach Chinese to the non-native speakers, so a little bit advantage. But, again, as I mentioned, even you have that kind of knowledge, the kids might not be able to comprehend. It is not that easy to break down the theory to practice. For weakness, I guess, the Irish teachers definitely could be explained something they fully understand, much better than I do. And, just for the example I mentioned to that. I think my pronunciation and understanding about the English pronunciation would be sufficient, but somehow it is, I think it is different root, like, when I compare the pronunciation 'how' and 'hao', I compare still from a native Chinese speaker's perspective. But if , if this is my Irish colleague, they would compare from the Irish speaker's standpoint toward Chinese, which is the exact root that would need to give the kids. So, I guess they are in the shoes of the learners. Well, we need to do it oppositely, and sometimes that is not so easy. And also, we, I don't know. Some of the teachers they also teach other subjects, so they see the kids more often, so the kids will listen to them a little bit more, well, for us, we only teach Chinese, and the subject feel like quite different from others, And, sometimes our approach, the methods would be a little different. The contact, it often come down to the contact hours, they don't see us that often. So, and, I think there is another thing is, they are really impressed by Irish teachers who could speak a little bit Chinese, and it is not all about the approach, it is like they are more convincing. I guess, again, like in turn, 100% scale, I think, to be honest, my Irish colleagues sometimes their pronunciation is not really that standard, but it is very easy for them to convince the kids and also give instructions to reason from like 0 to, let's say, 30%, 80%, that kind of scale, while for me, that part is not that easy. But they definitely couldn't do the rest, they couldn't raise the kids' pronunciation about 80%. They couldn't really guide them to achieve 100% correct pronunciation. Well that leave to me, I could do that part.

HW: Have you ever used any digital tools to assist your teaching of spoken Chinese?

CZ: You mean only the teaching of...only the teaching, I guess, you know, just the video demonstration, audios for the demonstration. Other than that, in terms of teaching, no, not really. Not really, just explain by myself.

HW: Have you ever recommended any digital tools to your students to help them learn spoken Chinese?

CZ: To learn, I did recommend a few in the past, but most of them are, they are more like games for beginners. They are more like just introductions. So, it is quite elementary, and I think it is more, how to say, it is more entertaining instead of educational, and, you could see the kids play, they very into the apps, very into the games, but in terms of the pronunciation, it really did not improve that much. And also, it is not that easy to implement it into your lesson. Because it is like, I don't know, like how you measure their achievement in the games and how to link that to the course. I could not really leave homework, let's say, play this app as homework because coming back, I don't know how long they play it and what's the effect. And everything just mixed together, I don't know like what the app really plays a part in the learning. I don't think, also like, most of the software or application, you couldn't really change the content. The content is set, so it is like, you could only use the very small part of one app for limited content, or limited function, and you need to go find another one. And sometimes you want to do, like you want to achieve something, you want to give them a comprehensive homework, you need several apps, and, the instruction itself like how to use the first app to do what and the second app to do what. It is just too complicated to the kids. I wish there would be one package to do them all. But I guess I justlike this. I would be just easier for me to teach the kids.

HW: What other helps do you or your students need for the teaching and learning of spoken Chinese, that we are not mentioned so far?

95 CZ: You know that one thing that always is frustrating is, it is one thing to teach, and another thing to learn. It is not that difficult during the class, you teach the kids, and they learning pronunciation. Most of the kids, they eventually get there, they know how to pronounce it quite well during the class after several rounds of practice. But we have limited class hours each week, and it is frustrating every time you teach them and you think everything is fine, and two or three days later, they come back and its all gone. You have to do all over again. And somehow like pronunciation, it is not that easy to ask kids to pronounce

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105 afterwards, because they don't have meaning, they don't learn the language like I did when I was a kid, I just reset and repeat. I guess it is nearly impossible for kids to do that, if only it is just pronunciation. And even if you wantThey don't have the needs, they don't have to .. only for fun. We don't have a Chinese community in here and even we do, I mean, they are kids, I guess the community is only for adults. If I want them to do something online, again, they are kids, there are a lot of issues, information control, they are not like, they could have some online chat, something like that, and I guess, it could be easy to get a bunch of Chinese kids to talk to them. It is just because they are kids, there would be more issues. So, I don't know, and I didn't come across any apps or in the other way, to provide them more needs, and methods to practice speaking that would solve my problem. I teach them to standard pronunciation,... them how, other than homework, or even . . . they feel the needs to practice, they could talk to each other, they talk to other people. And they could practice, next they come back, it won't be like forgetting everything ... which is very ...

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HW: Thank you.

Transcript of Audio Interview 02 (SF-N-M)

Present: SF
Location: Online Interview
Date: 22/06/2019
Interviewer: Hongfei Wang
Duration: c. 15 minutes

HW: How long have you been teaching Chinese overseas?

SF: I taught Chinese in a primary school for a year. Mainly teach students in the age of 6-7 years old,

5 HW: Are they all beginners or have they ever learned Chinese before?

SF: Beginner learners.

HW: Apart from teaching Chinese, do you teach any other subjects?

SF: I am not a teacher in other subjects, I am TA, the teaching assistant. I participate in TA's work for three days a week, including mathematics, Chinese, music, sports, etc., which is to be a teaching assistant.

10 HW: So, you have also observed how the local teachers teach? Other subjects that are not Chinese.

SF: Yes, I have observed the teaching of other subjects.

HW: What do you think are the difficulties that Chinese teachers generally encounter when teaching oral Chinese for beginners?

15 SF: As a volunteer teacher, I don't have enough teaching experience, and I still encountered a lot of difficulties at that time. One is in (teaching) Chinese pronunciation, like some special sounds, such as "ü". when (teaching) these sounds, the first is to demonstrate. It is difficult to show the pronunciation. We use the kind of u-band that we have learned before. It's this way. But maybe because my student is relatively young, he may not get the pronunciation when he learns this action. Then there is also a correction made by a student when he makes a wrong voice. I think there may be some age restrictions, including the part of the pronunciation, the principle of pronunciation, and the limitation of the ability to imitate, so the voice cannot be corrected. Very standard. It can only be said that there is a gradual approach. Including the voice, including our four tones, and the tones, it can only be said that they are correcting over the past days. When the students get it, they will correct it. As far as accuracy is concerned, there were no particularly high requirements overseas at that time.

25 HW: Is the tone of voice the hardest for students?

SF: I think the tone is more difficult,

HW: Apart from imitating this way, do you have other methods or techniques to promote their tones learning?

30 SF: At the very beginning of the demonstration, I would stretch the pitch longer, gesture, or sing it with the dorimofaso pitch, which is more exaggerated. Let the students learn. I think there is still some help. If It's a two-character word, and students have no problem imitating it, but it's more difficult to put it in a sentence. Now I'm not particularly good at teaching tones, it always takes some time.

HW: Do students have enough opportunities to practice oral Chinese outside of the classroom? Is it only in class that I have the opportunity to practice oral Chinese with my teacher or classmates, and will I have the opportunity to use Chinese after class?

35 SF: I don't think it is, unless it is a student from a Chinese family. We will organize some China Day activities. Basically, we can go to the Confucius Institute once a semester. Usually you say that there are not enough opportunities at all. Basically, the teacher creates a Chinese context in class.

HW: Compared with local teachers, what do you think are your strengths and weaknesses in oral Chinese teaching?

40 SF: The advantage is definitely obvious. As our native Chinese, the pronunciation of the correctness is definitely beyond doubt. Then there are local teachers, including Chinese and local teachers. Sometimes you know that their pronunciation is wrong. We definitely have an advantage in terms of correctness. The obvious disadvantage is that I think it is the teaching method, that is, I don't know enough about the local students and the local teaching methods. Of course, this is in my later period, half a year later, there has been almost some improvement, but I think this may also have the problem of accumulation of

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experience. The local teacher treats this child because of the special nature of my teaching object. One is that they are children, and the other One is that they are foreigners, and the local teachers have some understanding of the language of the teaching target, we think it has an advantage over us. Then the other is the teaching method, that is, the classroom will be more interesting and the students will be more interested.

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HW: Have you used digital tools to help teach spoken Chinese in your teaching?

SF: I probably used two things. They used it when they were learning Chinese in that elementary school. It was a small tape recorder. It was very easy to operate. It was just one click for children to record and then play it again. The function is very simple. , But I will use this thing, which will make the class more interesting. Then there are normal ppts, various video materials. The third is that our school and a primary school in Beijing were friendly schools at the time. I only used it once. Because of the time lag and network problems, they recorded a child to introduce each other to their classroom. This way, It's what a Chinese kid of your age is doing. We have learned some simple "hello" before, "what is this, what is that", the things in the classroom will make them feel it, and Chinese children can understand it when they say it.

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HW: It's very interesting. Use a remote one to create something that seems to be a little immersive, and then let the children interact, right?

SF: It was recorded and broadcast. The kids here also showed it to them, but they couldn't talk.

HW: Have you recommended any digital tools to your students to help them learn spoken Chinese?

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SF: No, because the students are too young. They don't use ipads in class, they just use books. I also found something like "Panda Chinese" at the time, but it was not suitable for children of that age.

HW: Your current students, would you recommend some learning tools to them?

SF: Many apps charge fees. After students have learned part of it, they found out that they would recommend some WeChat official accounts to them. There is no particularly successful app. For paid apps, students will question the teacher's recommendation, and free apps will have some quality problems.

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HW: Do you or your students need any other help in the teaching and learning of spoken Chinese (we didn't mention it before)?

SF: For overseas students, I think it is mainly an interest in learning, technically, I can't think of much. Just really interested. In other words, it is more important to have such a language environment.

Transcript of Audio Interview 03 (QW-N-M)

Present: QW

Location: Online Interview

Date: 24/06/2019

Interviewer: HW Wang

Duration: c. 20 minutes

HW: How long have you been teaching Chinese overseas?

5 QW: My total experience overseas should be more than five years. When I was a graduate student, I worked as a volunteer at the Confucius Institute for one year, and now I have been a Chinese teacher at the Confucius Institute for 4 years.

HW: The level of students you have taught should be at all levels, right?

10 QW: Most of them are intermediate to senior level, and then the elementary class has taken that kind of short-term class.

HW: Students who are starting from scratch or students with a little foundation should have also taught them, right?

QW: Yes. I have taught short-term classes such as HSK-1 and Level 2 for two months.

HW: Are the students in your school a college student, middle school student or elementary school student?

15 QW: They are the kind of adult students. There are college students as well as social students who have already worked.

HW: Have you taught subjects other than Chinese? For example, does the school arrange courses other than Chinese for you?

20 QW: It's basically related to Chinese. In addition to courses other than language, I have taught courses similar to Chinese culture and Chinese history, but I have not taught other subjects such as English.

HW: Based on your own experience or the teaching experience of other teachers you have seen, do you think the Chinese teachers, the Chinese teachers we sent from China, have encountered any difficulties in teaching oral Chinese for beginners? For example, what difficulties do students have, or do teachers have any difficulties in this area?

25 QW: Based on my personal experience, when I was teaching HSK short-term classes, I felt that they might be affected by their mother tongue. Some vowels might have difficulty in pronunciation. The most obvious one is "ü". If you say this sound, the teacher usually demonstrates one of them, and then tells them the tongue position, and then they can also pronounce this sound from "i", "i" to "u", like round lips. (02:27-03:01 And here in Italy, I have not taught primary oral Chinese. One more obvious thing is that after they reach the intermediate and advanced levels, there will be an obvious mistake that they have "g", this Tone, in Italian). 03:01 In this regard, apart from the teacher's repeated long-term corrections, I don't think there is a particularly good way to prevent them from making such mistakes from the beginning.

30 HW: Is the student's problem with the four tones big?

35 QW: The four tones are fine. The ones I took over were already intermediate and advanced students. Sometimes the four tones would be doubled, and the second beeps would be quadruple. Others were generally okay.

HW: Are there any difficulties in providing pronunciation feedback to students and correcting students' incorrect or inaccurate pronunciation? For example, students can't teach how to teach this kind of situation?

40 QW: This is the problem. Tell them that this is a long-term and repeated correction process. So far, neither myself nor the teachers around me have found a particularly good one that can help them correct quickly. Basically every time, the elementary level may be more correct. Be stricter. When they reach the intermediate or advanced level, they will make mistakes in their oral practice. After completing an exercise, they will focus on telling them which pronunciation is weaker and should be practised more.

45 Error correction

HW: In addition to normal classroom teaching, are there opportunities for students to practice oral Chinese?

- 50 QW: I think it is more limited. There are more Chinese students in my place. If students play more with Chinese students outside of the classroom, of course, they will practice a little more accent and normal oral Chinese. But there are also many students who are rather shy and have no Chinese friends, so they have no chance to practice spoken Chinese except in class. Or it is the kind of social students who are already working. They are already very busy at work. If Chinese is not available in the working environment and there is no contact with Chinese people, they will only have the opportunity to practice oral Chinese in class.
- HW: It is the lack of a Chinese context. Teachers need to create for students in class, right?
- 55 QW: Yes.
- HW: Do you have a Chinese teacher in your area? What do you think are your strengths and weaknesses in oral Chinese teaching compared with local teachers?
- 60 QW: I think local teachers have their own advantage in that they can predict the difficulties students will encounter in pronunciation based on their own learning experience and use their own practical learning experience to help students overcome some learning difficulties. The disadvantage is that I think that, after all, local teachers who have learned particularly well are still relatively limited. Their Chinese level is still uneven. Many teachers have some problems with their own pronunciation, so in this regard, we are native Chinese. The teacher's voice is more standard, but more accurate.
- 65 HW: We have the advantage of our mother tongue, and local teachers have their own Chinese learning experience, so they are more convincing for students?
- QW: Yes.
- HW: Have you used digital tools to help teach spoken Chinese? For example, use some apps, websites, videos, etc., these?
- 70 QW: For intermediate and high-level oral Chinese, I may show some videos for students, and let them watch some TV dramas and movies. For students of better level, watch "I have children at home", "Love Apartment", or some For programs, "pk11 people" and "Non-international talks", foreigners from various countries who learn Chinese very well discuss one topic at a time. Sometimes I combine some topics of advanced oral Chinese to show them some topics. Usually, they watch a lot of documentaries about China, some movies and so on. Mainly listen, I think. As for video resources, they are actually more in
- 75 listening. They seem to be able to say less of this. In addition to this, there is a website I use a lot, called Slow Chinese, but this one is mainly for practising their listening. The content of the articles on it is particularly fresh and novel, unlike some topics selected in our textbooks. Older. This is some current hot news, or some articles in contemporary China that reflect some of the life of young people, and it is the supporting listening material, so students can read the article first, and then do what they do on the way
- 80 to get off work or in ordinary times You can keep playing that when things happen, and you can practice listening.
- HW: It means that when you search for these electronic resources, the listening materials are massive and easy to find. It can also help students create a Chinese environment.
- 85 QW: Yes, but they are very good at communicating this kind of resource, and I have not used it particularly well.
- HW: It's just that there are very few tools like this, such as a tool that allows students to have a conversation with that, or how to practice oral Chinese. There are fewer and more difficult to find, right?
- 90 QW: Yes, yes. Maybe they use it a lot, not to practice oral Chinese. They will use Wechat or whatsapp voice to chat with Chinese friends. But it is also mostly written. There may be few voices, so I think it is a particularly difficult point in practising oral Chinese.
- HW: In addition to these, what other help do you or your students need in the teaching and learning of spoken Chinese? What efforts can the group of Chinese teachers or researchers do?
- 95 QW: I think the problem we talked about just now is. For example, there are a lot of reading materials or some audio-visual materials now available, such as the Internet, some textbooks, there are many of these. But whether it is an application or an interactive website that allows them to practice oral Chinese, I really don't have the resources in this area. I haven't heard some of my colleagues mention it, so if someone can develop a language like this for them to practice oral Chinese directly with Chinese native speakers, for example, they may be divided into different levels, elementary, intermediate, and advanced, and they can

100 practice oral Chinese directly. Whether it is such a platform or a mobile phone application, I think it is more urgently needed.

HW: Or it is a kind of human-computer interaction, a system that simulates people and can conduct dialogues according to the level of students.

105 QW: For example, in the Confucius Institute where we are, we will organize some regular cultural activities, and sometimes we also want to create some language environment for students who can speak Chinese, but the effect is also good. For example, organizing a Chinese corner, such an event, organizes Chinese students and Chinese learners to communicate together, but after they have met once, they leave contact information, but continued communication is very limited.

HW: It's difficult to maintain, right?

QW: Yes, yes. It is that the continuity is not very good.

Transcript of Audio Interview 04 (FG-N-M)

Present: FG

Location: Online Interview

Date: 02/07/2019

Interviewer: HW Wang

Duration: c. 15 minutes

HW: How long have you been teaching Chinese overseas?

5 FG: This year is my sixth year.

HW: Have you been exposed to students at almost every level?

FG: In the first year, I taught a lot of elementary students. Later, I took another teacher's class. The students had already passed the phonetic stage. They were almost elementary-intermediate, semi-intermediate, and they were brought up slowly.

10 HW: Today I mainly want to understand some problems in oral or pronunciation when teaching junior students. Have you taught subjects other than Chinese?

FG: No.

HW: Are your students mainly middle school students or college students?

15 FG: Currently there are middle schools and adult classes. In middle school, I teach students in grade 10, and the adult class is for social students, and the composition is more complicated.

HW: What do you think are the difficulties that Chinese teachers from China generally encounter when teaching oral Chinese for beginners?

20 FG: In overseas, it is generally a comprehensive class. Generally, classes are not arranged according to skills. My classes are all comprehensive classes, so there is no specific time to teach oral Chinese. It's all about pronunciation, vocabulary, grammar, and text together. There is not so much time left for oral Chinese, and students don't have enough opportunities to practice oral Chinese. This is incomparable to foreign students studying Chinese in China.

HW: Do students have difficulty learning tones?

25 FG: In terms of the tone, I think it is a sound. What I am more impressed is that when I start speaking, the teacher will let the students imitate, and then the voice will be a little longer, such as "Teacher--", but in the language Generally speaking, if they speak fast in the stream, they may also feel very confused. The first teacher did not speak as long as they said, and then they would ask this question. When they said it by themselves, he Will also make one sound four times, or softly like this. Sometimes there are such problems.

30 HW: Is there a better way to solve this problem?

FG: The tone may only be corrected. Repeated corrections. Actually, I don't have much experience. When we are repeating the texts for the students in the comprehensive course, I will correct the pronunciation in a timely manner, but I don't correct too much. I will interrupt them and sometimes it's not very good, so in the elementary stage. This is more important.

35 HW: Do students have enough opportunities to practice oral Chinese outside the classroom?

FG: Very little. In social adult classes, they all come to learn Chinese after work. Our class is usually from 6 to 7:30. They come to the school classroom after getting off work and eat after class. They will not have any. Time to review, let alone practice in other spare time. So basically in class.

HW: Compared with local teachers, what are your strengths and weaknesses in oral Chinese teaching?

40 FG: The advantage is that we are native speakers, so our pronunciation and grammar are the most authentic. Many local teachers, the best are from the Chinese department of the subject class, and have studied Chinese in the Chinese department of a foreign university for two years before passing Scholarships go to China to study Chinese for one year, after which they reach HSK-4 level, and then apply for HSK-5 level examination upon graduation, and apply for a master's degree in Chinese International Education.
45 After one or two years of Chinese education, they will directly Be a local teacher. Their level is considered the best, but they still have some limitations after all. The voice is far from that authentic. I

- haven't seen a very authentic pronunciation. In the explanation of grammar, students will suddenly have many weird questions. They cannot answer these questions well. How can I put it to say that grammar is originally a difficult system. When they are studying, they learn more. Shallow, and then they will know less, and will be a bit stretched when dealing with student problems. This is what I think is our advantage as native speakers. The disadvantage is that we are not as good as local teachers in understanding the difficulties of students in the learning process, because Chinese is too simple for us, and the difficulties in the text are marked out in the textbook, but for other things, we learn to ignore them, so they will Let it go. But for these local teachers, when preparing lessons, they will analyze sentence by sentence, and then they will predict that students will make mistakes in this place, so they will talk in more detail.
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- HW: They have a process of learning Chinese as a foreign language, so they are more empathetic when teaching, right?
- FG: That's right.
- HW: Have you used digital tools to help teach spoken Chinese?
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- FG: It is rarely used. Because what I teach is a comprehensive course, students will find vocabulary by themselves, such as pleco. Intermediate students will use a popular one called "Chairman's Newspaper." That magazine can be subscribed to some paragraphs and chapters, which they find very useful. Sometimes they will learn by themselves. In the past, when teaching in China, some videos were used for students to repeat after listening and performing deduction. Others are rarely used overseas, because of
- 65
- the limited hours of middle school classes, multimedia methods are rarely used in middle schools.
- HW: I don't know if you have this feeling, it's listening. There are relatively many Chinese materials in reading, but the spoken language and pronunciation are not particularly easy to find. It is available immediately, and it is not very easy to use.
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- FG: Maybe spoken language is generally based on face-to-face communication, so this kind of online is not easy to make, wait for some other reasons
- HW: So there are relatively few related products
- FG: Yes.
- HW: Do you or your students need any other help in the teaching and learning of spoken Chinese (we didn't mention it before)?
- 75
- FG: For middle school, it is a question of class time. If the middle school class time can be a little longer, two classes. In terms of the curriculum, I think the setting of the Chinese Department of the university may be more reasonable, which will facilitate more adequate oral communication.

Transcript of Audio Interview 05 (YJ-N-M)

Present: YJ
Location: Online Interview
Date: 09/07/2019
Interviewer: Hongfei Wang
Duration: c. 15 minutes

- HW: How long have you been teaching Chinese overseas?
- 5 YJ: Two years. I worked as a volunteer in the Confucius Institute for one year, and then participated in the recruitment of Chinese teachers and sent overseas.
- HW: What is the background of the middle school students you teach?
- 10 YJ: The students in the Confucius Classroom I taught were in two middle schools, high school and high five. The age is between 15-18 years old. They have been studying Chinese for three to four years and are preparing for HSK level 3-4.
- HW: Have you taught subjects other than Chinese?
- YJ: No.
- HW: What do you think are the difficulties that Chinese teachers generally encounter when teaching oral Chinese for beginners?
- 15 YJ: I think for beginner learners, it may still be the use of medium language. Or if my method is not appropriate, it is actually a bit difficult.
- HW: Are there any problems when teaching students pronunciation?
- 20 YJ: I think the students here are flat, and the sharp tone is a bit problematic. Then there is the tone. Last year, I took a zero-based class. I took them 24 class hours in one semester. The tone is quite difficult at first. It is to keep gestures and practice repeatedly. For example, at the beginning, I took them to read from tone one to tone four. In fact, many students have no changes in their tone.
- HW: Are there any problems with their perception of tones? Can they tell that these are four tones? Can they hear the difference in the four tones?
- 25 YJ: What students can hear, including what I wrote, and when they read it, they know it, they understand it in their hearts, and they also know it in their hearts, including the tone change. But there was a problem when reading it, and they understood it in their hearts.
- HW: Are there any difficulties in providing pronunciation feedback to students and correcting students' incorrect or inaccurate pronunciation?
- 30 YJ: Inaccurate pronunciation, I still let them imitate more. In many cases, even if i imitate many times, he still hasn't changed it, but in fact, it is not too affected. Because when he continued to study later, he himself suddenly understood how to send it, or if the number of repetitions increased, he listened to my demonstration, and he would do it too.
- HW: It just needs a process? Is it also related to the length of the practice time?
- 35 YJ: That's right. The time of practice is very relevant. In fact, when I corrected it, they understood it in my heart, but the time may be very short, including the usual practice, but in the latter process, there is also skipping voice learning. After that, if you read a word or sentence directly, you can actually read it accurately.
- HW: Do students have enough opportunities to practice oral Chinese outside of the classroom?
- 40 YJ: If they sign up for the summer camp, it is estimated that there will still be some opportunities to communicate with the Chinese, but if they are only in school, there will be very few opportunities after class.
- HW: Is there a Chinese community in the local area?

- 45 YJ: There will be some, but these students seldom come into contact with them. They still spend their spare time with some of their little friends or students in some tutoring classes they enrolled in. A middle school I teach is in a small town, and students rarely have Chinese friends after class.
- HW: So basically you can only practice with the teacher in class, or practice with your classmates?
- YJ: Yes, yes, or at most, we will be in the WeChat group or the whatsapp group, and then everyone will share a little Chinese-related video, or let them hand in some voice homework and the like, but there are fewer others. .
- 50 HW: So it is to increase their chances of using Chinese as much as possible and create some conditions?
- YJ: That's right.
- HW: Compared with local teachers, what are your strengths and weaknesses in oral Chinese teaching?
- YJ: I think our big advantage is our pronunciation. The pronunciation is very standard. This is an obvious advantage. We have natural advantages in pronunciation, pronunciation methods and pronunciation skills. But the disadvantage is the supplementary language and explanation. I don't think it is necessary to explain a lot to them. For example, in the case where the language cannot communicate smoothly, the explanation is not clear. The main thing is to imitate. Or use some other gestures, and these techniques with voice method. The advantage is that our pronunciation is very clear, and where the sound comes from. Or we can compare some sounds that are similar when learning English. Students will immediately understand how to post. We can make this comparison ourselves. The disadvantage may be the interpretation of the language.
- 60 HW: Have you ever used digital tools to help teach oral Chinese or help students practice oral Chinese?
- YJ: There are videos, such as playing some Pinyin songs. Then some of the apps I use are mainly Quizlet. I think there is less practice in speaking. It's mainly a group of words, and there will be more grammar exercises. Play more games. This digital tool is relatively small for spoken language. There are some stitching exercises that can use Quizlet to let students practise stitching. But this is an exercise in memory and rules. I really rarely use spoken language.
- 65 HW: Have you found some products that are better used? For oral and pronunciation.
- YJ: The students used some before, but I rarely use them myself. Some easy-to-use software passed between students,
- 70 HW: Do you personally reject the use of these auxiliary tools? Or if there is something that is easier to use, you would like to give it a try?
- YJ: I think I still have to give it a try. Maybe I neglected to use software to assist voice teaching.
- 75 HW: Do you or your students need any other help in the teaching and learning of spoken Chinese (we didn't mention it before)?
- YJ: Practice, I think practice, and provide a better context for them to communicate. This is also very important. Otherwise, some of the learning in class is still relatively mechanical. Because if students really don't use it, he doesn't know what kind of problems he will encounter. He just teaches them pronunciation and Chinese characters mechanically. This amount is still not enough.
- 80 HW: It is to allow students to be more fully exposed to the Chinese environment, even if it is a virtual creation for them, but to create a situation for them and increase the opportunities for practice.
- YJ: That's right.

Transcript of Audio Interview 06 (XX-N-M)

Present: XX

Location: Online Interview

Date: 20/07/2021

Interviewer: Hongfei Wang

Duration: c. 30 minutes

- HW: How long have you been teaching Chinese? Please give a brief introduction
- 5 XX: I'll just count for one year. But even if our class is a weekly class, it cannot be said that we teach every day. It means one to two sessions a week.
- HW: The object of teaching, what is the situation of the students?
- XX: My students are here, maybe, the Chinese students who grew up here are their parents...
- HW: Born here?
- 10 XX: Born here, children of Chinese descent. Their age is about, our class is the higher class in our Chinese school, which is the highest class, and the children have, at least ten years old and up, and I think they look like fifth or sixth grade. There are also junior high school students, like this. The highest and the biggest is the second grade.
- HW: So their mother tongue should be Chinese?
- 15 XX: Yes, most of them is that there are 14 students in our class, because later there are students who transferred or transferred in, but most of the children are...
- HW: It means that most of the parents are Chinese. Is there a kind of half, that is, the kind of mixed blood?
- XX: There is one in our class. But the situation is still different between children and children. Most of the children in our class are still acceptable. Chinese are all spoken at home.
- 20 HW: Are there any parents who are Irish but want their children to learn Chinese?
- XX: Not really.
- HW: Not yet.
- XX: Yes.
- HW: Apart from teaching Chinese, what other subjects have you taught?
- 25 XX: Mainly Chinese.
- HW: You teach these students that most of them have basic Chinese, not beginners.
- XX: No, it's usually there before. It may be students from other Confucius Institutes or some other Chinese schools. Transfer to us.
- HW: There is a certain level.
- 30 XX: Yes, most of our students are. We are the teaching materials run by Overseas Chinese, and they are promoted step by step. I am teaching five volumes now. They may all have two or three volumes starting with that kind of experience.
- HW: In the process of teaching, did you encounter any difficulties in teaching oral Chinese?
- 35 XX: Yes. Although they have their mother tongue at home and Chinese is their mother tongue, they may have a lot of words, even some idioms, they obviously don't have this context. They don't usually use idioms at home, and they don't use some. We may Children who grew up in the country may sometimes have some allusions when they speak, but you can use them if they are unnatural, and then they may, they may not respond when they hear this. But sometimes you tell them idiom stories, they all know, they know what "the oriole catches the cicada", but they may know the story, but you want to
- 40 use this story when you tell it, you must use the extended meaning, they just Can't reach that comprehension. Then, most of their own expressions in spoken language are not problematic. I think, because the children here are good children, they may watch some kind of domestic TV programs, so they may learn some very well. The colloquial expressions. For example, many children in junior high

- 45 schools now use "Tik Tok". I feel quite surprised. For some children, their Chinese is very good, but they reflect that they speak too casually, not like, It just makes you think that this language is of course understandable, but they say it is not. Sometimes that occasion may be wrong. The child may not even realize this. He will need some background.
- HW: In terms of pronunciation, how is their pronunciation?
- 50 XX: In my own class, most of the people are probably from Fujian, but parents are from Fujian. Their front and back nasal sounds are obviously not good. In pinyin, although they have also taken some pinyin lessons, they may still have no problem speaking, but when you ask them to do the kind of questions with pinyin, or to spell something, they can't distinguish the front and back nasal sounds. clear.
- HW: In response to this situation, did you have any difficulty in teaching them?
- 55 XX: Because, our textbooks are based on that we teach texts, but our texts are too simple, and then we will exercise their front and back nasal sounds during class, such as letting them speak tongue twisters. , Just pick some front and back nasal sounds. They may not realize that their front and back nasal sounds are wrong when they speak. But when they talk about tongue twisters, the front and back nasal sounds are very obvious, and they will feel weird when they say it. This is to make them realize that they have a problem at once. Based on my experience of teaching for one year, they can't fix this problem within
- 60 one year. This time, when I asked the question, in our final exam, when the pinyin was used, there would be some with front and back nasal sounds, but they still couldn't do it. Even though I have emphasized them many times in class, I guess this is a process of learning.
- HW: It's cured, a little bit.
- 65 XX: Yes, just seeing that word, maybe let them say yes, but just write that they don't realize the difference between the front and back nasal sounds.
- HW: Then this is indeed a problem.
- 70 XX: But I think this is very detailed, so to be honest, I think our Chinese education doesn't require them to respond to your writing, and now you know, when children write things on the Internet, they use Lenovo Pinyin. It's not necessary to be so accurate, so I think sometimes I'm too domestic thinking. This is why I think I have some problems with teaching here. I think I'm the domestic requirement because I'm me. My own set of teaching and learning is an experience, so I will find a way to lead them in that direction, but then after a year, I feel that there is a problem with my method, because there is no need to let them...
- HW: How to grasp that degree and to what degree?
- 75 XX: Yes.
- HW: Then your students should have more opportunities to practice oral Chinese outside of the classroom, right?
- 80 XX: Yes, most people are. A few of them may not work well. I just said that there is a mixed-race child in our class. Although he himself has a strong willingness to learn Chinese, he thinks this thing is very important. He is a very good-minded boy. He knows that this Chinese will be good for him in the future. It helps a lot, but he thinks there is nothing, nothing at home.
- HW: At home, one of the parents is Chinese?
- XX: Yes. His mother is.
- HW: Are you bilingual in Chinese and English at home?
- 85 XX: I may speak a little more English. Because his mother may be busy too, at work, so it is possible at home, he is also in junior high school, every day with other Irish children, it is impossible to speak Chinese with Irish people. So he has fewer opportunities to practice than others. In your class, there is another situation of children who are immigrants from Fujian. They may have more than one person in their family. They may have older sisters, younger sisters or younger brothers. These children all speak
- 90 Chinese at home. Sometimes they say with their parents, and they say with their sisters and sisters that they may be better than that kid, and that kid might be the only one in the house. so,
- HW: His practice opportunities are very closely related to his family background.
- HW: Do you know a local teacher in Ireland, a local Irishman who teaches Chinese? Have you been in contact?

- 95 XX: It seems not.
- HW: Then, if you compare with them, what are your advantages and disadvantages? Can you say something about it?
- XX: The most obvious advantage is that I am a native speaker. I don't care how good their Chinese is. It is my language, so I have this right to speak. But I think this is also a disadvantage at the same time, because you are in your own thinking habits, of course I think I speak standard Chinese, but when you go to teach, you may not be able to grow up here. The children understand your original intention or your set of thinking. Because the thinking we use is completely different. So I think that on the one hand, this is my strongest advantage. I can pass through me and the children can see many things in Chinese. For example, if they are learning Chinese, textbooks cannot satisfy their state, because textbooks too easy. Their own comprehension and their abilities, in fact, too simple texts are of no help to them. They are all in junior high school. If you show them the story of the little fox, they will find it very boring. To be motivated to learn, you must find suitable texts for them to read. So I occasionally add some domestic stories or materials for them to see. At this time, they will realize that their Chinese is still not that good. It may be because you will have an impact on them after all in writing. They will feel that it is not the same as the little fox I learned before. They come Let them read a reading question or something, and not let them do the question. Just let them read the Chinese used by the normal person and write some literary things. They will obviously feel that what they have written is similar to what they wrote. If the method is different, they will feel as if Chinese might be a bit difficult for them. What I bring to my children is that from a domestic background, I let them see some of ourselves, we Chinese speakers, and the kind of people whose native language is Chinese is completely different. But at the same time, I may feel that I am limited by my identity. I may have something to give them that may be particularly difficult. They may not be able to accept it in a short time. It is a bit like a Spartan education, even now. Before they learned to walk, they had already started trying to run, that kind of feeling. So for them, it is also a challenge and a kind of pressure, but I think there is such a difficulty.
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- 120 HW: Have you used digital tools to help you teach spoken Chinese?
- XX: I really want to use it, but due to our teaching conditions, it may not be because we may only rent the venue of a local language school on weekends, so I can't install some for the language school. Equipment and hardware can't be solved, but I'm just in the lecture, because to be honest, in order to expand the content of my class, I will search a lot of resources by myself, and bring the computer to show them some domestic cartoons, or talk Some Chinese characters, and then there will be something like the origin story of Chinese characters on YouTube. Give them some of this so that they have an understanding of Chinese characters. I know that there are some good softwares in China that incorporate the entire class into electronic teaching. Now children actually like to use this, but they can concentrate more. One thing, they are not like us, we can read a book for 40 minutes, and their attention quickly goes away. So I think electronics is very helpful. But there are advantages and disadvantages. The disadvantage is that you keep looking for new things to grab their attraction, and their attention becomes more and more difficult to concentrate. You always look for new things to attract them. But I still show them some cartoons on my own terms. I want them to stop learning Chinese as a task when I teach. I want them to use Chinese as a tool to understand what content will be in the Chinese context and let them see. I think there is Some children, just talking about the kid who uses Douyin very well, he himself obviously does not regard Chinese as a subject. He uses Chinese to understand some news, some other cultures that he is interested in. As for the Japanese and Korean Wave, he uses Chinese as a medium, not to complete the task of Chinese at the beginning, because the language will still be used in the future. I think he is a good example. But other students may still be a bit difficult. Here, I don't know about the various environments. Children's academic pressure is not great, and sometimes the parents are a kind of aspect. If it is a child from China, his parents Maybe the thinking hasn't changed, maybe it feels like letting students go to watch cartoons or read novels or something is to lead them to evil roads, that kind of feeling, but my original intention actually wanted them to use Chinese as a medium and then use it. This tool, to learn more about other things, so I will encourage them to watch cartoons. I will find some domestically produced cartoons with Chinese dubbing, but no subtitles.
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- HW: Relatively speaking, you may use a bit more in terms of video when you find materials.
- XX: Yes. I just want them to be more interested in learning these things.
- HW: What other help do you or your students need in the teaching and learning of spoken Chinese, that we have not mentioned before?
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- XX: Actually, the spoken Chinese in our class is quite good, that is, there is no problem in communication. Except for individual pronunciation, I don't think there are any huge problems. They are still relatively good, and they have communicated with their parents since they were young.
- HW: Do you know some of your other colleagues, such as the professor's zero-start class?
- 155 XX: Yes, some children may have been busy since childhood. They grew up here, starting with pinyin. We know that some of my colleagues teach classes in both Chinese and English. I use Chinese in class. Only one word is rarely mentioned.
- HW: Have you ever talked to them about some problems encountered in pronunciation or oral Chinese when teaching beginners? Is there anything particularly difficult to teach, think?
- 160 XX: Then I don't know the expression of thinking sometimes. You want to say this thing, and then you explain it to them in English. Are they learning English or Chinese? It is a problem. But I really haven't heard about what they are like in class.

Transcript of Audio Interview 07 (YZ-N-M)

Present: YZ

Location: Online Interview

Date: 09/07/2019

Interviewer: Hongfei Wang

Duration: c. 15 minutes

HW: How long have you been teaching Chinese overseas?

5 YZ: It has been nearly a year now.

HW: What is the background of the students you teach?

YZ: About half of them are Chinese and Irish mixed races, and the other half is Irish Chinese children. The age is between 6-13 years old.

HW: Do their parents speak Chinese at home?

10 YZ: I can say. But like a mixed-race family, a little bit less, some families will say, some will not say it at all.

HW: Have you taught subjects other than Chinese?

YZ: English. I have been teaching at the foreign language centre here for a year after passing the qualification certificate.

15 HW: What do you think are the difficulties that Chinese teachers generally encounter when teaching oral Chinese for beginners?

YZ: As far as the pinyin I teach, the biggest problem is to make them understand that Chinese has different pronunciations, four tones. This content has still not been fully understood by students, even when our Pinyin class has ended. Most students still make mistakes occasionally, and some students still don't understand it at all.

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HW: Even if their parents speak Chinese? What is the manifestation of this incomprehension? Is it because they have problems with listening and perceiving, or do they have problems with pronunciation?

YZ: Both. The pinyin class will focus on spelling. Some students still cannot read the correct pitch even after they have already taught pinyin.

25 HW: Can they distinguish four tones?

YZ: Not completely. The worst students cannot be distinguished completely, the best students can.

HW: Is the difference between students still quite big? The perception of tones also affects their pronunciation?

YZ: Yes. There is also a very strong language transfer in English. This kind of influence, when they read the spelling, sometimes they will read the pinyin of Chinese into English, and there are many people. The worst person in the class, he has a tone, and the other has this problem. He is still remembering according to the English pronunciation.

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HW: What level will students reach after completing the Pinyin class?

YZ: Ideally, you can read and write Pinyin normally.

35 HW: Oral conversation, basic, can you speak?

YZ: This is not so good.

HW: In daily conversations, hello, what is your name, is this kind of communication okay?

YZ: These are okay. They know a little because they speak Chinese at home. When I teach Pinyin, I will use words from everyday objects, hoping to strengthen their memory in this way. So they were able to name some commonly used objects and some concepts at the end.

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HW: Did you have any difficulty in correcting students' pronunciation yourself?

YZ: It was fine when the class was corrected, but I don't know how much they can remember.

- HW: Do students have enough opportunities to practice oral Chinese outside the classroom?
- 45 YZ: Not much time. If family members speak Chinese, they will use it. But some of the mixed-race families speak English completely, so they have very few opportunities to practice. Some students in my class have learned Pinyin before, taught in other language schools or at home, and then come here to take language classes.
- HW: Compared with local teachers, what are your strengths and weaknesses in oral Chinese teaching?
- 50 YZ: In terms of advantages, first of all, Chinese is our mother tongue, so we teachers have stronger ontology and language analysis ability, but this is also relative. Later, when foreign teachers learned languages, they used linguistics to learn languages very systematically, so they would be better than local teachers in terms of grammar or some component analysis. Another point is the sense of language. This was also an annoying problem when I was learning English. Those whose mother tongue is Chinese have a better understanding and flexibility of using the language than these teachers
- 55 of the second language. At the disadvantage, I think it is to understand where the student's problem is, and then design a solution, practice and explanation model from this perspective, maybe local teachers in Ireland are better at it. Because these problems may have occurred when they were learning Chinese, their methods may be better and more direct.
- HW: They have experienced this process and it is more persuasive to the students
- 60 YZ: Yes. And to be honest, some books in the teaching field are slightly different from the actual ones, so sometimes people who have really learned a language will be more flexible.
- HW: Have you used digital tools to help teach spoken Chinese? For example, some applications, videos or other computer software, etc.?
- 65 YZ: The main digital tool I use now is a tablet computer and my courseware. In class, I teach Pinyin through pictures, tongue twisters and various formulas. The courseware mainly shows pictures to students for associative memory.
- HW: Have you recommended any mobile app to students to help them correct their pronunciation?
- 70 YZ: This one is not available yet. Moreover, they are relatively young and have no patience to use them. The other is limited by the equipment in the classroom. Originally, we found videos and songs in pinyin, but because there were no projectors and speakers in the classroom, we didn't use much in this regard. The hardware facilities of Chinese schools have some influence on teaching arrangements. If it is a university with relatively complete facilities, the frequency of use will be higher. And I think because they are children, they will be better at this kind of things than in class, and they will be more focused. And through songs, it will enhance their memory.
- 75 HW: When you prepare materials, have you ever looked for relevant applications?
- YZ: I thought about video before. If there is such an application, I should use it when I put the content later.
- HW: Do you or your students need any other help in the teaching and learning of spoken Chinese (we didn't mention it before)?
- 80 YZ: The first thing I think of now is the question of after-class practice. Because I only have one textbook and workbook here, but because it is written in Pinyin, there is very little practice. I usually do some homework based on the content of the professor. , If there is an iapd or computer software that can do exercises, so that they can practice the spelling and writing of Pinyin while doing exercises, this will be more helpful.
- HW: So they will practice after class, right?
- 85 YZ: Yes, in addition to the paper assignments I gave them, they also have a software that can help them correct pronunciation, or help them correct writing, and some related video materials, or game content.
- HW: Or maybe let them practice conversation, etc. After the student level is higher. Because they have very few opportunities to practice outside the classroom.
- YZ: There are really very few, only once a week.
- 90 HW: It might be better if there is an application-like thing that allows them to interact with humans and computers and practice oral Chinese.

95 YZ: Speaking, and then listening. They also need to distinguish different tones, and then different pinyin, and for example, flat tongue, these problems. Especially Ping Qiao Tong, because their parents are in the Fuqing area, when they are speaking, their control of pinyin itself has problems, and these students can reflect these problems in class and homework.

Transcript of Audio Interview 08 (YF-N-M)

Present: YF

Location: Online Interview

Date: 11/07/2019

Interviewer: Hongfei Wang

Duration: c. 15 minutes

HW: How long have you been teaching Chinese overseas?

5 YF: About half a year, because it started in March this year at the Chinese school of the Fujian Chamber of Commerce. They mainly bring children from the two-volume class and the three-volume class. The students in the second-volume class are younger, about eight or nine years old. The three-volume class is a bit older, about 10 years old and 11 years old. However, the division of classes is not entirely based on age. There will be a test before admission. Most of the students are children from Chinese families,
10 and there are very few children from Irish locals.

HW: Have you taught subjects other than Chinese?

YF: Yes, I am also teaching English. Both my undergraduate and graduate majors are English. But because I am not a native English teacher, I don't have many opportunities to teach English here. There are some one-to-one courses that come to me. Now mainly teaches English online.

15 HW: What do you think are the difficulties that Chinese teachers generally encounter when teaching oral Chinese for beginners?

YF: I think the biggest problem is pronunciation and intonation. The tone of voice is that the students in Ireland are not very clear, they are not comfortable with it, and sometimes they can't make it clear.

20 HW: Is it an Irish student whose native language is not Chinese? Don't they have big problems with children of Chinese background?

YF: There are also problems. For example, especially those of Fujian background, they will be particularly susceptible to their Mandarin. When Hokkiens speak Mandarin, their tones and tongues won't rise, so they can't roll their tongues, zheli, they will Said zeli. They will be affected because their parents also have this problem. It is really difficult to change the accent, I think. Then it is more difficult to correct the sound. But overall it's okay. I think students from the north are okay. The southern students also have front and back nasal sounds, and they are not particularly clear.

25 HW: It's because of their family background. The pronunciation of the parents is correct. In general, the tone aspect is still a problem.

30 YF: Yes. The tone aspect is still a problem. Another is that a child was born here, and their spoken Chinese is obviously worse than the students who grew up in China to a few years and then came to Ireland. Because the word order when he speaks is different. Then you have to listen to him carefully, and then, for example, when you shuffle the order of a few words for students to connect them together, he doesn't know why the order is like this.

HW: Do you have difficulty in providing pronunciation feedback to students or correcting their mistakes?

35 YF: Yes. Actually, my class is okay. Most of my classmates have a certain foundation in China, or the family attaches great importance to Chinese. However, although the parents of some classmates are Chinese, he said that Chinese is no longer the child's mother tongue anyway. The parents don't think that Chinese is his mother tongue, but English is his mother tongue. Then it will be very difficult to correct the pronunciation at this time. , Because he no longer has this consciousness to study hard.
40 Then I think other children are okay. Except for the students whose accents have more influence, read it to him a few more times.

HW: In other words, in the family, whether parents treat Chinese as their children's mother tongue will also affect the motivation and effect of learning, right?

45 YF: Yes, it will be very influential. Most parents, including mixed-race families, think that Chinese can't be given up. They will spend a lot of time watching their children do their homework when they are not in class, and they will recite texts to the parents with books. At this time, students' Chinese will improve very quickly. There is a boy in our class, Fujianese. His Chinese has not been very good, but his

parents have taken it seriously, and his grades have improved very quickly. So the impact of the family environment is very important.

50 HW: Do you think your students have enough opportunities to practice spoken Chinese outside the classroom?

YF: I think so. There are some students I brought because they have such a good family environment. So their spoken language is still relatively good. Some friends around them, especially like Fujianese, are like a big family. They stay together wherever they go. It's very interesting to have a child. His Chinese has actually regressed. He grew up in China when he was a child. But when he came over, his Chinese regressed. I asked him why. He said that the teacher, I learned too many languages, Chinese, English, Irish, sometimes I don't know how to distinguish.

55 HW: When learning multiple languages at the same time, will they interfere with each other?

YF: Yes, they interfere with each other. He told me that he couldn't distinguish this Chinese from other languages, and he would mix it up.

60 HW: Compared with local teachers, what do you think are your strengths and weaknesses in oral Chinese teaching?

YF: Although I have never been in contact with a local teacher, because I teach English, when I was studying, the class was a local English teacher from Ireland. From my own perspective as an English teacher, the local teacher was explaining When I speak my own language, I will be more relaxed, such as telling students some idioms, allegorical sayings, and some knowledge of Chinese culture. These will explain more transparently. There is also an advantage when teaching students the radical or pronunciation. The pronunciation will be more pure and the tone will be more standard. And even when correcting errors, you can easily hear if this complies with daily expression norms. If it is a native speaker, there will be more flexibility. The disadvantage is that if we haven't studied Chinese (the learning process of Chinese as a foreign language), we think it is like this, it is supposed to be, and there is no why, so when teaching, we will think that this is common sense, and students should understand it. , But he doesn't actually understand. So sometimes I blurt out some jokes on the Internet, those words, as far as I am concerned, maybe the kind that everyone is accustomed to, they will think what you are talking about, I don't know. Another thing is that we don't learn grammar, students don't know the word order, we think it's normal, so we should say so, but they say why it's like this, and it's more difficult to predict, predict the difficulties in the learning process. What it is, of course, this is also related to teaching experience.

65 HW: Have you recommended any digital tools to your students to help them learn spoken Chinese?

YF: In our school, they don't have multimedia, and for word problems, I will ask them to go home and look up the Xinhua dictionary, but they don't have a Xinhua dictionary, so they can only use online dictionaries and apps to look up. There are not many other things. I can only take my computer with me, and then when I introduce traditional culture to them, I use some videos or other things to explain.

70 HW: Have you ever used some apps to help students practice oral Chinese, improve pronunciation, etc.?

85 YF: I haven't used it,

HW: Do you or your students need any other help in the teaching and learning of spoken Chinese?

YF: Yes, for example, when teaching, in addition to the Confucius Institute in Dublin, domestic Chinese teachers come over. They have such a systematic training. The trained teachers are different from the untrained teachers. In some other schools, there are not so many such trainings. For Chinese majors, and related similar ones, he will come to teach, still need some training.

90 HW: Is the teacher's source background more complicated, but lacks systematic and targeted training?

YF: There are too many language schools in Dublin. It would be better if there is training, even if it is online training.

Transcript of Audio Interview 09 (MC-N-E)

Present: MC

Location: Online Interview

Date: 14/07/2019

Interviewer: Hongfei Wang

Duration: c. 22 minutes

HW: What is your current Chinese proficiency?

5 MC: Ok. I am on the 14th chapter of the HSK-4 now. so I guess Zhongjiban, intermediate level.

HW: How long have you been teaching Mandarin Chinese?

10 MC: I do this, probably, 4 years. Only with Transition year in my school. They were timetable to take Chinese from September to Christmas, and then the next group took it from January to May. So we just ...like a module. Usually I had two 40-minute classes a week. This year my principal, she timetables me for one hour and twenty minutes with the group. That was really tough. I have two of them, one after the other, and I think the kids found it quite long. You know. The single class would be much better, but we did it anyway, you know.

HW: For the TY Chinese, do you teach both the language and culture?

15 MC: Yes, I try. In fact, There is a Chinese woman who married a local guy, who lives near my school. And sometimes, I persuade her to come in and she chat a little bit about culture. I created the lesson and she jumped in with me, to help me, not all the time, she is a mom, so this year she ... have much time to join. But they said they enjoyed ... to meet her. She assisted me.

HW: Will you introduce the short course Chinese into your programme?

MC: Well, I have asked many times, the Irish system is changing very slowly.

20 HW: What other school subjects do you also teach?

MC: French and Music.

HW: Do you have any difficulties in teaching spoken Chinese to beginners? For example to demonstrate the pronunciation, or offer feedback and correcting the students' wrong pronunciation?

25 MC: Well. I am growing confidence with it. Now I have the ability to watch Chinese films, like HUANGLESONG, you know this TV series, I have watched all of it, twice. I love it. I really love it. I started to copy what it say, I think I do quite well. When Xiaoyu is with me, my friend. Like I might do numbers, The kids find number four "si4", they will say "xi4", and I have to correct that. And number nine, "jiu3", they will say "jiu4", "shi2" like 10, they will say "xi". Like I said the timetable for a long
30 1h our 20 minute once a week, so they only hear once a week. But, I will correct them on, you know, they found that very hard "ji" sound. But I know myself, I have to keep. And xiaoyu, she will go "z-ai -ji-an", really slowly. The kids get it when she says it and I say it. They think it is funny, corrects me when I am too harsh on the 4th tone, "han4zi4". Sometimes in the Irish language, sometimes I can.. what I am saying in Chinese to something they might know in Irish. Then I say, you know in Irish you might know this sound, and they would get "Ah". I think sometimes you can use that a little bit.
35 Or sometimes we might ... some in English. So they don't forget it, you know. You tried .. some in other language.

HW: Do you think the students have sufficient opportunities to practise spoken Chinese out of class?

40 MC: No, not really. For the class hours I have, I might find a clip for a song, a rap, quiz, I might find a clip, whatever it is, maybe they are looking for to buy something in the market, and I want them to pick out the number that they hear, you know. And the role play, at first, I think, the writing, the characters, the characters strokes, you know with the brushes and mats. I think because of the TY, they are like, switch very quickly, maybe more chosen of subjects in TY. Course not all of them want to do it. They just want to be realistic. Not everybody, some kids love it. There is no opportunity to do it outside of school.

45 HW: It seems like if they have a long-term target, they might spend more time on Chinese?

- 50 MC: Maybe. I know that in another school. In the center of Ireland, Mullingar, my friend's kids go to school there, and they did the YCT exam in TY. So they have something to aim for. But in my school, they go out for so many trips, there is a huge gap between I see them again, I might ...them for two weeks. And they go back, forget everything, I feel even if I want them to take the exam, they are not there enough for me to get the work done. So, they enjoy, I feel I was just so love on that department cycle. If you have eight, you could form a class, with a minimum of eight students. And the government would allocate more to the subject on the school timetable. So this would be the short course, But I don't understand why they won't start it. But it is out of my control.
- 55 HW: Compare to the native Chinese teachers, what is your advantages and weakness in teaching spoken Chinese?
- 60 MC: I think I realised that I am used get them interacted to me in my French class, my music class, so I know I have to come up with some tasks better interactive. I think I have a good idea of their attention bond when they are doing activities. The discipline is another thing, you know, there is a certain code. A content code, that maybe the external person don't know. But like having the Chinese girl, you know talking about "Nin guixing", we would talk about Lixiaolong, then xiaoyu can speak it more about Bruce LEE. Like for doing tones or something, she might give me another insight. When we doing numbers, she was talking about certain birthday you do or don't celebrate if you are Chinese. It is like, having a good car, or having designer stuff, she would say that "BMW" is "bi e mo wo". That was really funny. She might give us the police, the emergency number in China. She knows something better than I do and she can add something that I didn't think of from her culture. We might go on a discussion on this for a while and then back on. And role play as well. I think we had a very good team.
- 65 HW: Have you ever used any digital tools to assist your teaching of spoken Chinese?
- 70 MC: Not really, because the school is only starting to introduce like a mobile phone policy. My principal says she is going to take it slow because she knows this is going to be mistake made. So to be honest, we haven't been encouraged, we can use phones, the children do not have ipads, so apart from that, I use youtube online material, sometimes I create my own stuff on quizlet, and recently this guys in Galway are heavily sending emails to all schools, and they are called XINSHOUHANYU. And they have app, and they can stage big .. of your school. And the kids all on the phones, and it is like a game competitive, and I know the schools are paid them quite a bit money, and the kids probably think we could be doing this all the time, why would I have to listen to the teachers.
- 75

Transcript of Audio Interview 10 (TW-N-E)

Present: TW

Location: Online Interview

Date: 14/07/2019

Interviewer: Hongfei Wang

Duration: c. 22 minutes

- HW: What is your current Chinese proficiency?
- 5 TW: I passed HSK 2. I passed the mock HSK 3 at the end of the professional diploma course. Unfortunately, I haven't had an opportunity to sit the official exam since as I have been abroad when it has been on. My spoken Chinese is very poor. I have no real opportunity to speak it outside of my class
- HW: How long have you been teaching Chinese?
- TW: I have taught Chinese for the last 5 years to transition year students....the class was 1hr 20 mins a week but our timetable has changed to 1 hr a week for all subjects
- 10 HW: What other school subjects do you teach?
- TW: I teach history, religious education, SPHE, meditation
- HW: Do you have any difficulties in teaching spoken Chinese to beginners?
- TW: I have no difficulty as what I teach is at a very basic level. Also my 1 hour class is both language culture studies.
- 15 HW: Could you specify the "very basic level" you mentioned?
- TW: Sure. Like I was said, I teach the students just one time each week, so I just try to teach them very basic words, I might teach them like the homelike of the house, mom, dad, try to count 1 to 10, those simple things. Like you know, YCT-1.
- HW: Are they all TY students?
- 20 TW: Yes. We do not have the short course in my school.
- HW: Will you introduce short course?
- TW: I do not think so. I would like to, but if introduce, it would affect some of the school jobs in my school. Because they do feel that a lot of students would like to choose it. , and they might choose Spanish and French, And if they don't chose those, the job would actually gone. So I have not forced the students, I
- 25 do not want to see stop the jobs.
- HW: Do you have difficulty in demonstrating Chinese pronunciation?
- TW: I don't think so. Again as I only teach basic language I have a good master of the pronunciation. I also support my own teaching of pronunciation by using video clips of native speakers saying the words/phrases that I am trying to teach.
- 30 HW: You use videos of native speakers to support the pronunciation of words/phrases, Is there any demonstration on sentences or conversation level?
- TW: Yes. Some of them would. It depends on what the topic is. And it depends on my class. I enjoy it. I might try to understand what it teaches, so like that, I see somebody try to engage, try to talk to each other. And they get to hear it. There is one clip about the home life, and you get to see a real home, the
- 35 mom and dad live there, they actually speak to each other, and the key words, key lines come up to the screen. So the class can see how you made the words, the phrases, and you break it down, all slides, and they can do it too, and they try to
- HW: So the students repeat.
- TW: Repeat, they do the pair work,
- 40 HW: What about tones demonstration?
- TW: At the start, I was trying to explain what the tones are, and we go through those during class time. So I will say I don't stress on them for a lot. If they get them wrong, I would say that's the wrong tone, I

will go back to them once more. But I wouldn't drill them too much. I would just say that is the wrong tone. Let them hear it.

- 45 HW: Will there be sufficient materials for your need? The online materials.
TW: Yeah, as I said to you, the Confucius Pack that I was got, the one that was sent online. I have found that was very good, I don't use all of the time, I kind of made some of my own slides, and I kind of building my own clips. Because sometimes the link just wouldn't work. So, certainly thing I would find online was what my needs are, my students needs are.
- 50 HW: How relevant would those materials relate to your course?
TW: Related to the course? One thing that I would like to distress at the end was actually worksheet. I find I am spending quite a lot time trying to make have to pay a fee, and I found they don't really meet the needs of what my class actually are, so I have to adjust them all. So that would be really great if there are more of those thing.
- 55 HW: Do you have difficulty in providing feedback and correcting students pronunciation?
TW: No, I have no trouble. As my class has a relaxed atmosphere, the students feel safe in making mistakes and are open to correction. They find it funny when they mispronounce words.
HW: Regarding providing feedback and correcting student pronunciation, is it possible to always be aware of the mispronunciation of the students?
- 60 TW: I think it is, Yeah, when you get them to say the key words back, the phrase back, did you get to hear, if they don't say it right, and you repeated, ,, I replay the clips. And I pick one or two boys girls in the class who ...depend on what class is.
HW: How strict will the students' pronunciation be?
TW: It was quite good actually. I would say it is quite hard to once each week. But first they do often say it wrong, but then when you and you do the pair work, a lot they might just get one word wrong, one tone wrong,
HW: Do you think the students have sufficient opportunities to practise spoken Chinese outside of class?
TW: No the students have no real opportunity to speak Chinese. This year I have tried to organise further opportunities for students to speak Chinese.....we went to a Chinese restaurant, they had to order in Chinese, we went to the Asian market store for a tour.
- 70 HW: What about the cost of the tours?
TW: In my school, the TY, was really really good. So out student paid a lot money at the start of the school year, the ... for the class was really really high. They are happy to what the needs are. So for this year, .. for trips, the funding that they don't have to pay anymore, which is amazing. So the meal, I think was 385 for the group. And the Asian Market so the school was happy
- 75 HW: How often could you manage to organise such activities?
TW: I tried to arrange things once each term. So at the start of the year I have got students out and we made cards. And the second term, we went to the Asian Market...
- 80 HW: Compare to the native Chinese teachers, what is your advantages and weaknesses in teaching spoken Chinese?
TW: Advantages: know the students well, their context, abilities, what interests them
Weaknesses: not being Chinese! , not having slang, everyday vocabulary to use
HW: What do you mean by 'not being Chinese'? Do you mean something about the flexibility of teaching, the ability to provide authentic learning content, language use?
- 85 TW: What I mean is, if you are going to teach Spanish,
Swear words, students would ask what's the bad word for saying this. I certainly wouldn't know. The slangs for, you know, this kind of thing. I wouldn't know the words. I think if you are from...
HW: It is kind of related to the authentic

- 90 HW: Have you ever used any digital tools to assist your teaching of spoken Chinese? We're they helpful?
How did you use them?
- TW: I use digital tools all the time.....YouTube clips to help with pronunciation....learn Chinese with Emma.....learn to count, food etc...Memrise to learn key words...characters, YoYo Chinese
- HW: Am I correcting that the digital tools you mentioned mainly refer to the videos and some applications?
- 95 TW: In terms of the clips I used? I use video clips. All the students have ipads. So this is the first year that the TY was actually have come into the class,
- HW: What are the role of the videos in your class?
- TW: So again, I may teach slides, Are they mainly used for demonstration or is there any other usage?
- TW: Demonstration, they clearly get the key words, how to express them.
- HW: What about the apps?
- 100 TW: As I was said this is the first year TY can use ipads in the class. I find it very good. I have been trying to teach them key words,
This is the first year I haven't actually the class YCT
The change of the class, I don't have too much class times,
- HW: Have you ever recommended digital tools to your students?
- 105 TW: Yes! The above tools and quiz let
- HW: What other helps do you or your students need for the teaching and learning of spoken Chinese, that we didn't me so far?
- TW: A Chinese club to assist spoken Chinese, rash course in preparation for YCT and HSK exams. Simple textbooks, PowerPoint.... (anonymous) PowerPoint is very good but not all digital links work.....worksheets would be great too!
- 110 HW: What is your expectation for the Chinese club? What's the function of it?
- TW: I used to think about it in terms of myself.

Transcript of Audio Interview 11 (MF-N-E)

Present: MF

Location: Online Interview

Date: 09/08/2019

Interviewer: Hongfei Wang

Duration: c. 13 minutes

HW: What is your current Chinese proficiency?

5 MF: I passed the HSK-3 in 2017. I am getting a little bit rusted but I try to 15-20 minutes Chinese every day, you know, just keep going that.

HW: How long have you been teaching Mandarin Chinese?

MF: 6 year since 2013.

HW: Is there any other school subjects do you also teach?

MF: I am mainly a science teacher and my special ology is biology. Chinese is only with TY.

10 HW: When you teach spoken Chinese to the beginners, do you have difficulty in demonstrating Chinese pronunciation?

15 MF: No. I feel quite confident in what we are doing. The frustration is that we never get past chapter 5, 6. You know, because we only have 10-week module. All of the students which will be maybe 70 students of TY, they all have 10 weeks of Chinese. So it is very much a taster course. So in terms of introduction, this is my family, this is where I live, where I come from, I could do that , no problem. I do feel sadly that it is only 10 weeks, and you have new group again. I actually I have asked my school principal that would it be possible to take those who are really interested, take them to a four year. I am quite confident to what we do in the classroom.

20 HW: Just focus on the very basic Chinese part, do you have difficulty in providing feedback and correcting students' pronunciation?

25 MF: I have difficulty in the limited time we have. Not in the actual process of teaching it. I will be able to correct them. We of course in any introduction to Chinese you talk about what makes Chinese different, and the Hanzi, in terms of tones, we talk about the different meaning of "ma1,ma2,ma3,ma4". They sort of they understand it very clearly. If you don't say the right tone, you can call your mom a "horse", for example. There is no difficulty for giving feedback, they main problem is time limited.

HW: Are the students excited to speak Chinese?

MF: Yes, absolutely, that is one of the advantages in teaching it. Because it is so new, there is novatl factor there,

30 HW: Compare to the native Chinese teachers, what is your advantages in teaching spoken Chinese?

35 MF: The main advantage is that I know the students better. Because I work with them all the time. So I have a relationship with them. I know their strengths and weaknesses. That is a big helpful instead of somebody just coming in. and also I think, you know, the very thing I would to say, If I can learn Chinese, my age, you certainly could do it as well. Because it is perceived as difficult when you look at the Chinese characters for the first time, it looks like very ... ,, I can actually have a conversation. I travelled a few weeks in China in 2016 with my wife. At least we never got lost, we never went hungry, so I have enough Chinese to survive there, Well, I can do it, travel there, and it is fun, you know. It is a good place to go. There is a difference in disadvantage, as the Chinese person has more credibility, they are from China, they are more believability, while somebody just visited there. So that is the main disadvantage, the credibility the Chinese would have.

40 HW: Have you ever used any digital tools to assist your teaching of spoken Chinese?

45 MF: Yes, all the time. We have the classroom set up with IT. Again, because of the time is limited, there is a whole I could use and I do use, you know, power point presentation, and all those have been developed by the Confucius Institute in Ireland. So we use this introduction to China, but also if there is as special day like going to the Christmas holiday, something like that, we chose Chinese film, and I have another resource, which built by myself, like the great wall, the first impress of China, flying

50 tigers, which are changing Chinese in subtle. They are good, they enjoy them which we can show on special days. One of the things I do successfully with the students is that, they, because the limitation of the time, the class, they have to research and present a topic, most of the students do it in power point presentation, and topics ranging, it can be anything to do with China. So we have sports of China, Beijing Olympics, Chinese food, Chinese pop culture, Chinese education system, it is absolutely,,,, it involves , ,,,, they do a little bit research, they presenting it. I found that, you know, a great way of getting them involved in the subject.

55 HW: When you were learning Chinese, have you ever used any applications, for example, on mobile phones, for you to learn Chinese?

60 MF: Yeah, I mentioned that I do about 15 minutes a day on Duolingo. I tell the students about as well the HAPPY CHINESE on MEMRISE, there is no end of free app you can use. The great advantage of those, if you are just waiting for a bus, or something, you can do it anytime, if you are spend 5, 10 minutes on those. And PLECO is another really good one designed for Chinese characters, you know, you can check what it means. Yes, we always, some of the students would ask recommendations for phones, You know , in their own time, and with the mobile phone, ...

HW: What other helps do you or your students need for the teaching and learning of spoken Chinese, that we are not mentioned so far?

65 MF: The main help would be having an actual goal of the courses. With something at the end of it. I know there is HSK, YCT for the students. You know at the end of the course, Chinese is going to be the leaving cert subject, which will be excellent. And in that way, that will be a measuring of success, at the moment.

70 We really need more that sort of a system. 10 weeks, they enjoyed the course, but most of them move on, and I think that gonna be their Chinese learning experience in life, you know. If they have more opportunity, like longer, Chinese introduce like a leaving cert subject, that will make a big difference, because there will be something really tangible for them to work towards. That's the big thing. At the moment, it is just for fun, really.

Transcript of Audio Interview 12 (RG-N-E)

Present: RG
Location: Online Interview
Date: 10/08/2019
Interviewer: Hongfei Wang
Duration: c. 30 minutes

- HW: What is your current Chinese proficiency?
RG: I have HSK-2.
- 5 HW: How long have you been learning Chinese?
RG: Since 2014. I think. But not consistently.
HW: How long have you been teaching Mandarin Chinese?
RG: From the same time. 2014. But I haven't had it every year on my timetable. I had it last year and the year before. It depends every year my principal has time for me to do it or not.
- 10 HW: Are the students all TY students?
RG: TY students. And it is only 40 minutes a week. So one class only. This year I saw them on Wednesday morning, for 40 minutes. And sometimes I don't see them for 2 or 3 weeks. Because they were doing other things, like trips or other activities. So it was hard for them to remember it sometimes. Because sometimes there were 3 weeks I did not see them.
- 15 HW: Are you the only Chinese teacher in your school.
RG: Yeah.
HW: Will you introduce short course in Chinese to your school?
RG: I am not sure. I have talked to my principal about it, but at the moment we don't have any short courses. Not at all. So that is for her to decide the timetable, I think. Maybe in the future. But at the moment, not right now.
- 20 HW: What other school subjects do you also teach?
RG: I am a Spanish and German teacher. And Chinese, a little bit.
HW: Because for TY, mostly focus on the culture part?
RG: Yeah, mostly. The language part is kind of a taster. I do it by module, for few weeks we did the basic, food, numbers, counting, and then we were doing the family, the love the family. Then we were doing a little bit about like Chinese pop music, and we learned the song TIANMIMI, So I teach all girls, they love when we are singing. They love to sing.
- 25 HW: So, when you teach Chinese language, focus on the basic part, do you have difficulties to demonstrate pronunciation?
RG: I only teach the topic I am comfortable with. So I usually, I use the HAPPY CHINESE book, usually I only reach maybe chapter 6, 6 or 7, so I am comfortable with all of the vocabulary, the pronunciation of that, I am comfortable to correct them. Obviously I don't teach what I am not comfortable with myself. For example. I wouldn't teach, I don't know.
- 30 HW: Does the student have difficulties to follow your pronunciation? To perceive or produce?
RG: Some do. Some are really talented with languages. They have good ear, I think if you keep tell them about tones, and practice the tones from the start, I think, a lot of the girls are from the countryside, so they have good ear and natural ability to follow my pronunciation. But some maybe don't love languages, and sometimes they jog about a little bit.
- 35 HW: Do you think the students have sufficient opportunities to practise spoken Chinese out of class?
RG: No.
- 40 HW: Is there a Chinese community in Galway?
RG: Yeah. During the year, I tried to bring them to different things, there was the spring festival celebration. And we sang TIANMIMI in front of lots of people, it was really nice, There might a lot Chinese people there, Irish people there, and they were so proud of themselves. But there were only 6 students of my class.
- 45 HW: Compare to the native Chinese teachers, what is your advantages and weakness in teaching spoken Chinese?
RG: Well, I will start with the weaknesses. I am not fluent. And I have only spent on month in China. And that was 5 years ago, already. I know that my Chinese is nowhere as near good as my Spanish or my German, and I am not as confident with it as my other languages. So I need to improve before I can be a better teacher. And sometimes they asked me things like how do you say this, or how do you say that, and sometimes I don't know. For example, if we were doing
- 50

55 food, and they want to know how to say some dishes that I didn't learn yet, and then I didn't know, so I have to say :” oh, don't worry about that, we all just focus on these words today. “so that's obviously my weakness. And I can't do the characters, so everything is in Pinyin. So when June(a Chinese teacher) comes, obvious she is native speaker, she can write the characters on the board, so, yeah, that's the weakness. And I think my strengths are that I know what it is like to start learning Mandarin, and I know what they will find challenging. And what they will have fun with. What they will find interesting. And how much is too much. Where to stop. And sometimes in my Chinese lesson, it is too much, for me to June might say I understand, but its too fast for me. So I know maybe the pace better. Maybe I know different activities that they enjoy from the other classes. They are my strengths.

60 HW: Definably, and your Chinese learning experience could convince the students more!
 RG: Absolutely. If they see I can do it. If I can say a few sentences to them in Chinese in the class, and they can look at me and: “wow, Ms Gilory is speaking Chinese, it is possible!” I can do it, they can do it.

65 HW: Have you ever used any digital tools to assist your teaching?
 RG: At the start, I was using the teaching pack and the power points from the (anonymous). But now I feel that some of them a little bit out of date. It is a little bit boring. And I want to change it. We do a little bit Duolingo, there are videos, youtube, called learning Chinese now, and learn Chinese with Emma, it is a good one. So when we were doing the family, I found a Chinese song, so these kind of things I look for at home, to bring to the classroom. I think you do need a little bit of technology. Definitely. Or sometimes when we were doing about the Chinese new year, to make a little craft, or like we were making pigs this year, I was using videos, to show them how to make it.

70 HW: Have you ever recommended any digital tools to your students to help them learn spoken Chinese?
 RG: I told them to bring duolingo home and to use it on the phone. If they are bored, they can practice on the phone. How many do it at home, I don't know.

75 HW: It seems like there are a lot of apps for learning, but it is hard to build it to teaching. How to supervise, how to test the students, make evaluation , kind of these things.
 RG: I think I would like next year, to do the HSK-1 with them. Cause at the moment, they don't do any of them. They do a presentation at the end of the year, on the topics was interested to them. Maybe Chinese musical instruments, or maybe Chinese geography, something in Chinese. Language they have no evaluation.

80 HW: What other helps do you or your students need for the teaching and learning of spoken Chinese, that we are not mentioned so far?
 RG: Well, when I was studying German or Spanish, I really benefited from language exchanging partner, so like someone meet me for a coffee, 20 minute speaking Chinese, 20 minutes speaking English. That would be a huge help. And at the moment it is very hard to find. So a language exchange partner, that would be a good idea. Or you know, even for a virtual one, talking to a machine if no real people is available, would still be much better than the current nothing.

85 HW: So you need a Chinese language exchange partner to interact with you.
 RG: I thinks so. That's how you learn things like”Taibagnle”, you know, that how you learn things in the context. It makes more real.

90 HW: Have you ever think of to practice spoken Chinese with a virtual partner?
 RG: Yeah, I was thinking about that as well. That would be a great idea.

95

Appendix G Interview transcriptions (teacher evaluation)

Transcribed using a simplified version of Neuendorf (2017)'s marking system.

KEY:

(.)	short untimed pause
()	inaudible or unclear speech
(information)	guess at unclear speech
((gestures))	descriptions for movements
<u>please</u>	louder speech
PLEASE	much louder speech
[and then [it was	overlapping speech
(an anonymous ...)	altered information in consideration of privacy and anonymity

Note: The reference codes used to identify transcripts are written in the format of 'initials of the interviewees – code for text (N for Needs Analysis, E for Evaluation) – code for language background of interviewees (M for Mandarin, E for English), number of lines in the transcript'.

Transcript of Audio Interview 01 (MC-E-E)

Present: MC

Location: Online Interview

Date: 20/07/2021

Interviewer: Hongfei Wang

Duration: c. 25 minute

HW: Thank you for participating in this interview.

MC: Hi, very nice to see you.

HW: So shall we start now?

MC: Yes please.

5 HW: So part one is about the background information, How long have you been teaching Chinese in schools?

MC: I started for about two years now.

HW: And how long have you been learning Chinese?

10 MC: I study Chinese for more or less seven years now. I studied four years for my undergraduate degree, then I spent a year in China afterwards. Then I come back from my masters. That took me for about two years, so overall, about six years now.

HW: I presume you took the HSK test.

MC: Yes, I got my HSK level 6 in China.

HW: So what kind of Chinese modules do you teach in schools?

15 MC: I teach takes the module for the whole school. Then I also teach a regular transition year module.

HW: So what is the level for most of your students?

MC: They are all roughly beginners.

HW: Have you used any tools or apps or websites for teaching spoken Chinese and how does it work?

20 MC: I use a few apps but they are mainly for reading and writing, I suppose. I myself used Chairman's Bao and you know, in the Chairman's Bao you could... there is a... there's a video recording for each of the reading pieces, so I would use the interesting reading pieces and also use the recording materials for my class for spoken, but they're basically monologues. It's not conversation. And again, I use the app more for reading and writing. That recording is just trying to make up the spoken part of it...

25 HW: Okay.

MC: I don't think they are... I mean there are many... I don't think I came across any apps that is for spoken Chinese in particular. I mean there are a few apps that you could practice Chinese with native speakers, but that generally will not be suitable for my students, they are mainly for adults. And... there are quite a number of apps and games... I can see you have a question about games there... but...it's mainly to practice basic characters... you know?... I don't know... there are many of them... (.)

30 HW: Like flash card?

MC: Yeah... and... I don't know there are few... I don't know whether the pinyin chard would count? I think I have a few websites where you could use a combination of pinyin. I have a few websites they have the pinyin chart which you could click on and you could have the combination of the pinyin and the pronunciation... That helps my teaching for demonstration. I give that to students as a reference after class. But... you can't really practice conversation or spoken Chinese using that... just practice pronunciation, I guess.

35 HW: Okay. So now let's go to part two. Now you have seen the tools and used it a bit as well, so I would like to have your feedbacks on them if that is okay?

40

- MC: Yes.
- HW: My question is... at the moment any challenges for you in teaching spoken Chinese?
- MC: I'd say at this stage is... it's language confidence... it is a major issue for my students. You see...
 45 I'm not a native speaker. So I have my advantage, that my experience of learning the language is pretty convincing for my students. They see if I could do it, they could do it. But at the same time, in terms of spoken Chinese, I think... I think... I think they sometimes still lack of confidence of being able to speak to a native speaker or just communicate with native speaker, you know. I found sometimes when... they could... could practice spoken Chinese with me, and even if I give them recognition, there is still... I suppose them wondering about how good they are. That's
 50 because I think they know that I was in their shoes, so I will be able to understand them, but what if they really talked to a Chinese people, you know? Someone in our neighborhood or something like that, whether people would understand them? So I thought this doubt is always there. So it's kind of like... I could give them the confidence to begin with... I could boost their confidence at the beginning... to motivate them to learn, but the exit ticket I couldn't give it to them. The exit
 55 ticket would be more convincing if there's a native person talk to them or something else... or just a second opinion... even this second opinion comes from a machine or AI as you presented. so I think I found that is still challenging for me... to build up their language confidence.
- HW: Do you have a Chinese community where you teach or near the students?
- MC: No I don't think so. I have to say... we have one Chinese restaurant, but I don't think they all
 60 speak Mandarin. I think they speak Cantonese? So can't really find an opportunity for the students to practice Chinese outside of the classroom. And as I said... there are resources and apps online but it's mainly for adults... can't really be used for students. Sometimes I try... so you know about the WeChat?
- HW: Yes?
- MC: You know... you can convert the text to speech, and you can do that reversely sometimes. So I've
 65 set up a WeChat group to kind of have a chat with the kids and sometimes I'll ask my Chinese friends to join that group just for my students to have that feeling of talking to Chinese people? But the thing is... my friends... they are not language teachers. They don't really have a very good control of their language. I mean they tried their best... but it's very difficult for them... especially
 70 (for students) at this level. It is basically that you really need to know what they (the students) know (in terms of the target language) to be able to talk to them. So what happened... most of the time... it is just very general conversation or greetings and that's it... nothing deeper... and it always stuck. It's not even as smooth and effective as talking to a robot to be frank.
- HW: So, would using the tools helps improve the situation?
- MC: The first one... the game... I actually I need to be frank with you... At the beginning... because
 75 you know all my students are girls... and we are a very traditional Catholic school... I'm just not sure... you know... whether the game would be a good selling point for them. But it seems they are getting on QUITE well with the game. I think... at least... look... frankly...it isn't going to be as fun as a real game... you know... as it's still... it's a... it's a gamified tool. But still... it's... it's
 80 much better than a lot of the games and tools on the market, you know? Some of them are like a PPT type of games, you know?
- HW: So in which way the first tool is helpful?
- MC: It helps you to realize exactly where you made mistakes. In comparison... well... when I was
 85 learning Chinese... when I have to practice tones in the past... the only tool is the that pinyin chart I just mentioned. But that kind of only give you a standard pronunciation, and if you don't know how to go from your own pronunciation to the standard pronunciation, it's not going to be quite useful. I mean... I have students who literally couldn't tell the differences between their own pronunciation and mine. So that chart will not be useful at all. But then the game sort of give you an indication... if you... your voice is too high, then the Mario will be very high... higher than the
 90 coins which I think is set to be the guideline for the standard pronunciation I presume? And then... if your voice is lower, obviously the character jumps lower... so it does give you an indication and it's actually quite easy for students to grasp how to pronounce towards the standard pronunciation. I think that helps a lot.
- HW: And what about the second tool? Was it useful?

- 95 MC: And the second tool obviously provides an enforcement for them (students) to talk to someone... Now this is simulated... it is not a real person... but still as I said... we don't have access to a real person in my neighborhood so this is more than nothing. Even if there's not native speaker, he is still a second opinion.
- 100 HW: Could you talk a little bit more about how you implement this two tools in your curriculum design? In which parts will you use the tools?
- 105 MC: Eh... I think mainly is the practice and the self-assessment part of it? For example, for the first tool, I used to give... I used to give the pinyin chart to students, for them to practice the pinyin and then they record the practice and I will give them feedback based on their pronunciation. That part used to take a lot of time when I give written feedback. Then later I've been using the voice recorder to give voice message as feedback. That is way faster but... still... sometimes it is actually not that easy to tell where the student made the mistake, you know? You can't really... especially when the quality of the recording is poor... you know... some kids they probably used some old... very old cell phone or something to record it. The the quality is not that good so you can't really tell where went wrong... And you can't see how they did it... how they produced it, so it's not that easy (to give feedback). And also again... you actually quite often found yourself... when you correct them in the class, everybody seems to doing okay towards the end of that session (practice session). But when they go home, they tend to forget. And without any assistance, they could do... they actually... in general do worse than what they could do in the class. But the tool here could help... kind of like a helper on the side. Because I don't check how they do with the game. It is something they could practice with, and they could practice whatever many times they think necessary. Then when they think they are okay... and they know when they are okay, because the game gives you feedback, then they could record themselves and send it to me, and I will mark. I think that boosted their confidence because they know they really get there and they won't fail. But eventually it makes no difference for me, because we want them to learn... because we want them to eventually achieve what they aimed for.
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- 120 HW: Okay, then what about the second tool?
- MC: For the second one, is it's pretty much the same. It's somewhere in between after class practice and my assessment for the class. They will get to use this tool to practice and check themselves before being checked by me... so just to prepare themselves. That's how I implement them in my class
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- HW: Okay, so I think you have partially answered the question about the challenges for you in assessing spoken Chinese.
- 130 MC: Yeah... because... because... it's hard to... (.) It's hard to conduct formative assessment for spoken Chinese. Because you only have this limited contact hours with students in class, but actually most of their time practicing the language has to be after the class. Then if you want to conduct formative assessment... we're supposed to assessing the progress... but you were not there (after class). And then you can only ask them to record themselves and compare over time, like how did they improve in here or improve in there... but that's all over a relatively long term. You can't compare their short-term progress.
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- HW: What do you mean in terms of long term and short term?
- 140 MC: Long term would be... let's say two or three weeks long... something like that. But you can't really measure the subtle changes... say... within the week or even just in between a few times of practice... like how your second try would be better than... or worse... than the first time. It's very subtle so it is not something quite visible if measured by outcome. It is very difficult to measure that. And... and... sometimes as I said... especially with COVID... we have less contact hours and kids they turn to forget. So sometimes it could be frustrating when they show no progress in a while... and can't really blame them.
- HW: So would the tool helps the summative assessment or mainly formative ones?
- 145 MC: At the moment... I don't know... maybe there could be some improvement... but at the moment... there are no... like a backlog or something to store the data (so cant use for summative assessment). I don't think that's a big issue because I don't think that's the strongest usage for the tool (for summative assessment). I think the tool is best to be used for formative assessment, to help students evaluate themselves. And I actually think it's good that you don't have the backlog...

150 you know... especially for the second tool. Because you have a better experience that you are doing an oral communication.

HW: What do you mean by that? You mean the backlog could be a distraction or something like that?

MC: Yes... you know there are apps... I won't say many but a few tools that you could use... you can use the speech recognition technology and you could convert text to speech and speech to text... something like that? Some of them said they could help practicing spoken? I tried a few and I
155 actually tried a few with my students as well. We tried to use that to practice oral, but the things is... regardless of the interface... because sometimes it is just a picture there with a man's face... then you talk to the picture and you see... you see your voice changes into text... and then the computer respond with text. That's... that's how it goes. Or worse, you just stick to a script and produce things and the text of your speech is checked. Either way, it's VERY... VERY...artificial. You'll be fully aware that you're talking to... not even a robot... but a system.

160 HW: Okay.

MC: And the second point is... I found that... and that's the biggest difference here... I found most of the time... because the process is so slow in between the text and speech exchange, I found myself staring at the screen and focus more on the text rather than having a conversation. So I don't think
165 that is anywhere helpful in practicing spoken Chinese. I think it would be useful to check whether you're saying what you want to say, to check the content. But it's just not a good way to practice spoken. You tend to focus on the text. So I think in this way (the second tool) this is good, because literally you see no text on the screen. It is a more immersed experience. However, I think from a summative assessment point of view, you would want to see the script to mark on the content and everything. But in terms of practice for oral communication, I think this way is very useful. It's
170 more or less like watching a movie in Chinese with or without subtitles. You really practice your listening skills when watching a movie without subtitles, even though you might understand less, but you focus so much more on what is going on in speech and your skill develops much faster. With the speech and text thing, you will feel like watching a movie with subtitles and you will be looking at the subtitles all the time.

175 HW: Okay I think I understand your point now. Then, do you see any challenges for your students in learning spoken Chinese?

MC: Eh... I think for the students, learning the tones is the biggest issue. It's mainly about the perception as I told you... some of the students cannot see the difference (between their own pronunciation and the standard ones), not to mention how to achieve the standard pronunciation. While other than that, the biggest problem is still they don't get a chance to practice it, and even if
180 they do get the chance to practice, it's very difficult to monitor that process. So they're on their own. I think that's the biggest challenge so far.

HW: So would the two tools help address the issues?

185 MC: The first tool will help with improving the perception. Because you know there are apps on the market which could show the graph of the pronunciation, that will help but just not as natural and fun as the game (first tool). And I think I just mentioned the second tool helps with practicing outside of the class, so that should answer your question?

HW: Oh yes. Then could you give me some insights on how to improve the tools based on your
190 experience?

MC: I think mainly for the second tool, I think it's good to not have the text for practice, but it will be good to have them for assessment. So maybe in the future, I don't know how you could realize that... how the AI recognizes speech... but I presume text properly would be involved anyway? So in the future, if possible, if there could be a function... you know... for example, the practice
195 version that students will not see the text, while there is a teacher version for assessment, which we (teachers) could see the text... or maybe just from the backstage... students don't need to see it...

HW: Okay, just the people who monitor the assessments to see the scripts of the conversations, and maybe do some error analysis?

200 MC: Yes, and give some feedback. Because at the moment, when you're talking to the AI, if you made mistakes, the AI told you they don't understand, but you might not know where went wrong. It could be your pronunciation, or it could be the content. So I think it would be beneficial when

205 students made an error, the text could be checked and maybe in the future, for the AI to give some more detailed feedback based on that, so they (students) could go back and check their content or pronunciation.

HW: Okay, perfect. Thanks for that, that is really helpful. So... last question... will you be willing to use the tools in the future... when you know... that it improved?

MC: Yeah, definitely. I'm looking forward to further improvements of both tools, and yes please do keep me updated.

210 HW: Okay, thank you

Transcript of Audio Interview 02 (SC-E-E)

Present: SC

Location: Online Interview

Date: 20/07/2021

Interviewer: Hongfei Wang

Duration: c. 26 minutes

HW: Hi, thank you for participating in my research. Can we begin now?

SC: Yes please.

5 HW: So the first part is about the background information. Could you let me know how long have you been teaching in schools?

SC: I just started... I thought... Chinese for my second year PME and then I just began to teach in school for about half a year.

HW: So that you are a new qualified teacher?

SC: Yes I am, yeah.

10 HW: How long have you been learning Mandarin Chinese? And what is your current proficiency level of Chinese? So you can take either HSK or CEFR as a reference.

SC: I've been learning it for about 6 years now, four years from my undergrad degree and two years for my masters. And I passed my extra scale level 5 in my first year of the PME and I have been working on my age is in level 6 at the moment.

15 HW: And what kind of Chinese modules do you teach in schools?

SC: Eh... now it is just transition year.

HW: So I suppose most of the learners are beginners, yes?

SC: Yes.

20 HW: Okay, first question, could you let me know have you used any apps or website or software in helping you to teach oral Chinese?

SC: Does it have to be Chinese specific or it could be a tool for any languages?

HW: It could be for any languages but it has to be focused on the oral perspective.

25 SC: Okay so focused on the oral. Eh... not that many tools I think on the market for spoken Chinese. I have... I do use a lot of tools for... non language specific ones. I... for my... for my placement, I'm in a Google school... and for my current school... it's Microsoft. So I use both Google platform and Microsoft. Eh... and then... there are a number of universal ones... because... because I also teach other subjects. So I use, for example, Padlet, Edpuzzle, Spiral and Classroom Screen... this kind tools for all my subjects, and I use them for Chinese as well.

HW: Are these tools mainly for facilitating general teach and learning?

30 SC: Yes, because for Chinese specific ones... I am using one called Arch Chinese, which is a platform with a lot of small tools for Chinese. But I had to say most of the tools are for reading and writing. I do... I do pass on some... some of the apps that I used to use when learning Chinese, for example, I used to use Memorize for vocabulary, and then I used Chairman's Bao for reading. But that's too advanced in general for my students... but I do give them those information... but it just doesn't seem to be that helpful for my particular student group.

35 HW: So... are there any game based spoken Chinese teaching and learning tools that you used or recommended to the students?

40 SC: No. Actually I don't think there are lots of spoken Chinese apps on the market. I think most of them are beginner level for vocabulary building... or you know... learn to write the character, to read the characters. Because I DO use a lot of games for... for reading and writing purposes... for example, I have used Tarsia, Drag & Match, Jigsaw for Chinese, but they are all for reading and writing... they are... I just don't think there are lots of apps for spoken Chinese out there... not to mention games. No, I... I don't... at least I didn't see there are many...

- HW: But do you think there is a demand for that?
- 45 SC: Yeah, I think so. Because... take my own learning experience as an example, actually my spoken didn't really improve that much past the initial state of saying words and practicing tones. It didn't improve that much until I get to... like... stay in China for a year... you know? That's the time my oral really improved. But in here, not much as I didn't have much facilitation after the class, and... like... you really had to make an effort to... to practice with... with your classmates, but... like... it requires... it requires basically a group of dedicated... interested peers to do this. Because you... you need to find people to practice with you. So... so... no, so... I think your tools are quite helpful. I wish I get to know them earlier... WAY earlier... when I was speaking... learning Chinese. Because even now I did not find that many apps that will help spoken Chinese in particular... you know?
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- 55 HW: Okay, let us talk about the tools. Let me ask a few questions about them, okay?
- SC: Sure.
- HW: Okay, so my first question is... at the moment any challenges for you in teaching spoken Chinese?
- SC: I think... I mean... again because I'm still new... so I had a lot of challenges. (laughter) I'm not sure whether they are in particular for teaching spoken Chinese. Put in general... I find it a bit more challenging when the learning gets more serious. I have no problem of getting the kids interested, and I could demonstrate... my level is enough for demonstration, and kids seems to like... I myself seems to be persuasive... because I... like... I was in their shoes, and the experiences in learning the language... and the thing that I will be able to do that (credibility in learning Chinese). We have a lot of fun together, but as soon as it gets more serious, say practice... like... when it requires some drills or practices sentences and conversations... yeah... I kind of lose part of the credibility. That... I find when it gets serious... then I... I found a little bit challenging to bridge the fun part of the learning and the serious practice part of the... of teaching the language.
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- HW: What do you mean? Did the COVID make it more difficult?
- 70 SC: Not really. I think I am okay with COVID. Because I... I got some training about... like... blended learning and teaching online from my course. And I also check some videos on my cellphone about them. I am interested in those different tools, so... like... I get... like... I... because I use them before I even begin teaching, you know? In my own learning I use those apps. So it's not that much of a problem to... to implement that in my own teaching. I use them anyway... before COVID. Then it is matter of when I carry out online discussions, group work in a different manner. I didn't find COVID is much of a challenge to me, but definitely the challenges are still there... in terms of... in terms of ... There are quite abundant tools to work on... you know... the initial learning of characters, and the vocabulary building... much less so for reading and... and writing composition... and then VERY rarely I would see tools for spoken Chinese.
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- 80 HW: Okay, I think you really benefited from your ICT background, don't you think?
- SC: Oh yeah, definitely.
- HW: So you think the tools are beneficial for your teaching? But how?
- SC: Oh yeah. As I said, not so many apps on the markets to help with the spoken part of it. And to be frank,⁰ that's a big part of the learning, because... if you look at... say... if you look at the specification of the leaving cert (Chinese), a HUGE proportion is the listening and speaking. But... like... the majority of the tools I have at hand are about reading and writing. And some of them are not even helpful. But for spoken Chinese... it is... it's... I think it's the most part that I need assistance, but other than these two prototype tools, there aren't... there aren't many (tools)... And then... I think the issue for ME in in learning the language still persists.
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- 90 HW: What issue are you referring to?
- SC: You know... at that time, i don't have many opportunities to practice it (Chinese). And... and... it's actually a pity to see this many years later, still there is not much solution to that... you know? My students in schools still recognize that there are not many chances to practice it. I mean... in theory... you have... I mean... I'm in (anonymous place), yeah? This is like... if you think about it.... There are probably a lot of Chinese people you can find, lots of Chinese people... I mean you could probably find Chinese people on the street. But... in theory... you can organize trips to
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- China supermarkets or restaurants and let the students talk to Chinese people there. But in reality, is not that easy. Because... first you need to be aware that they are beginners. They know very little Chinese. They want to have a conversation, but literally the conversation needs to be pre-scripted. In reality it's very difficult unless I could get another teacher who understands the pedagogy and who have a good control of the language. Otherwise, you think they can just say hello or Nihao ('hello' in Chinese), when they run into people in the Chinese market, and watch the people talk? But people always say something confusing to them, and the conversation will fall apart, and that will end up destroy their interest or motivation.
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- 105 HW: So you think the students would be better practice using the tools?
- SC: Yes definitely. Because you know... the AI... is something in between. It's... I think it's sort of... it's... it's not as pre-scripted, but also it's not totally random either. It's not like you need to say the exact word so to be recognised by it (the AI). But at the same time, it does have a range of words and expressions. I think it has more tolerance for the input, that it could recognise what students say within a certain range of the language. This makes it much easier for students to learn the content and apply them in the conversation. And the pronunciation does not have to be perfect. As long as it is understandable, the conversation could happen. While at the same time, the information returned by the AI is always... is always comprehensible for my students. They will always be able to understand what the AI is talking about, which is VERY VERY important.
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- 115 HW: Why is it so important?
- SC: Because we want them to practice what they've already learned. we don't want to add up another layer of cognitive workload on top of the conversation. So they could really focus on what they can say, instead of constantly trying to figure out what the other people is talking about. I think that's so important and... and then... another thing I found useful is... There's no barrier in using those apps, for me as a teacher and for my students. The first one... that game... anyone played Mario or remotely seen people play Mario could instantly get how to play this game. I don't need to spend time to explain much on instruction. Even the platform in my school... I'm using the OneNote at the moment... we use it for assessment and sharing materials, and we use it across subject. Still, we spend... it consumed a HUGE amount of time to expand to the student how this would work, how I will release assignment to them and how they should return it to me on time, and how I give them feedback and how they check everything uploaded to the platform... things as such. But for these two tools, if you choose the first one, it just gets on and you play it. And the second one, you just get on and you just play it. I don't explain nothing and the kids jump right in. And also it's very flexible. I could use it in class, out of classroom, before or after the class, very flexible. I think that considering... considering Chinese as a new language... I think that (easy to use functionality) lowered barriers. It is fun to use and helps learn the language, but it doesn't require much extra effort in learning how to use it. I think that's very important for beginner learners. They are learning a new language, which is also very different from any language they already learned. They have enough on their mind. They don't need... they probably don't want to spend too much time on learning how to use the tools rather than just get on with it.
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- 135 HW: Okay, great. Then is there any challenges for you in assessing the spoken Chinese of students at the moment?
- SC: I'd say I'm still in the process of trying to... you know... the language control part of it. I'm trying... I'm still in the process of working on my language control because I think... it's actually easier for me to assess a presentation, which I give a topic and arrange students to do it, and I assess the outcome. But then it's a bit challenging for me to assess the conversation with students, because sometimes I found it hard to continue a conversation in the way that is always manageable by my students. I sometimes need to look at the textbook or materials at hand, that tells me what I could say to... try to... you know... just try to control my language all the time so I can sustain that conversation with the students. So... yeah... I would prefer to use the second tool to build into assessment. I found it easier because that reduce my workload of managing the language I say. I could determine the range of the language returned beforehand, so I don't need to physically memorize it? So it for me... so I think it's easier for me on that part (language control).
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- 150 HW: Then what about the students, any challenges for them in learning spoken Chinese, that you didn't mention yet?
- SC: I just think they need more opportunity to practice... to use the language. I mean the first tool is great. All the boys and girls love that game in my class, you know? At the beginning I thought it

probably be the boys who would like the game more, but it seems everybody loves it. Such a great tool to practice pronunciation, which... which could really be a dull thing speaking from my point of view. I didn't enjoy that much of correcting my own tones back then. But then the first tool perfectly transformed it into a game. Everybody seems to enjoy it. While the second tool I think is the most important part. Like... I really suffered from not being able to practice my spoken Chinese. I just got to listen to my teacher... lecturer in class, but then afterwards... you only got the recording of the book and then the recording is not even conversation. And most importantly, you just... it's... it's... it's one way, you know? You listen to the recording and you got nobody to talk to. It is not interactive. There's no interaction, just practice by yourself. Not like this, because I played with the tools a little bit as well. You could really feel like you are in a real conversation, which is so important. I think it would build up your confidence in speaking. Just because... just because the format is different, you know? I was thinking back then, I practice a lot of speaking things, but that's... that feeling of getting used to talk to PEOPLE only established while I was in China. It is not an easy task, but I think these two tools build up the confidence of the students. With the tools, that confidence could be built gradually from day one, to get used to be in a conversation, not like me until much later.

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HW: Okay, so you think the main contribution of the tools is to help build up students' confidence? Because it is immersive?

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SC: It's actually a huge gap... speaking from my own experiences... a huge gap from doing very well in class and be able to talk to a real person. Like... you could get an A... A plus, in your class, but you could still do terribly when talking to a native speaker. There's a HUGE gap in between and I think the second tool could potentially fill in the gap.

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HW: I think so, too.

SC: Yeah, you know... like I used to feel like I could... I could really talk to my teacher and the teacher will understand me. I just couldn't have a chat with the international students, as they won't understand me at all. And we always end up... I mean... we could go on practicing Chinese but we always end up speaking in English.

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HW: Yes, that happens.

SC: And that's me, that's me as a college student. Imagine if you are a teenager. If you have that experience for one or two times, then you will never want to speak with the native speaker again.

HW: Okay, thanks a lot for the feedback on the tools and everything. Then do you have any suggestions for further improvement of the tools?

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SC: You know for the first tool, it's all fun playing it. If... last time I try to use this, I try to use this in the context of a competition. Because it happened very naturally among the students. They will compare and see who beat the game with the shortest amount of time. I was thinking... I don't know whether it would be very difficult to make... but if there could be a mechanic to records how many gold coins you get in one game run or you have a time calculator on top of the screen, would it contribute towards a competition mechanic?

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HW: Okay, great idea. Any more? Any ideas about the second tool?

SC: For the second one, as I said, I would love to use it for assessment. but it doesn't have a build-in system to record everything. In terms of assessment, you do need to record everything. So what I do is... you know those apps like talking avatars?

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HW: Yes?

SC: You can record something and then the avatar could speak what you recorded? I would ask the students to record their conversation with the AI, like a role play but it doesn't require you to get a partner to do that. Because the AI will automatically check the result for you, whether your pronunciation is good enough or your content is correct. From a teacher point of view, if there will be a build-in system for me to acquire the script between the student and the AI, that would be very handy as I could do a lot of things with that script and recording. For example, I could use it for assessment, but also for project. I was thinking it could be recorded automatically as an audio file or you could have a system log to record everything in written, so I could check and implement the whole thing in comprehensive assessment.

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205 HW: Okay, thanks. Then the last question, would you be will to use the tool in the future if they are fully developed?

SC: Oh yes of course. I really look forward to the potential of the second tool. As I said, because at the moment, everybody is saying you need the exposure of the language, but to me, I think you need the expose in the right format. In terms of being able to speak the language, you need to be exposed in and participate in more conversation. You can't just talk to yourself after class. You need to talk to people, or in this case, to talk to at least a virtual people. It's the best if we have a friend who are willing to help you and won't judge you. But it's so difficult in my context, you know, lots of issues... like GDPR and child protection... everything... It's difficult to establish that kind of partnership. So I think maybe artificial intelligence might be the best solution for the moment. It's safe for the purposes... from the information protection perspective and from a motivational perspective. So I really look forward to more coming out of your project.

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HW: Okay, thank you so much.

Transcript of Audio Interview 03 (MS-E-E)

Present: MS

Location: Online Interview

Date: 20/07/2021

Interviewer: Hongfei Wang

Duration: c. 24 minutes

HW: Thank you so much for participating in my research. So should we start now?

MS: Sure.

HW: Can you please tell me teacher how long have you been teaching Chinese in schools?

5 MS: I think about six or seven years now.

HW: And how long have you been... how have you been learning Chinese and what is your current Chinese proficiency? We could take HSK or CEFR as a reference.

MS: I passed the HSK 3 like two years ago I think. I learn Chinese on and off for probably the same... about the same time... six or seven years.

10 HW: So HSK 3? I'd say somewhere between CEFR A2 and B1?

MS: Probably, yes.

HW: So what type of Chinese modules do you teach at school?

MS: Just a transition year Chinese module, that's all we have here.

HW: What language levels are most students at?

15 MS: They are mostly beginners... never learn Chinese before. Some of them learn Japanese and a few heritage speakers, but they've been on and off... mainly students at beginner level.

HW: Can you tell me how... have you used any tools or apps or websites to facilitate your teaching of spoken Chinese and how does it work?

20 MS: I have to say not many. Normally... we don't... like... our school's facility is not quite good for IT, so I haven't been using quite a lot of apps and also it's a little bit hard to require students to... to... like... not all of them would have access to such things like a smartphone or a tablet. So mainly for me to demonstrate things, but not many (apps) implemented (in teaching and learning) I'd say.

HW: Have you recommended any apps or tools to your students?

25 MS: Yeah no, I do recommend... you know the Pleco dictionary?

HW: Oh yes.

30 MS: I think that is useful for students to check the words and characters. And then, besides that... maybe a few apps... there are lots of apps for beginner level Chinese but like... they are really similar to each other, and I found... I found a few ones that are more systematic. But they do not seem to be made for foreigners... you know? There's many for Chinese kids though... some of them will... some of them are helpful. They have some games implemented in various ways, but it's very... it's very... it's the easy games... like connecting dots and typing the characters on something, and some like a shooting game... shoot the stuff that has the right character on it... things as such.

35 HW: So while you were teaching Chinese, you are also learning Chinese, yes?

MS: Yes.

HW: The, have you ever used any game based tools for Chinese... could be for teaching OR learning... that you think was useful for your learning?

40 MS: Some apps I used... but not games. I myself is not really a fan of games. I found them not very efficient... like for learning. But that's for me... for myself. I do see... 'cause... we're a boys school... so I do see boys are more... like for this generation... of course they like games... but

- just not for me. For me, I mainly use apps for vocabulary building, and... and... and this dictional type thing, and then I will probably encourage my students to use more of the social media platforms to get information and to engage with native speakers... that type of thing... rather than games.
- 45 HW: Okay, thank you. Now let us move on to the next bit. So I just introduced you about these two tools and you have used it for a while, so now I want to have your feedback on them if that is Okay, yeah?
- MS: Yeah, okay.
- 50 HW: So my first question is, at the moment any challenges for you in teaching spoken Chinese?
- MS: I would say demonstration is the number one issue. I mean I have HSK 3 and I think my pronunciation is Okay. But I think my pronunciation is more accurate at the level of vocabulary? Sometimes when I pronounce a long sentence... with something... I'm... I'm not quite sure where... I'm not quite confident that my pronunciation is very standard. So I DO always try to find a video or something to demonstrate that pronunciation, and I think because of that, sometimes my... like... my demonstrations could vary a little bit, and I found it a bit challenging to... to guide them towards one standard pronunciation. They all sound a little bit different from each other... sometimes. That's one of the challenges.
- 55 HW: Okay, that is about demonstration of the pronunciation? Yes? Is there any more?
- 60 MS: And then... you know... I'm in (anonymous place). So we don't have... like... the boys... they have very rare opportunity of speaking Chinese outside the classroom. So they... it's actually quite challenging to find a meaningful context for them to practice the language. When they practice with each other, it's just... it's not authentic. If I could find a good activity, they could immerse more into it, and they would be more willing to practice. But still... you know... when they are aware that they are just practicing, and they are just talking to each other using only these few words they know in Chinese all the time, it just doesn't really feel very authentic. And they couldn't be very engaged in that way.
- 65 HW: Okay, then is there any particular challenges in relation to the impact of COVID?
- MS: Oh yeah, that has a significant impact on our class. I'm in... because I'm not... I'm not using... I'm not using a lot of ICT tools in the past. I prefer more of concrete objects and demonstration in the classroom, so the COVID really hits me hard at the beginning. I think my class online is quite boring at the beginning. Because I couldn't use... I didn't know how to use a lot of things, and I couldn't have my stuff in the classroom, so I tried to learn a bit more about the breakout rooms and things as such. You know... put on the pictures and ask the students to have a conversation? Put that picture in the background (of the online classroom) to have a more authentic experience, something like that. But just... we don't have that many of classroom activities and... and... and opportunities to practice the spoken language.
- 70 HW: So do you think the tools I just presented to you could help with the issues?
- MS: (...) I think so. I think for the... there... there are two tools, yes?
- 80 HW: Yes.
- MS: So, the first one, the Mario game. I think because... because it's implemented... I think it implemented the standard pronunciation without showing the standard pronunciation. So you have... like... the students could play the game and then you have this... the signs and you have those gold coins to guide them how to pronounce the words. But there is not showing a standard pronunciation. So I think it helps students to naturally get there without feeling excessive pressure... you know? Because... particularly in my school, boys are... they think themselves not quite good at languages, and they think studying languages could be girlish, that it's not quite a thing for boys. And at the same time... they're pretty much... you know the Chinese saying of the 'face'? They are really concerned about losing their face, so the issue I have is when I used to put up a video or a demonstration from native speaker, and they... some of them... a few... would be very stressed out because they think it's very difficult for them to achieve that. But with the game, you don't have a... like... you don't have the answers there. But you do get feedback on how to get there. So, every time they pronounce, they play the game THEMSELVES, they improve and they eventually... they will get there. I think that took a lot of pressure away from the boys at the beginning, and they would be more willing to practice. And also like it's kind of... it transforms
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- the mistakes, it is not a bit deal anymore, you know? If you made a mistake, you either jump... you didn't jump into the right direction or you missed the gold coin, so what? You could do it again! If you fall into the river, you need to do the whole thing all over again. But it's fun! It's a game. It's less of a risk for the boys than saying the wrong thing in front of their buddies. They won't think it's such a big deal so there are more willing to... I mean they perceive it as a game rather than a practice or task. And the boys like games, so they're willing to play. As long as they play, they can improve, and that helps their pronunciation. It would actually save me a lot of time, too... to find the videos of the pronunciation and... and to guide the boys on how to pronounce.
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- HW: How about the second tool, the one with the AI as a language partner?
- 105 MS: I think the second tool could be even more useful in my context. As I said, we don't get that many... we don't get that many Chinese people around. I mean most of my boys here have never seen a Chinese guy around. They only see those in my videos or something... and it's not quite convincing for me to prove something to them. Say, if I give them positive feedback... I say 'Look, your pronunciation is great! You should be able to speak to native speakers!' As they don't
- 110 get the chance to practice with the native person, they don't have the chance to prove it, they won't buy it. So the second tool could provide them the opportunity for that. I know it's not a hundred percent real, but as I said, the boys are really concerned about their self-esteem anyway. I doubt if we do have a native speaker, they would... they would have the courage to just jump right in and practice with the person. So I think that AI is actually something in between the real person and completely on their own. They would have the opportunity to practice with the AI, which is
- 115 not real person, who to be frank sometimes would give negative feedback, and nobody would know other than themselves if they made an error. Nobody would know how much time they put into to practice, so they would not appear to be left behind. Instead, they could all go back and practice, and come back with rather okay pronunciation. For some of them that I know are not
- 120 very good at pronunciation and tones, they get the chance to make it up. Then they all could talk to me and with each other at a certain level, and that I think would be very important for the boys, very motivating for them.
- HW: So, I think you mean the virtual language partner could reduce the anxiety and pressure of the students...
- 125 MS: Yes and you know the... I mean, okay... it's not a real person. The sense of achievement (for being able to talk to the AI) probably will not be as tremendous as (be able to talk to) real people, but you know... When I was learning... for example, when I was learning with a teacher, even if they are trying to encourage you, sometimes you really could see the disappointment in their eyes and faces (laugh) when they give you a compliment, you know you are not doing great, but they
- 130 just give you compliment anyway...
- HW: (laugh) so you know they are not sincere...
- MS: Yes, and you can REALLY tell. And actually I don't think that is very helpful... at all. But I'm just going to say, I think it's such a huge pressure on the teacher as well. You can't... I mean... I probably wouldn't be able to do it... you know... keep being genuinely positive in a convincing way ALL THE TIME. So it's an advantage of the AI. It always had a smile on it and will only
- 135 speak positive words back to you. It will not judge you but just tell you when you need to improve. And then... and then... you have no pressure. Nobody knows how bad you were, and as long as you achieve as good as intended, you come back with a good level, and people would recognise your good level.
- 140 HW: Okay, I will need to move on to assessment if that is okay. At the moment, any challenges for you in assessing spoken Chinese?
- MS: I think... yeah... I think... remember I mentioned about the boys, they speak in their own ways sometimes? I mean they are probably okay, but sometimes they sound very different from each other. So I'm not quite sure in terms of the learning outcome, whether they will be able to achieve what is intended. So, for example, could they really go to an Asian market and get those things I
- 145 signed for them just speaking Chinese to the shopkeepers, with their slightly different pronunciations? So I was thinking... I guess... maybe the second tool could help because the AI program could determine whether their various pronunciation would be at the level of... of... being acceptable... being comprehensible? I guess if they could pass the AI, then I would tend to think they could probably be understood by the native speakers? You know, just to have an extra
- 150 layer of insurance. Otherwise, sometimes I might need to use the... I tend to meet with the native

Chinese teachers that I know or... you know... through the SLAR meeting, where we sit down and we go through the recordings. I meant I just I need a little bit of consultation with the native teachers to make sure of that. But if I have the second tool to help me, I probably don't need that?

- 155 HW: Okay, then what about the students? At the moment, any challenges for your students in learning spoke Chinese?
- MS: I think as I mentioned, the two... the two major issues... one is the confidence... or you could say it's self-esteem. It's the boys... you need to constantly encourage them to progress... in a subject which is not traditionally recognised as a strong case for boys. So I'd say that, and then second
- 160 is... try to practice the spoken Chinese.
- HW: So could the tools help address these challenges?
- MS: Yeah, I think. The first one, at least they will be very motivated to learn?
- HW: As in beginner level?
- MS: Yes, I mean you can probably use it as an introductory tool, you know? I bet you could... you know... for the first class... without learning anything yet, you could throw them a few words in that game and let them try to beat the game. And if they could do that, they would get a first impression through that game, they probably think they could do it after, you know, in learning the language. That would be quite a positive first impression I'd say. So that would be a great motivating factor. Motivate them is always a challenge, you know. And then the second one
- 165 (tool), they just really get to practice, I think. They would be glad... I mean... still it would be great to talk to a real Chinese person afterwards, but I think they would be quite happy to be at the level that they are AI proved... that they are ready... ready to talk to real people afterwards. I think that would help their mentality.
- HW: So any remaining challenges or areas of improvement for the tools?
- 175 MS: I'd say I think the first one is perfect. I think for the second tool, you know for different scenarios, you have the different characters? Sometimes you have this more like cartoon characters, and some that are more like real people? I don't know... this might not be correct or for all the students... but just you know... for the boys... I think they will be more attracted by the real people avatars rather than the cartoon ones. I mean just those scenarios with real people avatars
- 180 seem to be more convincing. They probably would be able to immerse more easily in that. Also, I don't know exactly how it works, but maybe if you could have a... I don't know... real people simulated videos instead of the avatar, it will be more immersive? You know because at the moment it's a background with an AI avatar in front of it. If the whole thing could be a recorded and simulated real people carrying out conversation, that would definitely be more convincing.
- 185 HW: Okay, thanks for the advice. So, last question, if the tools become more mature in the future, would you be interested in using them in your class?
- MS: Oh, for sure. The first one seems to be a very good introductory tool. I could use it right away in my class. Then the second one, I think it has its own advantage, that it could be a bridge... like a preparation tool before getting into a real life conversation. It is just at the moment I know your budget is probably limited, so the whole interface and everything looks obviously it's a prototype.
- 190 So when it's more polished, I'll be interested in using that in my class.
- HW: Thank you!

Transcript of Audio Interview 04 (CT-E-M)

Present: CT

Location: Online Interview

Date: 20/07/2021

Interviewer: Hongfei Wang

Duration: c. 30 minutes

HW: Hi, thank you for participating my research and taking the interview.

CT: No problem.

5 HW: Shall we start now? ((nodded head)) Part one is the backdrop background information. Chang, as a native Chinese teacher, how long have you been teaching Chinese in Irish (post-primary) schools?

CT: I think about six or seven years now.

HW: And what type of Chinese module/s do you teach at schools?

10 CT: It is mainly the transition year Chinese module. And sometimes we have a taster course for the first years or for any student who would be interested.

HW: At present, what language levels are most of your students at?

CT: I think mainly at the beginner level. ..., Beginner level students who have no experience in the past.

15 HW: May I ask have you used any Tool/App/Web to facility your teaching of spoken Chinese? And how does it work?

CT: Our school is a Microsoft Teams school, so we use Microsoft Teams for basically everything, especially during Covid. We use OneNote as the platform to facilitate teaching. I don't know whether it would account. And for particular apps, ..., I use Quizlet and Kahoot more often. You mean the teaching of spoken Chinese in particular, yes?

20 HW: Yes.

25 CT: I would say Quizlet and Kahoot. ..., In terms of how it works, I use OneNote as a platform to distribute information and then my students could hand in their homework through OneNote, and I could give them some feedback on that platform. And I have recently been giving audio feedback instead of writing. Because it is faster, and it is more personal. And then for Quizlet and Kahoot, it is mainly to, ..., I could use some of them in my classroom, mainly just give homework, you know the flashcard and quiz, that type of thing. You could create some videos with questions, something like that.

HW: Are there any game-based spoken Chinese teaching and learning Tool/App/Web that you used or recommended to students?

30 CT: Some of the tools that I use, I can't remember exactly the names, but even for Quizlet and Kahoot, they have those elements of games. But, ..., I mean the games in those apps are quite basic, they are just basically in the format of ...very quick casual games. Just to give a little fun factor to it. I know there are few, I know there are some apps that they have the games like the shooting games, you can shoot the balloon with words or something like that. But, I didn't find anything that is of
35 good quality. I think a majority of them, I tried a few with my students, but I think in general they think the games are too ... I don't know how to put this. It's too on purpose like it's not fun enough. It's very clear they want you to learn through the games, but the game itself is not very fun like my students would instantly recognize. This is something to do with learning itself. It's, it's a game for the sake of being a game rather than again they could really enjoy. You know,
40 especially, for example, for the boys, they would know it is a game as an alternative exercise, it is not like they are really playing video games. They won't do this for leisure purposes. So the experience is not very natural. Just not quite organic. So, yes, I would use some apps with game elements, but no, I haven't found any apps that could implement the learning very well, in a meaningful game. It's more like a rock, paper, scissors type of game, not showoff, tricking
45 students to learn in a not very subtle way. And the students would know.

HW: Thank you for sharing. And now I would like to ask you more questions about, you know the tool I just introduced to you that I designed for facilitating the acquisition of tones in a game-based way and also the second tool I showed you like the computer as an L2 speaker, for the spoken (Chinese) learning. So I would like to have your feedback on the tools.

50 CT: Sure, no problem.

HW: My first question is at the moment are there any challenges for you in teaching spoken Chinese?

CT: You know we had a very challenging year of not being able to meet students face to face as much as we can in the past. And in terms of teaching the spoken as a part of the language, it's obvious it's way more challenging. First is that the students couldn't see you quite often physically. It's difficult enough to demonstrate the pronunciation in the past, but with the mask, basically, the student couldn't see you or how your mouth moves. It's, it's more difficult to demonstrate the pronunciation. And with limited contact hours, it's difficult to check the progress, check how they do for the spoken part of it as well. If we're, if we're having an online class it takes quite a long time to check each other, to check each student's pronunciation, even in breakout rooms and take ages. And then, ..., you could leave it as homework and check the homework, but you can't correct them at that moment which means if they made a mistake and you want to correct it ((coughed)) you just won't be able to do it at that moment. You can't, they made mistake, you say 'look, you could do it this way.' Right there, you're, you are still correcting homework, so you can't give them the instant feedback, you know. It's always checking the homework and that's Covid and I think that's mainly Covid related.

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HW: So how about it before the Covid, does the challenging the same, or you know, that the Covid make it more difficult?

CT: Before the Covid, it was more of a UDL-universal design of learning issue that I found the level of students in crying spoken Chinese varies hugely. So like they always not at the same pace when you teaching the pronunciation. There is always some that are more advanced, they could instantly grasp the pronounce, but then you always have a feeling that they just won't be able to progress as fast as the majority, takes a bit more time, not to, not to mean they're slow but just they have their own Strengths, but some of them, they just need a bit more time to practice and you can't linger on that. So correcting them and when to correct them, is, is, is, is a kind of like a challenging. And again if I leave it as homework, I can correct the result, but, it's a little bit difficult to guide them on how, you know, how, how they, how they achieve the outcome, that is a bit difficult.

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HW: So could the tool benefit your teaching, and how?

CT: I think both tools are really great in the concept, you know the game that like Mario that everything, that one really helps with giving the feedback. You know, because as I just said as a teacher, and, I mean it doesn't matter is that online or face to face classroom, your, if you want to correct a process of a students pronunciation, you can only do it only individual basis, right? (Yes.) You can't look at 10 students and correct them and point out the issue, and then it takes a lot of time. So, so if I want to give feedback on the process of pronunciation, just correct them, say, say if they say NI hao, the NI, second tone is not high enough, you really need to in that context, in that moment you really need to give the students feedback, 'Look, from this say at the second part of pronunciation or in the middle pronunciation you didn't raise your tone high enough, you need to keep going.' But then I can only do that, one at a time and take lots of time, and you can't you cannot do that to a homework because you didn't see the process and they don't, it's very difficult for them to figure out which exactly moments you're referring to. But with that game, I mean, of course didn't see it as a game, but to me it's more like, I think to me are related to more to a graph, you know, so because it's controlled by the sound, so say the same situation if the second tone is not high enough, then the the Mario won't be able to jump high enough, and that instantly gives you or give this students a hint- look just right here you are not high enough not a second before not a second after this, right there, so that's instant feedback and students know at the moment right moment, right after she made the mistake. And then, students could go back and try it again. and you sort of have that guideline go coins or like little apples to mark the marked standard pronunciation so they have a goal, so they have their ideal outcome right there. And then not to mention there is, for this part is zero effort for me, it's zero effort for me, what I need to do is to monitor and make sure everybody is paying attention and playing the game, which is not, which is not a very difficult task. Because it's, as I said, it's fun, it's not like some of the apps I used before. It's fun itself so students turn to concentrate on the game at themselves, so I just need to monitor, but through that, you know and you can have the whole class practicing and having

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105 feedback at the same time which is very efficient. And I do, then, I could direct my focus from
correcting the pronunciation to managing the class. And also I think majority of the students, they
get sufficient feedback or help from that app, so I could actually direct my attention to that a few
students that do need my help, an extra push to get it right and then the whole class seems to be
able to move forward on the same pace, so you know the more advanced students could play a bit
more, they are having fun, and then the slower students would be able to catch up and then they
will be feel to be left out, which actually is very important for my students cause they're mostly
110 beginners, the confidence is very important for them to through that. To them like, they just play
the game for 10, 15 minutes but they would be able to move on. But, in comparison in the past,
they do homework, pairwork, it still takes 15 minutes at least to get everybody right, and most of
the time, it's not possible. That's the first tool. The second tool I used more as a homework,
because, I probably did not mentioned that, but, cause we are in Ireland, we don't have, like a, ...,
115 we don't have accessible Chinese communities, so really the kids, they don't have opportunity to
practice the language afterwords. Any homework I leaved to them, I tried to make it authentic, but
let us be honest, they need to be(15:04) the practice. I won't say I will be convinced by the
second tool, because still it is simulated artificial intelligence, but it is more than nothing. The
students do get chance to practice, practice in what they learn in the class, and the AI may give
120 them feedback, so which I think is good.

HW: Thank you thank you so much. And can you tell me at the moment any challenges for you in in
assessing the spoken language?

CT: Yeah. As I said, you can assess the outcome, but it's difficult to assess, it is little bit more difficult
to assess the process. So in terms of formative assessment, it's very difficult to assess the process.
125 Return to the assessment turn to become more summative, if you only measure the outcome. And
then with tool, with the two tools, I could assess and monitor the process of their learning. And
then, especially for transition year. they are not, I mean the main purpose for them to learn the
language is to build up their confidence and interest in that language rather than to achieve a
certain level of the proficiency. I mean, given time they will be there but the confidence and
130 motivation, is a whole different level, it's more difficult to achieve, and it is difficult to measure,
you know. so I think for the first tool, ..., I think it is very good to help the formative assessments,
in terms to help assess the process, how they're getting on, the learning and to give, as I said, to
give feedback, in a way the students would enjoy. Because when you see them play that one, they
are really playing, they could be in the mood of playing rather than in the mood of learning
135 consciously. And I think that helps the formative assessment. And for the second one, for the
second one, I think it's more of self assessment. I have used it for building formal assessment, part
of this, it is more of a self assessment. They would have a ..., AI language buddy at home to
practice, so I wouldn't know much about the process of that, but it's main of a self assessment.
They could practice with the AI and they could check with whether AI would understand them,
140 and then it looks like, see the processes, for example I given the task to say, for example to
introduce yourself, and to interview the AI about a certain topic about age, then they could go
back and practice with, using the tool. And then when they come to the class, I could check the
outcome. Well, in the past without the tool, I don't know, practice with the mirror, or just read it
aloud. So, ..., overall, I think the tool helped, the process of students achieving the outcome, it's
145 not, I mean, I have done the assessment for a number of years, it is not an issue for me to assess
the learning outcome, but it's the issue for students to have some sort of feedback at different
stages at different levels when they achieve from zero to define a learning outcome in between the
how they could gain some gradual feedback when they need them. I think that's the main
contribution of the tools.

150 HW: I think you just answered the questions that the tools could help partially assess students' spoken
language. The next question is about the students learning process. So from your perspective, at
the moment any challenges for the students in learning spoken Chinese?

CT: Yeah yeah there are number of challenges. First is, I mean Chinese is quite a different language in
comparison with other European languages they learn. So sometimes the students, they don't
155 have, I don't know how to put it, they don't have that sense, they don't think, some of them they
couldn't really tell the difference, you could pronounce one thing and then, the students could
pronounce another thing and from their point of views, i think they sound complete the same,
which is quite different. And then how to be able to point out, how students will be able to point
that out. I mean, that is probably the, as I seen in your paper, the perception of the tone. How,
160 how, how could they increase that capability, I haven't fully been able to figure out other than just

listen and repeat it, observer and gradually still learning. And that's one thing. How would they know the difference between their own pronunciation and the standard pronunciation? A second as I mentioned a few times, is how to get there. I have the videos about their pronunciation method, and I could demonstrate, but, still feels like more of the observe and do styles, you observe how to
165 pronounce and then you do it, but like I couldn't, I couldn't really see their house while they're doing it. It's not that easy to know what exactly is going on. It's not, because it's sound, it's not graphic, so it's not that easy to point out where exactly went wrong, so how to help them to achieve the learning outcomes is a little bit challenging for them as well, especially if they go back home and practice without a teacher or a native speaker around the side.

170 HW: So do you think the tools could help the students in learning spoken Chinese? If yes, how?

CT: I think so. The mario game as I said it's more of transform that, I mean it could provide a visual feedback, right? Look at how mario moves, gives you feedback rather than just a sound, rather than just repeatedly hearing the standard pronunciation. It's easier to know your are higher or lower, short or long enough. I think that would help with the, with the perception as I just said. So, so
175 they have more concrete ideas what are exactly the difference between their own pronunciation and the standard ones. And not only about the outcome but also about the process. And then the second one really just provide the system necessary when they, when they're out of the classroom, when they, when they practice. They have a AI to practice with, so they give them opportunity to practice. That's one thing. And the second is you have to be kind of in the range of being
180 comprehensible, so the AI would understand you, so that benches is like you need to achieve a certain level ton interact with AI. That sort of give you a motivation, the game could probably help you to reach that level and you could play with AI. I think that could give you the opportunity to practice, give little bit more feedback while the teachers are not there.

HW: So any remaining changllegeing areas or improvement for the tools?

CT: I think for the first tool, when I used it in the class. I could see how students play with it. If
185 anybody got stuck, I could go there and help. And because that, how it was developed, students could always see how the Mario moves and give them instant feedback. So I don't need that part. Tool would provide students with feedback and normally it would help everybody to achieve, I mean in a rather specific maner, with achieve what they want to achieve, which is OK. but I have cases of students, even with assistance of that is still very difficult for them to get there and then I will think if possible to have like a record or or a lot of what is excatlly the the students do, so I could go back and check what is the problem. and then you know to give more feedback to the students. Because it's good I give instant feedback by the same time like we didn't have that mean
190 of, of recording the feedback. So, so it's not quite useful, after they played the game. I don't have a record. Same with the second tool as well. The second tool is more of I know the AI is programmed to to be able to understand when the pronunciation is at a certain level accuracy. For example, 70% accuracy, or something like that. Then the AI would understand it and students could engage with the AI. But then, all I could check is the outcome, again, I don't have a record of what is actually happened. if the students really stuck at some level, for example, OK, the AI just won't be able to understand them, and then I I just don't know how to help, I probably need that information to be able to help, you know, like a backstage user data something like that to be able to, to track the progress and to help. I think that's the main, that's probably the main
200 suggestion I would give to improve tools.

HW: Thank you for your suggestion. Last question, are you willing to use the tools in the future?

CT: Yeah definitely. And I think it has great potential. I mean I'm at the stage of using it mainly for
205 teaching and learning, and I have a few ideas on implement this into the assessment. but i haven'g come to it yet. And it links to the suggestion I said with a little more building ...tracking system about data backstage date or something, it might be easier for me to build in into assessment. So you have more like a reason record refered to. That's mainly for fun and for summative assessments. For formative assessment it is quite useful already. So yes I'm going to use it in the
210 future.

HW: Thank you, thank you so much!

Transcript of Audio Interview 05 (HS-E-M)

Present: HS

Location: Online Interview

Date: 17/09/2021

Interviewer: Hongfei Wang

Duration: c. 26 minutes

HW: Good afternoon! Thank you so much for helping with my research. Can we start now?

HS: Yes no problem.

5 HW: Okay, so... Can I ask about your background information, how long have you been teaching Chinese in Ireland?

HS: I've been teaching here for two years. In the past I mostly teach the transition year, while last year I begin to teach the Leaving Cert (LC) as well.

HW: Okay, and what language levels are most of your students at?

10 HS: The majority of my students are all beginners... for both transition year and LC... but the purpose of their study are a little bit different. The transition year I have... I actually have two kinds of transition yet. One is just a broad taster module... just to learn a bit of the language and culture... basically just explore the language and culture... and there will be another kind of transition year that they prepare towards LC and the proportion of language study would be much bigger. And then I have the LC and they are beginners, but their (teaching and learning) paces are relatively
15 faster than the transition year.

HW: Are all your students Irish? Or you have any students that have a Chinese background?

HS: For my LC group I actually... yes... I had... have I think 2 heritage speakers in my class.

HW: Can you tell me have you ever used any tools or apps to facility your teaching of spoken Chinese, and how does it work?

20 HS: I actually use a lot of apps. I actually prefer to use an iPad in teaching other than the laptop in my school. I have an iPad from the school and I like to project my iPad on the screen, and most of my class will either have an iPad or tablet or phone in hand, so we... so we can actually do something together using the iPad. But in terms of your question for the tools... other than... other than the presenting... I use some of the generic apps for learning languages, like 'Duolingo', so we could
25 have some basic practice or 'show me board' that type of function. Do you ask about apps for spoken Chinese in particular?

HW: Yes, but you can talk about any kinds of apps.

30 HS: I don't think there are many apps for spoken Chinese out there. When I... when I think about it... they are mainly to study characters and vocabulary. I use some of the... I use some of the apps for the native Chinese kids, for example the 'Hongen Shizi' and it has pronunciation. But I guess that's not really for teaching and learning spoken Chinese.

HW: Okay, then how often do you use the 'Duolingo' or other generic apps?

HS: Yes quite often, it is a routine usage. I do a little bit of teaching and then for practice I always used Duolingo and some of the it's implemented activities with the students.

35 HW: Then is there any tools or apps that you use are gamed based?

HS: (long pause)... No, not really game based... they have this kind of game elements or competition... like that... like I said the 'show me bored'... I could create a game around it, but it's like... the app itself is not really based on a game.

40 HW: Okay, now let's move on to the tools I showed you and you have used it in your class. I would like to know your opinions about the tools. Okay?

HS: Okay.

HW: But first, tell me is there any challenges for you in teaching spoken Chinese?

- 45 HS: OK I think the most difficult part is to teach or to demonstrate the process of the pronunciation. Because... as a native speaker... there's no problem for me to demonstrate the standard pronunciation. But then... but then... it's not quite active. If you ask them to follow you... because they don't know how to get there... from their own pronunciation... Other than some very basic instruction, like to show the shape of my mouse and tell them where the tongue is supposed to be... that type of thing... it's... it's not easy to demonstrate the process. It is not like if you could demonstrate the whole processing in slow motion... how they... how they could pronounce that word slowly... but accurately... and then afterwards they could like... make it more like... make it faster and standard? It's not easy (to show the process).
- 50 HW: So... I remember that... you know... the listen and repeat process is kind of like... a very common approach that is being used in teaching Chinese, and in English when we learn it... just listen and repeat. So you don't think that is quite effective for Chinese?
- 55 HS: No, I think it's not effective in learning any languages. Because you don't have the scaffolding in between (the standard pronunciation and learners' own initial pronunciation). So basically, if you do... that would be a problem. Say when we learn English... when we get the same set of recording materials, but everybody's pronunciation would be different though you had the same materials. It's kind of like your performance.... I mean your... your ability to pronounce in the foreign language probably will be highly depending on the aptitude... on your talent. Because we all get access to the same set of materials. We just go back and listen... maybe some listen more frequently than the others, but we all sound different, nobody sounds the same, and there are always people whose pronunciation is more standard. But I guess sometimes it's hard to argue whether they practiced more or they are just good at it (pronunciation).
- 60 HW: So do you think the tools could address the issue or benefit your teaching in other ways?
- 65 HS: Following the point about the process... you know the Mario games? It breaks down the process and it didn't really... didn't really slow down the process... but recorded the process. So you could observe and reflect on it slowly. And because it's (the feedback) instant, so you see exactly what is impacting on your pronunciation, and so you really know exactly where to change... which is very important... because when we do the demonstration, you're kind of like comparing your whole pronunciation of a word or a character with the standard pronunciation of a word and character. But when I say process... it is sometimes the student would have a problem with... like... a particular vowel or like part of the transition... somewhere in between the pronunciation of the character or the word. But when they compare the pronunciations (standard recording and their own), they can only compare the whole thing (pronunciation of the whole word rather than syllable)... that makes it challenging for students to be aware of exactly where went wrong. And that's just about pronunciation. We also have tones for them... talking about something like they're not quite aware of before learning Chinese... so that makes it even more difficult to sense the difference. Because the tone is continuous. When you find them pronouncing the word, for example a combination of a fourth tone and a first tone. They (students) drop it very low for the first part, and then in the second part they cut it and then make it very high. There is a clear cut of the two tones and they are separated. But for us as native speakers, it's a flow. It's a... it's a continuous process going from forth tone to first tone... it's continuous. But for them, they don't know how to connect that (different tones) and that makes it difficult. So you find... so you find sometimes the students pronounce a single word which is rather standard. But as soon as they make a sentence and sometimes the pronunciation went completely the other way. That's I think... that's I think... that's a challenge. So the tool would help address that particularly issue. The first one... the game... would make the... would reflect on the process (of pronunciation).
- 70 HS: (long pause) It actually confuses me... as I said... because for example, for students that the pronunciation of a single word could be standard, but when they use that in a sentence it could be completely different. First, I don't know how to change that. And second, I don't really know how to assess that. If you say they're wrong, when they pronounce the word, it's standard... it's correct. But when they pronounced in a sentence, it makes no sense... it did not sound very natural. Then I guess it's incorrect? So I'm having difficulty in assessing that part. But the tool would help.
- 75 HS: So do you encounter any challenges in assessing the students? I mean for spoken?
- 80 HS: (long pause) It actually confuses me... as I said... because for example, for students that the pronunciation of a single word could be standard, but when they use that in a sentence it could be completely different. First, I don't know how to change that. And second, I don't really know how to assess that. If you say they're wrong, when they pronounce the word, it's standard... it's correct. But when they pronounced in a sentence, it makes no sense... it did not sound very natural. Then I guess it's incorrect? So I'm having difficulty in assessing that part. But the tool would help.
- 85 HS: So do you encounter any challenges in assessing the students? I mean for spoken?
- 90 HS: (long pause) It actually confuses me... as I said... because for example, for students that the pronunciation of a single word could be standard, but when they use that in a sentence it could be completely different. First, I don't know how to change that. And second, I don't really know how to assess that. If you say they're wrong, when they pronounce the word, it's standard... it's correct. But when they pronounced in a sentence, it makes no sense... it did not sound very natural. Then I guess it's incorrect? So I'm having difficulty in assessing that part. But the tool would help.
- 95 HS: Okay, could you be more specific, like which tool are you referring to?

- HS: I am referring to both but mainly the second one on this point. Yes, the first one would help assess the pronunciation of the single words and characters, but it is mainly the second tool, the one you get to talk to an Avatar or AI.
- 100 HW: How would that help?
- HS: You were talking to the avatar and then it gives you the responses. Now that kind of addressed the issue. I don't really know like... if you have... if there's a difference between pronunciation of the word and this word in the sentence or any expressions... like to what degree will that amount of change be accepted for communication, you know? Because I'm conscious that students here (in Ireland) are not to learn to a point of getting very standard pronunciation. That their main goal is to be able to communicate. So as long as it makes sense.... as long as they could come to people and talk, I guess it's really not that important whether their pronunciation has to be near native standard. They will never... I said never sounds exactly the same as native speakers, but as long as that is acceptable... So I guess the second tool kind of like a benchmark... I say if the artificial intelligence would be able to understand... maybe that's just a line (for acceptable pronunciation)? It does help me to better conceptualize the differences between standard and acceptable for communication. If the AI recognizes your voice, reply to you and give you feedback, I would consider that is okay for the moment. I can't really tell which pronunciation is more acceptable than the others, even though I am a native speaker and I think I am a qualified teacher.
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- 110
- 115 HW: So you actually have a good tolerant of your students' pronunciation? You are not bothered that their pronunciation is not standard sometimes?
- HS: I know there are teachers who will not tolerate, but I don't think so. My main issue is to focus on the communicative side of it, rather than that I am more tolerant. But I am just not quite clear how flexible that should be. It is like you as a teacher needs to draw a benchmark about how pronunciation should be evaluated in against communication purposes, to be comprehensible. I think that is something beyond my current level.
- 120
- HW: So for that you would trust the machine... I mean the AI more than yourself? Even though you are a native speaker and a teacher at the same time?
- HS: Yes. It does not bother me that it is a machine.
- 125 HW: Okay, good to know. And any challenges for students in learning spoken Chinese?
- HS: I think that... the same that I just mentioned. The first is the accuracy of the tones and second is about the flow. They have difficulty connecting that... all the tones they pronounce are separated... well natural speech it's a flow. And then the last one is... when they practice spoken, Chinese it's very slow for them. Because they need to mind the tones and pronunciation and I noticed that their talking speed is relatively slow... it's very slow actually... that's not abnormal. But at same time, student have this perception of trying to be fluent, and I think for fluent they are primarily thinking of the speed of the speech... which is not always like that. You could talk relatively slow but comprehensible, and that is also fluent. But you could talk very fast and nobody would understand you as there are loads of mistakes, which is meaningless and it is not fluent. So I think, yeah... still I think to get them to talk a bit faster is quite challenging for me at this stage. Because that impacts on their confidence, they just want to talk a little bit faster so they seem to be more fluent with the stuff learned. But you could find them talk very slow and won't be able to speed up and that sometimes would have a negative impact on their confidence.
- 130
- 135
- HW: So would any of the two tools help with that?
- 140 HS: So you have two tools here, okay? For the first one... because I couldn't find a very meaningful or interesting ways to motivate students just to practice the pronunciations. I mean for the single characters and the words... because especially... because (the practice) it's not meaningful. So the first tool is kind of like a fun... it's... it's a game. It's fun. It does help students to practice and basically I think they're playing games rather than just practicing their drills.
- 145 HW: Okay, then what about the second tool?
- HS: The second one, as I said it is important once it goes on to the level of sentences and chunks, that the tasks need to be meaningful. So the second tool does make everything meaningful. They're not practicing pronunciation just for the sake of practicing pronunciation, which is very important because lots of times... sometimes even when I talked with the other teachers... and they can't tell the difference between practice pronunciation and practice spoken Chinese. The first tool is just
- 150

about pronunciation. While if it comes to practice spoken Chinese then it has to be meaningful... it has to be communicative... there has to be a task...

- HW: So students could practice specific scenarios...
- 155 HS: Yes, and even if the material is the same, the students feel much more realistic rather than just recite the conversation maybe in front of a mirror. You can see even though it is an avatar instead of a real person, but you're feeling like talking to someone and having interactions and getting some feedback. And when the other side could understand what you were saying, it does boost their confidence.
- 160 HW: Would you think the young kids nowadays... that I think this generation they are more comfortable in talking with the virtual characters?
- HS: They ARE, and I tell you they are probably better talking to a virtual character than real person at this stage.
- HW: Why? Tell me about it.
- 165 HS: It is the technology, that's the thing I'm about to say. Because I asked the students about how they use this and what are their experiences... and the things they found useful are... I have students come to me to say it's easier for them to understand and change the pronunciation because they can put on their phone and listen to the pronunciation or play the game with a louder volume and with the game you also get the feedback. They say if I demonstrate pronunciation, I'm doing it in front of everybody and the volume they could receive it certain. While when playing with the game, they could adjust and get a louder volume... they say it's like there is a person speaking to their ears, so it's easier for them to listen in details and identify the issues. Also you get the visual feedback which is at the same time, so much easier to perceive the tones and correct pronunciation.
- 170 HW: Okay, so about dual channel feedback simultaneously.
- 175 HS: Yes, and also like... you can repeat. You don't know how important that is. They have that space... they have that freedom... and they don't... they're less concerned about or not even conscious of
- HW: losing face...
- 180 HS: Yes! And they could be responsible of their own time. Say... for example the second tool, if they have a problem with the sentence in the class, how many times can I give them the opportunities to practice that? Three times? I think that's probably the most time I could allocate. Even if I'm going to... I have a whole class waiting there and it's not good for the wellbeing of the student and they won't want to repeat three times while everybody else is looking at you. It's... it's going to be very embarrassing. But when you are at home, you can always ask the machine to repeat, or for the first tool, to give it another go of the game, before you are really ready to engage what you have practiced with others in class.
- 185 HW: Okay, thanks for sharing that. Then do you have any suggestions of improvement for any of these two tools?
- 190 HS: Not really anything at the moment. If I think of anything maybe I could get in touch with you afterwards.
- HW: Okay, and following from your point that tasks should be meaningful, do you think it would be a good idea to upgrade the first tool up to the sentence level as well?
- 195 HS: (long pause) Eh... No, I actually don't think so. I don't really know. I'm not sure. Because to me, it's a good balance. The first tool helps practice at the level of the characters and words, and the 2nd to practice at the level of sentences. I guess it really depends on your purposes. I know I mentioned something about their tones change in between the pronunciation of the word and in a sentence. But for me, I want them to increase their ability of pronouncing the words... getting a standard pronunciation of words... when they're using the first tool. While when it comes to the second tool, when it comes to the level of sentences, I want it to be a meaningful task. I think if
- 200 HS: they use the first tool for sentences, it is a little bit deviated from my current purpose. I want students to focus just on pronunciation for the first tool, while I'd rather students to FOCUS on the communication perspective while HAVING feedback on their pronunciations for the second tool... so it's more holistic.

Transcript of Audio Interview 06 (WX-E-M)

Present: WX

Location: Online Interview

Date: 17/09/2021

Interviewer: Hongfei Wang

Duration: c. 20 minutes

HW: Good afternoon. Thanks for joining me for the interview.

WX: No problem. Good to see you again.

HW: So how long have you been teaching Chinese in Irish schools?

5 WX: I think about four years now.

HW: And what type of Chinese modules do you teach at school?

WX: I mainly had transition year students in the past, and since last year I began to teach the new Leaving Cert (LC) class.

HW: What are the language backgrounds of your students?

10 WX: My transition year group is mostly Irish. And for my LC group, it's about 1/3 heritage speakers and then the rest are Irish or I also have international students.

HW: What are the language levels of your students?

15 WX: They are mostly just beginners. For the Irish and international students, they're all like never studied Chinese before, and then my heritage group... it is very mixed... some of them have very high level of Chinese... like probably near native speaker. Some of them just moved to Ireland recently. And then there are also some who moved when they were young, so... so they have a good foundation but not as... not as proficient as the rest of them... but still much higher than the Irish students.

20 HW: Okay, then have you used any tools to facilitate your teaching of Chinese, especially in spoken Chinese, and how does it work?

25 WX: I use a website called **** reader. It reads the Chinese text for you, and you can use it for any text. So I use that for the textbook... for example, I have a paperback textbook and then use that to create a digital textbook, as the text for you and you can help to show the pinyin and the meaning of the characters and words... does that mean the... the... the use of apps for teaching spoken in Chinese?

HW: No, not really. Is there any apps that you use or see for particularly spoken Chinese?

WX: You mean for them to practice the orals?

HW: Yes.

30 WX: I have a... like a Chinese app to make the short videos, something like TikTok... but not the same... and you can have on your phone and I use that quite often to encourage students to make short videos or role play... something like that to practicing orals.

HW: Okay, thank you. So among all the apps that you used, is there anything that is game based?

WX: So like the tool is a game?

HW: Yes.

35 WX: No, I don't think so. I don't think I ever used any apps for Chinese that are like games.

HW: Okay, now let's move on to the second part. So, at the moment any challenge for you in teaching spoken Chinese?

40 WX: My biggest challenge... because I have a mixed group... at first their level are very mixed... so it's hard to... it's hard for me to find a balance for the content. Second, the biggest issue is the... is the atmosphere of the classroom. Okay, see... I have this group of heritage speakers and it really depends on... most of the time they're very cooperative. I ask a question that they are very willing

to answer, but in Chinese. And their level of Chinese is REALLY high. And that is kind of a little depressing for the other students, because they could... they could be struggling with some basic pronunciation while they hear the other group like fluent in Chinese. And some of the other students (Irish group) are like already very shy and they don't really like to stand out already, so in that type of mixed group, it makes it even more challenging for me to engage with them (Irish group). I think that's one of the biggest challenges.

HW: Okay, but that is an issue not only for spoken Chinese, right?

WX: Well the spoken part is more evident, because in writing they could just write on your own. So it is not that obvious as you are not wrecking others as you are on your own stuff. But if you are speaking, you are kind of speaking either in front of the class or in a group. That is just more obvious.

HW: Is there any impact of COVID on teaching spoken Chinese?

WX: (long pause)

HW: For example, for that period I think the schools are closed and everyone have to move online? Is any influence of that on your teaching?

WX: I guess the biggest part is about the pronunciation. For the students to learn the pronunciation, it's... the online makes it quite hard to demonstrate the pronunciation on the screen. It is much better in person where the students could see my face in 3D (laugh) that you see exactly how I make the sound? But online it's rather more... like flat. But it actually does help with the issues I mentioned earlier about getting the Irish students more engaged. That's because online I could... I could control... like... I could put them into break-out rooms and I can determine when and who should speak, so to give a fair chance to all students, and that would help motivate the Irish students a little bit better. So I guess you have both advantage and disadvantage for teaching online.

HW: So could the tools help address some of the issues you mentioned, or other problems maybe?

WX: First, my school is a boy school, and the first tool is a game, and the boys like games. So they love playing with it and it's good to see them get excited about any perspective of learning the language. And they engage better and practice more actively. That is good. But at the same time, sometimes they just focus too much on the playing side of it. They will find strange ways of playing the game. If you could... for example... I noticed some students could actually... so you can make random noises and the character (of the game) will move like you were pronouncing the word. So sometimes they would try to make funny noises and see how they could get away with the game. So they're playing with it rather than... like... use it as a tool for study. And for the second tool, I think still they are not at the level of being able to quite like... utilize that tool. They are still at the level of saying some phrases and some isolated sentences, so they are not quite at the level of being able to interact with the tool yet. That's the Irish learners. For the heritage learners, I don't think they engage quite well with the tools. They might tend to think it is a little bit childish, as their level of the language is beyond that? Also, for the second tool, it is good opportunity to practice oral for the Irish students. But for the heritage students, they probably have some native speakers that could talk to at home. So they probably did not find it's very fresh or useful. It is more like, when I see it... as soon as they get around with the tool, they don't really engage with it that well anymore.

HW: Okay, move on from there, is any particular challenges for you to assess students' spoken Chinese?

WX: I presume you are asking more about the Irish students? Because really the heritage students, they don't have much problem with the oral.

HW: Yes, let us talk about them first.

WX: Okay, I have a problem. If I ask them to present something... present something is actually okay. But when we have... when we have a conversation... that type of assessment... I need to assess on... like the accuracy of the pronunciation... but also I need to be mindful of their content, and in general their performance... so I found it difficult to keep focus on all these perspectives. Sometimes when I focus on what they actually talked about, and to keep the conversation with them, I lose the focus on their pronunciation. So it's very difficult. And then if I ask them to record it as a presentation, it loses that interactive element... it becomes a monologue. If I ask them to do

100 a conversation in pairs, sometimes again... because the level of my students is too low, they
cannot maintain it... it would fall apart. And if I ask them to prescribe the conversation, it's more
like a reciting task rather than a communicative task, and they basically just decide what to written
down and then memorise it together. So, it's again it's not interactive. I could in theory record
105 everything and go back and listen and give them feedback, but it is not always quite if you are in
the school so the quality of the recording would be poor. And also, you cannot give feedback right
at the moment that students need them. They also need to go back and listen and trying to figure
out what I am referring to, and it is time consuming, and they cannot always find it. It just will not
work. That is the challenge I have in particularly assessing the oral interaction when I wish to give
comprehensive feedbacks on content, grammar, and pronunciation while they could still
remember what happened.

HW: And did the tools help with the assessment?

110 WX: The second tool, it does. As I said, I can't use it to a greater extend as the level of my students are
still quite low, but for the limited part that I could use, it is a very good tool for assessment.
Because it takes off my responsibility of keeping an eye on the grammar and the content...
because the AI will not continue the engagement with you when there are issues with those... then
I could monitor that but I also could spare my attention to mark their pronunciation. The whole
115 process is more holistic now, that the AI will determine whether it would be understandable, and I
get to assess more specifically on the pronunciation. It ease my burden for keeping the focus on
multiple levels. I can take notes and give more useful feedback for students while not disturbing
much of the flow of the conversation. It takes at least two teacher to do that in the past probably,
but you can't have two Chinese teachers for that. That is just not possible. It is too luxurious.

HW: Okay, then what about the learning side of it. Any challenges you noticed about students learning
the spoken part of it?

120 WX: I think I need to talk about this about Irish students and heritage students separately.

HW: Okay.

125 WX: The problems these two groups have are actually the opposite. For the Irish students, they don't
have an opportunity to practice the language after class. And with the presence of the heritage
speakers, even in the class, there are very limited opportunities to practice the language as they felt
the peer pressure. I need to really push them to speak so they get to practice and not to mention
some of them already having issues with perceiving the tones and practice the pronunciation. It is
just from the motivation side of it, it is really difficult for me to get them more engaged and they
have a lack of the exposure to the language. And then the opposite side of that is the heritage
130 speakers. Most of them are relatively fluent in Chinese language but some of them have very
strong accent. I guess they come from... I don't know but I guess they come from the... maybe
northeast of China or some of them... they might speak Cantonese at home... so they have very
strong accent and it's like we only... I only meeting them for twice in the week... personally I
don't think the hours are enough... but most of the time they will spend with their family and their
135 pronunciation is directed mainly by them instead of me. My time with them is not enough to
correct their mistakes because they like... the individual time I can allocate to each of these
students is trivial in comparison to the time they spend talking with their family members in a
dialect or accent that they think would be Mandarin, but it is not... I just felt like my strength is
not strong enough to battle with that and they're not aware of that (they are speaking Chinese with
a different accent).

140 HW: So they actually suffer from having a language environment?

145 WX: It's the opposite of the Irish student. They have too many opportunities practicing a different
direction of the pronunciation... that's their issue. I mean I'm not against the accent or all the
different dialects or languages, but they just need to be aware that it actually is not Mandarin. And
it mislead the other Irish students as well, some of them have already had difficulty in perceiving
the tones and other perspectives of the pronunciation, and they hear it differently from me and
from the heritage students.

HW: And you mention the second tool could help with that?

150 WX: Well if they (heritage students) are willing to use it, then yes. I think for both of the two groups, it
just creates more opportunity to practice the language with the correct pronunciation, and it also
gives you feedback on how to get to the correct pronunciation. I just think if the heritage students

are willing to use... they did not engage that well to be frank... but if they do, it would at least reduce the impact of their home language on learning the Mandarin pronunciation.

HW: Okay, thanks for the feedback, then do you have any suggestions to improve the two tools?

155 WX: I noticed that... I think the tools are designed to be used more on a computer or a laptop... but actually in teaching and learning in schools... most of the time... at least in school... students will be using either the phone or the tablet... so the screen is actually much smaller. So sometimes... say for the second tool... when you have some text on it, it could be really small... it really depends on what type of phone you have and... so... I wish the interface will be more user friendly for using phones and tablets. I think they will use laptop at home but it won't be as frequent as like... most of the time I think... especially for their generation... they will be around
160 cell phone and tablet and portable devices. So I think the whole design in the future it could be more user friendly towards that direction.

HW: Thank you!

Appendix H Pre-test and post-test questionnaires (student evaluation)

Section 1 Background Information

1. Year in School:
 - 1st year
 - 2nd year
 - 3rd year
 - 4th year
 - 5th year
 - 6th year
 - Other

2. How many languages have you studied or been studying?
 - 1
 - 2
 - 3
 - 4
 - More than 4

3. Have you studied any East Asian languages (Korean, Japanese, Chinese) before?
 - Yes
 - No

4. How often do you play games on the computer/tablet...?
 - Daily
 - At least weekly
 - Rarely
 - Never

5. How would you describe your general ability in speaking Chinese?
 - Only a few words spoke slowly
 - A few simple phrases spoke slowly
 - A few simple conversations spoke slowly
 - Some conversations spoke clearly
 - Almost all conversations at natural speaking speed

6. How long have you been learning Chinese?
 - Less than 6 months
 - 6-12 months
 - 12-18 months
 - 18-24 months
 - More than 2 years
 - I am a native speaker

Section 2 Chinese language learning

- *Strongly agree* - *Agree* - *Neither agree nor disagree* - *Disagree* - *Strongly disagree*

7. I can identify the Chinese tones accurately.
8. I can pronounce the Chinese tones accurately.
9. I am confident that I can speak Chinese.
10. I am anxious when speaking Chinese.
11. I am motivated in learning spoken Chinese.

Appendix I Student evaluation questionnaire

- Strongly agree - Agree - Neither agree nor disagree - Disagree - Strongly disagree

For tool A – the tone acquisition game

1. I enjoy playing the game.
2. The instruction of the game is easy to follow.
3. The interface of the game is easy to use.
4. The technical difficulty in playing the game is suitable for me.
5. The game could help me perceive tones accurately.
6. The game could help me produce tones accurately.
7. The game could help me to be aware of my mispronunciation.
8. The game could help me assess my outcome in practising tones.
9. The game could help me assess my progress in practising tones.
10. The game could help raise my confidence in practising tones.
11. The game could help reduce my anxiety in practising tones.
12. The game could help motivate me in practising tones.

For tool B – the virtual language partner

1. I enjoy using the tool.
2. The instruction of the tool is easy to follow.
3. The interface of the tool is easy to use.
4. The technical difficulty in using the tool is suitable for me.
5. The tool could help provide opportunities outside of class in practising oral Chinese.
6. The tool could help provide an immersion experience in practising oral Chinese.
7. The tool could help me to be aware of my mistakes.
8. The tool could help me assess my outcome in practising oral Chinese.
9. The tool could help me assess my progress in practising oral Chinese.
10. The tool could help raise my confidence in practising oral Chinese.
11. The tool could help reduce my anxiety in practising oral Chinese.
12. The tool could help motivate me in practising oral Chinese.