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Typing to Replace Handwriting: Effectiveness of the Typing-Primary Approach for L2 Chinese Beginners
(打字取代手写——以打字为主的初级中文教学的有效性)

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Abstract: It is a common assumption in the TCFL field that handwriting Chinese characters (Hanzi) is a prerequisite for Hanzi reading and memorization, and that typing instead of handwriting hinders CFL beginners' literacy development. This study provides evidence for the contrary. Pinyin-based typing employs holistic processing of phonological–visual chunks. This fundamentally different cognitive route supports sound-meaning-form mapping and retrieval, thus facilitating Hanzi processing and memory. The performance data of 108 CFL true beginners from a US university were analyzed with 1,440 assessment records. Compared to using handwriting as a primary mode for daily practice, learners using Pinyin-typing and digital tools performed equally well in reading comprehension and Hanzi accuracy in typed essays, and significantly better in essay length, sentence-level word recognition, and program-end cumulative Hanzi retention. The results suggest that the Pinyin-based typing approach with distributed practice throughout the courses enhances Hanzi rehearsal and retrieval at the word and phrase levels, which in effect facilitate word retention and promote Hanzi literacy development.

摘要: 在 L2 中文教学界手写汉字常被认为是汉字认读和记忆的先决条件，而以打字方式取代手写则会不利于初学者的汉字学习，乃至阻碍其读写技能的发展。本研究提出了相反的证据。拼音打字采用的是语音-视觉组块的整体处理方式，属于完全不同于手写的认知途径; 此方式支持"音-义-形"对应连接及其语块提取，有助于汉字的语块处理和记忆。本研究对一所美国大学中文班的 108 名中文初学者共 1440 项成绩记录进行了数据分析。打字为主的学习者在阅读理解和写作汉字准确性这两方面的表现与手写为主的学习者相当，而在写作长度、句子层面的单词识别、以及课程累积汉字记忆这三方面的表现显著强于手写为主的学习者。研究结果表明，将打字练习系统性地分布于全课程可有效地增强汉字在词语层面的演练和提取，从而在实际上促进词语记忆及汉字读写技能的发展。

Keywords: Beginning Chinese, Chinese character recognition, Chinese literacy, Hanzi retention, typing vs. handwriting

关键词：初级中文，汉字认读，中文读写，汉字记忆保持，打字与手写

1. Introduction

The Chinese character writing system (Hanzi) has been regarded as the greatest barrier to learners of Chinese as a foreign language (CFL). The traditional stroke-based handwriting-memorization (HM) method is laborious and time-consuming, demanding tremendous cognitive resources. For CFL beginners who have very limited time for Chinese learning and need to prioritize aural–oral skills, HM is distracting and counter-productive because of its inefficient use of cognitive resources (Allen, 2008; Halliday, 2014; Ke & Everson, 1999; McGinnis, 1999; Moser, 1991). Conceivably, struggling beginners are further demoralized by memorizing new characters that come every day, in addition to repeatedly practicing previously learned ones. Indeed, Hanzi retention is a daunting task for learners.

Over the past few decades, researchers have explored or proposed alternative pedagogical models in CFL settings, such as delayed writing and separate-track models (Packard, 1990; Yin, 2006), learning whole characters without HM (Everson & Ke, 1999; McGinnis, 1999), and Hanzi character learning using digital and multimedia modalities (Jin, 2006; Shen & Liao, 2017; Xu & Jen, 2004; Xu et al., 2013). Nonetheless, the most significant break-through was the advent of the Pinyin-based word processing, a "game-changer" (Z. Zhang, 2009) that affords a fundamentally different style of Hanzi pedagogy for CFL beginners. Not only has the Pinyin-typing approach significantly lowered the hurdle of HM, but it has also facilitated the integration of technology-enhanced Chinese learning (P. Zhang, 2016), and has promoted language use through e-learning activities such as emailing (Xie, 2011) and blogging (P. Zhang, 2012). Since the early 2000s, several typing-primary or mixed models for CFL beginners have been explored with favorable results (Feng & Yang, 2013; He et al., 2008; Xie, 2011; P. Zhang, 2018).

1.1 The Pinyin system and Pinyin Input Method

Pinyin, literally "spelled sounds," is the official romanization system for standard Mandarin Chinese developed in China during the 1950s. Since the 1980s, Pinyin has become the most commonly-used phonetic guide for CFL learners worldwide. Therefore, a Pinyin Input Method (IME) is a sound-based Chinese character input assistance program using Pinyin spellings. It is the only Romanized and cross-platform Chinese IME based on international standards that uses the standard computer keyboard with English letters. There have been several other popular IMEs, such as Cangjie (structure-based), Wu Bi (strokes- and form-based), and Zhuyin (sound-based using a unique set of phonetic symbols). However, these non-Romanized Chinese IMEs were designed mainly for native

Chinese speakers who already have a solid command of Chinese and Hanzi. Before using any of these IMEs, one must also take a substantial training typing course to gain familiarity with its complex coding system.

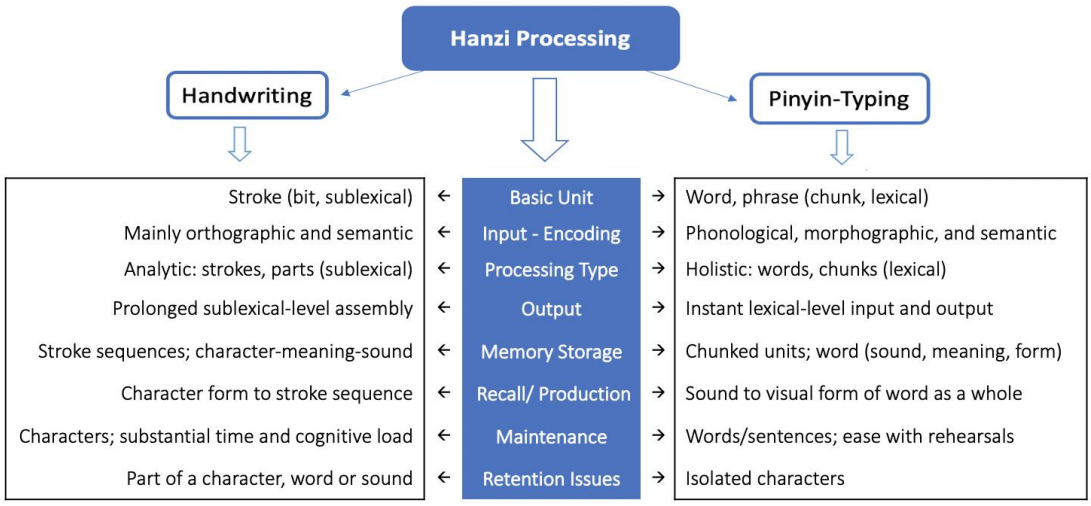
Evidently, learning to output Hanzi via a Pinyin IME is the easiest for CFL beginners. Most learners are not only already skilled in standard computer keyboarding, but also familiar with Pinyin (after 6–8 hours of training in a beginner's course). As a cross-platform system, Pinyin IME is also installed on Windows, macOS, and Linux or other Unix like systems, as well as mobile systems such as iOS and Android. However, one major obstacle is the large quantity of monosyllabic homonyms, i.e., one sound and one spelling is shared by many characters, ranging from a few to over a hundred. For example, typing the sound "yi" will yield over 150 possible characters. Fortunately, multiple input modes are normally available in a Pinyin IME: character, word, or phrase/sentence. Since disyllabic/polysyllabic homonyms for words with two or more characters in Chinese are extremely limited, using the intelligent word/phrase mode can effectively filter unfit homonyms and quickly yield highly accurate Hanzi output. In other words, inputting strings of Pinyin words and phrases instead of monosyllables can significantly improve Hanzi output speed and accuracy.

Despite the successful practice of Pinyin-typing in beginner's courses at American universities, stroke-based HM has remained the primary practice in the CFL field: most U.S. CFL classrooms continue requiring the HM routines (Li et al., 2014; Ye, 2013). Many teachers regard the typing approach as improper for CFL beginners. Jiang (2017) discussed some common presumptions among native Chinese teachers, e.g., handwriting is the only correct way to achieve Hanzi literacy; without handwriting learners cannot recognize and remember Hanzi, and typing can inhibit the learner's reading and literacy development.

1.2 Pinyin-typing: A different cognitive route

Does Hanzi retention depend on handwriting as commonly assumed? Is Pinyin-based typing inferior to handwriting in developing Chinese literacy? This study argues the opposite: Pinyin-typing is a ground-breaking innovation that optimizes CFL beginners' Hanzi learning. It involves a phonologically-supported cognitive process that influences Hanzi acquisition at a deeper level than the seeming convenience. The traditional HM approach was based on the functional need of handwriting since people relied on the pen and paper for written communication. However, as digital technology has enabled e-writing via keyboarding and even speech, the HM routine lacks a scientific basis and a pedagogical rationale. Specifically, the stroke-based HM is founded on prolonged procedures of sublexical input/output devoid of phonological input. Typical HM steps include: (1) follow a writing guide to learn the strokes and the stroke order of the character; (2) assemble the character stroke by stroke for an initial familiarization; (3) repeat the assembly steps until the character's composition, components, and exact stroke order are committed to memory, and (4) maintain learned characters by repeated handwriting practice of characters (see Appendix A1). Obviously, for CFL beginners, memorizing 8-10 new characters a day in addition to maintaining ever-increasing learned items is not only time-consuming but also cognitively draining. In contrast, Pinyin-based typing

employs a fundamentally different cognitive route. Rather than bits and pieces (sublexical), the learner focuses on meaningful units in words and phrases (lexical). The phonetic- to-Hanzi conversion during typing entails instant phonological–visual processing: inputting and outputting meaningful chunks of words and phrases (see Appendix A2). Clearly, the two modalities involve distinctly different processes in learning and represent two cognitive routes (Figure 1).



Note. This chart was created by Phyllis Ni Zhang (2021), contrasting the characteristics of Hanzi handwriting and Pinyin-based typing in cognitive processing.

Figure 1 Pinyin-typing vs. handwriting: Differences in cognitive processing

As can be seen, Pinyin-typing transforms the Hanzi processing from a sublexical-based visual-motor procedure into a lexical-based phonological–visual chunking procedure, which can substantively impact learning outcomes. Conceivably, the typing/digital route opens a new and promising path to Hanzi literacy for CFL learners. This study seeks to explore the effectiveness of typing/digital approach on CFL beginners' Hanzi learning concerning their reading and e-writing development.

2. Literature review

This review draws on theories from cognitive psychology and discusses related CFL studies. Pertinent cognitive aspects include information processing (encoding, storage, and retrieval), working memory (WM), long-term memory (LTM), and depth of processing. The discussion of CFL research centers on Pinyin-based typing and its related processing, practice, and issues.

2.1 Information processing and memory: Theories and key concepts

Phonological Loop (PL). PL plays a key role in language processing. According to Baddeley (2003), PL is an active sub-system of WM that interact with LTM. It processes verbal content, including sound and visual text: (1) storing and refreshing the sound of

language in rehearsal loops, and (2) transferring visual information (words and sentences) to a phonological code through subvocalization so that meaning can be extracted. In other words, to read a written word, people first convert it to a spoken/acoustic code to be processed in WM and then transferred to LTM. Thus, PL "can be a useful aid in learning new words" and facilitates the acquisition of language (Baddeley, 2003, p. 194; also see Baddeley at al., 1998). Based on the PL mechanism, a morphographic language such as Chinese will take an extra step for the visual acoustic conversion. The learner must first make a sound-meaning-form link of the word and store the package as a mental representation, allowing for subsequent PL retrieval. Conversely, missing the sound coding can inhibit effective retention in LTM.

Chunking. Chunking refers to grouping or organizing bits of information into larger or meaningful wholes to facilitate WM and memory consolidation. According to Miller (1956), the human immediate memory span can only hold approximately seven items of information. To effectively aid information processing and LTM, small bits should be *recoded*: grouped or organized into larger chunks. As a psycholinguist, Ellis (1996, 2012) viewed chunking (i.e., learning and memorizing phonological and written sequences or formulaic expressions) as an essential process of second language acquisition (SLA) because it promotes the development of automaticity and fluency (1996, p. 107). Ellis further explained how language sequences/chunks in WM transfer and evolve in LTM:

> Short-term representation and rehearsal allow the eventual establishment of long-term sequence information for language. In turn, there are reciprocal interactions between long-term sequence representations and short-term storage whereby long-term sequence information allows the chunking of working memory contents that accord with these consolidated patterns, thus extending the span of short-term storage for chunkable materials. (1996, p. 115)

Holistic vs. analytic processing. Chunking entails holistic processing (HP) in language processing, i.e., taking a chunk (e.g., a word or a phrase) as whole without analyzing its parts. By contrast, analytic processing (AP) focuses on the parts of a word/phrase. HP is associated with higher efficiency in word recognition and text reading (Ventura et al., 2020). However, the processing of Chinese written text may require the use of both holistic and analytical strategies. For example, Chinese children tended to use HP to identify two-character compound words but switched to AP to judge characters when in isolation (Liu et al., 2010). Nonetheless, a learner's tendency to analyze Chinese character parts in each encounter is "detrimental to efficient reading" (Jiang et al., 2020, p.9)

Depth of processing and retrieval. According to Craik and Tulving (1975), information processing with encoding elaboration (e.g., semantic categories and meaning cues) can increase the depth of processing, enhancing LTM. More importantly, retrieval affects retention, rather than the amount of attention and effort, because "deeper encodings are associated with greater retrieval potential in an environment conducive to recall" (Craik, 2002, p. 309). Tulving emphasized that retrieval is "the key process of memory" (Guzzaniga, 1991, p. 91) as encoded and stored information can be useful only if it can be

retrieved. Despite some criticism on the depth framework, psychologists generally agree that the process involving *meaning* facilitates retrieval and retention.

2.2 The phonological factor in Hanzi learning

Previous CFL research has recognized the strong relationship between phonology and Hanzi learning and reading (Everson, 1998; Everson & Ke, 1997; Yin, 2006; T. Zhang & Ke, 2018). Characters presented with sound have been found to be better retained than those without it (Zhu & Hong, 2005). Everson (1998) observed, that learners tend to systematically resort to phonological resources in Hanzi learning, i.e., taking sound and visual forms as "a packaged deal" (p. 200), which effectively facilitates their reading. Other studies (Jin, 2017; Shen & Jiang, 2013; Z. Zhang, 2009) have emphasized the importance of phonological awareness, e.g., syllables, segmentation, phonetic components in literacy development. Z. Zhang (2009) asserted that the phonetic components of characters should be given a central place in Hanzi instruction since their phonological information plays a key role in Hanzi learning and recognition. Therefore, sound-based typing supports Hanzi literacy development efficiently with enhanced sound-meaning connections, better awareness of phonetic components in Hanzi, contextualized Hanzi recognition/ differentiation practice (vs. isolated characters by handwriting), and better meta-linguistic awareness of the word/polysyllabic word (vs. character) as a basic unit in Chinese (Z. Zhang, 2009, p. 86-87).

Clearly, for CFL beginners, "the memorization of the large amounts of characters needed for beginning literacy seems doomed to failure without firm spoken language support" (Everson, 1998, p. 201). The Pinyin-based typing approach makes sense both cognitively and pedagogically: bypassing the meaningless stroke-based sublexical practice enables the learner to focus on and benefit from the phonological-based processing of meaningful units. The Pinyin-typing mode synchronizes with and reinforces the learner's aural-oral practice, thereby promoting Chinese acquisition through an integrated approach (Allen, 2008; Xie, 2005, 2011; Z. Zhang, 2009).

2.3 Chunking as a solution to the Hanzi reading barrier

The absence of explicit word boundaries in Chinese written text is generally recognized as the greatest barrier to reading comprehension (Everson & Ke, 1997; Moser, 1991; Shen & Jiang, 2013). Learners struggle to decipher the meaning of an evenly spaced line of text without any clues to word boundaries (e.g., 昨天我和朋友一起从上海坐飞机到广州去). To read Chinese sentences efficiently with accuracy, the chunking training based on meaningful units (e.g., words, phrases, collocations, and idiomatic expressions) is essential. CFL professionals have suggested ways to foster learners' ability to parse words/phrases through speech-based training (e.g., awareness of strings of phonemic units, chunk-based recitation and reading aloud; Jin, 2017; Shen & Jiang, 2013; Yin, 2006). It follows that Pinyin-based typing can also lend significant support to such rudimentary training with phonological–visual mapping (Xie, 2005), because inputting-outputting chunks (in words and phrases) naturally develops the learner's ability to process Hanzi by meaningful units, facilitating word parsing and sentence segmentation. Given that handwriting learners tend to analyze parts of a character, intervention is necessary to

develop holistic reading to improve reading efficiency (Jiang et al., 2020), and chunk-based typing may serve as a suitable instrument for this purpose.

2.4 Hanzi retention

Some longitudinal empirical studies have revealed that the intensive HM routine for CSL beginners does not facilitate Hanzi retention. Studying a 3-month beginner's program, Jiang (2007) found that the reduced-handwriting group performed significantly better in both character recognition and handwriting tests than the control group that had more HM practice. Similar findings were reported by Wang (2015) that as learners progressed to new Hanzi items during a year-long program, both their overall performance on character recognition and handwriting declined considerably, with only 50% of handwriting retention at the end (p. 23). These findings contradict the presumption that the more handwriting practice, the better L2 learners can recognize and remember Hanzi.

A few studies have compared the effect of typing versus handwriting on retention with varied findings. Guan et al. (2013) found that handwriting supports character-meaning memory but not sound, and typing strengthens character-sound memory but not meaning, whereas Jiang (2017) found no differences in sound or meaning recall between handwriting and typing learners. However, these findings based on character-level tests are inadequate to explain learners' word-level performance. Lu et al. (2019) reported a word-level experiment based on a CFL setting, arguing that "[w]hen considering communication, words (rather than characters) are the basic unit of a sentence" (p.3). This study compared the effects of a digital-only without handwriting condition (NH) versus a with-handwriting condition (WH) that used a third of the allowed practice time on handwriting. The results show that NH performed significantly better than WH, suggesting that handwriting practice is not as efficient as that with digital tools for learning and retaining Hanzi. Lu et al. argued that efficiency should also be considered as an important CFL learning criterion. The key findings demonstrate two important things: (1) handwriting's effect on character-meaning memory is only limited to a short period of time, and (2) typing practice with words (lexical units), different from discrete characters (sub-lexical units), effectively enhances morphographic-semantic mapping—even better than handwriting.

2.5 Typing-primary models: Practice, issues, and benefits

Several typing-primary models using a regular Pinyin IME have been explored in some CFL beginning Chinese programs, such as typing Hanzi from Day 1 (Feng & Yang, 2013); typing Hanzi regularly supplemented with a gradual handwriting program (He et al., 2008); typing Hanzi proceeded with a basic handwriting training (Xie, 2011; P. Zhang, 2015b, 2018). While these programs reported overall success, learners' weaker character-level performance due to word/phrase processing has also been noted. Feng and Yang (2013) argued that it is natural for CFL learners to first focus on words/phrases before attending to characters—a similar course that Chinese children develop their character knowledge over time as their word bank expands (p. 36). This view aligns with Ke (1996) that in-depth orthographic and character information can be acquired after obtaining adequate knowledge of basic words. Allen (2008) shared the same view: "[o]nce the pronunciation, speaking, and electronic reading/writing skills are solidified, handwriting

then could be introduced more effectively" (p. 245). Furthermore, the typing-primary approach provides additional pedagogical benefits. Z. Zhang (2009) noted that Pinyin-typing develops better sound-meaning connections for learners, greater awareness of phonetic components, intensified recognition/differentiation as well as contextualized practice, and greater meta-linguistic awareness of Chinese word (p. 86-87).

2.6 The gap in research and current studies

Previous research has been heavily centered on HM-based character learning; studies on Pinyin-based typing versus handwriting are scarce. Lyu et al. (2021) found only 16 published quantitative empirical studies on this topic from 2009 to 2019, of which only one examined word learning and retention. Moreover, there have been few studies on learning outcomes pertaining to level-related practical reading and writing skills, such as those described in ACTFL Proficiency Guidelines (2012). It is, therefore, compelling for the CFL field to be informed of empirical evidence on learners' actual learning outcomes in the classroom setting, including pre- or semi-functional levels beyond characters and words. For example, research is required to determine whether learners can achieve Hanzi literacy without handwriting (Allen, 2008), or how learners' Hanzi skills contribute to their reading comprehension performance (T. Zhang & Ke, 2018). From a pedagogical point of view, evidence of the effects of typing on the beginner's Hanzi proficiency development is essential for restructuring CFL instruction for the digital age. It also calls for a shift of research focus from the character-centered orthographic knowledge to proficiency-oriented skills and literacy development.

Given the need for closing the gap, this study seeks to investigate the long-term effect of the Pinyin-based typing-primary approach on learners' actual performance. It argues that as phonology plays a key role in human memory, typing via phonological-visual chunking of words and phrases can optimize Hanzi processing (encoding, storage, and retrieval). Therefore, sound-based typing using Pinyin is in effect superior in supporting beginners' Hanzi learning and literacy development. Contrastively, HM for beginners is inefficient and counter-productive due to its cognitive overload and the lack of phonological support. The study attempts to answer these research questions: Can the Pinyin-typing approach achieve expected Hanzi learning outcomes in place of the traditional HM routine? To what extent do typing-primary learners differ from their handwriting-primary counterparts in target performance? The following four aspects are to be determined:

1. Reading comprehension as measured by periodic assessments
2. Hanzi production and output accuracy in e-writing as measured by term-end impromptu essay-writing assessments
3. Contextualized word recognition as measured by periodic assessments
4. Long-term word retention as measured by course-end and program-end Hanzi assessments.

3. Methods

3.1 Instructional context

This study was based on existing records of students in a two-semester beginning Chinese program (Course 1 and 2, with 14 weeks per course/semester) at a private university in the US where this researcher works; Courses 1 and 2 each lasted for 14 teaching-weeks with a 4-week break in between. A regular week had two 75-minute lectures and two 50-minute oral sessions. Course materials were published textbooks developed by this researcher: the textbook, Volumes 1 and 2 (P. Zhang, 2015a), and the literacy workbook, Volumes 1 and 2 (P. Zhang, 2015b), as well as a companion website with interactive online exercises. Each course introduced approximately 350 characters and 500 word/phrase items.

Hanzi instruction: Initial training and general requirements

Course 1 started with a two-week (6 hours) foundation unit on Pinyin and Hanzi basics. Hanzi training included character strokes, radicals, and four 20-minute in-class tracing practice sessions. During the first two weeks, students also completed a 50-minute homework assignment on Pinyin and Hanzi exercises following each session. At the end of the foundation unit, students received a 30-minute training on typing Chinese using a commonly available Pinyin IME program (e.g., the Pinyin IME installed on Windows or Mac). The training emphasized strategies for output efficiency and accuracy, e.g., inputting chunks of words and phrases instead of monosyllables. Throughout Course 1 (14 weeks) and Course 2 (14 weeks) of this beginning Chinese program, students were expected to: (1) spend a minimum of 40 minutes a day on Hanzi learning/practice as part of the routine homework, and (2) do weekly sentence reading–typing exercises or grammar exercises requiring sentence reading and typing.

Hanzi treatment: Changes of handwriting requirements

This program transitioned from a primarily handwriting approach to a primarily typing one: Stage 1 (before 2016) adopted HM with a rigorous daily load with Pinyin-typing being used as the secondary mode; Stage 2 (2016-17) adopted a moderate and more balanced HM approach (HM-b) that reduced handwriting by 50%. While some students found moderate handwriting helpful, others regarded handwriting as unnecessary. Another change was made (Stage 3, 2017-2019) to accommodate different learning needs and to test out the effectiveness of the typing-digital approach. Pinyin-typing was adopted as the primary mode for Hanzi requirements: after the initial handwriting training, Course 1 only required minimal hand-copying (without the stroke-memorization) and Course 2 no longer required handwriting in daily work and quizzes. Although students were free to choose their own practice method, e.g., handwriting, mixed/balanced, or typing/digital, all students were still required to complete typing-assignments and use only the typing mode for all tests.

Hanzi-related assessments

The direct measures included four main types:

- Reading. Three periodical and six unit-based reading comprehension tests consisting of narrative passages of 300–600 characters with true/false or multiple-choice questions in English (Course 1) and in Chinese (Course 2).
- E-writing. Three term-end typed essays (timed impromptu writing on provided topics/prompts).
- Word recognition (since 2016-17). Six unit-based and timed reading–typing tests.
- Cumulative word recognition (since 2016-17). Term-end Hanzi recognition tests (word recognition and sentence reading-typing).

The indirect measures included three surveys: an entrance questionnaire on language experience followed by testing items (Pinyin, typing, and passage reading) and two term-end surveys with reflections on Hanzi learning and practice, among others.

3.2 Research design

To examine the effectiveness of the typing-primary approach compared to the HM-primary approach, this study used a quasi-experimental design with retrospective cohort comparison groups with students enrolled in the beginning-level courses taught by this researcher (Spring 2015–Spring 2019). The conditions of the all the cohorts were consistent: the head instructor, textbooks, lesson plans, and assessments remained mostly the same throughout. Data mainly included the digital performance records of these cohorts. While the early HM cohorts using pen and paper for written tests had limited digital records, the available data still provided valuable information on reading and e-writing and was therefore included. Other data analyses (sentence reading-typing and Hanzi recognition/ retention) were made only between the typing-digital and HM-b modalities. The following retrospective cohorts formed the three comparison groups based on their practice modalities according to course requirements:

- HM (2015 spring, fall): Daily handwriting and memorization (8-10 characters); weekly sentence reading–typing or other typed exercises.
- HM-b (2016–17): Balanced with reduced daily handwriting and memorization (4-5 characters) and weekly sentence reading–typing or other typed exercises.
- Typing–digital (2017-2019): Daily practice with Hanzi word lists and/or Quizlet (audio-enabled e-flashcards with words and phrases); minimal hand copying in Course 1 and no regular handwriting required in Course 2; weekly sentence reading–typing or other typed exercises.

(See details in Appendix B.)

Inclusion/Exclusion rules

(1) To ensure baseline equivalence and to avoid confounding variables, this study included only true beginners as determined by an entrance test and a survey administered during Course 1 in each cohort. (2) Beginners who spoke Chinese or had Hanzi writing

experience were not included here. (3) Only those with complete assessment records in Courses 1 or 2 were included. Course 2 students who did not take Course 1 of this program were excluded. (4) True beginners who enrolled between 2017 and 2019 but did not use typing–digital consistently as the primary mode were not chosen for the typing–digital group. Given these restrictions, the present sample can only be considered representative of true CFL beginners enrolled in a rigorous college program, with regular attendance, who have adopted a consistent Hanzi practice mode as defined above.

Sample size and data sources

Sample Size. 108 students were included, aged 18–20 years (47% male and 53% female). The HM group included 54 students: Course 1 had 27 students who enrolled in Fall 2015, and Course 2 had 27 from Spring 2015 who completed Course 1 in 2014 (a different cohort). To match the number of the HM group, HM-b and typing-digital groups each had 27 for Course 1; from this, 26 of HM-b and 25 of typing-digital learners continuing in Course 2 were included for paired-sample analysis.

Data. A total of 1440 records (1,200 records of tests with identical items and format and 240 records of entrance/exit surveys) were collected and analyzed. All data were collected from the existing digital records of the two courses from 2015–2019. Although much of the 2015 cohorts' handwritten data were unavailable, the limited digital data from these early HM cohorts still provided valuable information and were therefore included (see Appendix B).

Measures and instruments

To evaluate learners' Hanzi reading and Pinyin-based typing performance, the averages of reading comprehension scores, reading–typing test scores, and essay word count and typing error count were computed for each group using the same set of criteria. The mean, median, and standard deviation scores were summarized. The Hanzi count in the essays was character-based using the Word Count feature in Microsoft Word and English words were excluded. Repeated typographical errors were not double-counted. Given the multifaceted nature of L2 writing and limited scope of this study, learners' grammar errors were not included in the analysis.

Comparisons of means (or medians where appropriate) between or across the groups were performed using parametric tests (analysis of variance [ANOVA] and t-test) and non-parametric tests for non-normally distributed data (Wilcoxon signed-rank, Mann-Whitney U, and Kruskal-Wallis H tests). Paired-sample tests for the available HM-b and typing-digital data of Courses 1 and 2 were also conducted to measure learners' Hanzi retention and progressive development.

4. Results

4.1 Reading comprehension performance

Course 1 periodical assessments

Each reading task contained one or two passages, each with 300–600 characters followed by 8–12 true/false or multiple-choice questions in English. The summary of the three reading tests is presented in Table 1. An ANOVA found no statistically significant differences across the three groups (N = 81, F (2, 78) = 1.26, p = .29).

Course 2 unit assessments

Due to a lack of available data for the HM cohorts, only two groups were analyzed: HM-b (n = 26) and typing–digital (n = 25). Each reading passage contained a narrative story of 420–550 characters followed by seven to eight true/false or multiple-choice questions in Chinese. The performance of the two groups was consistent with their performance in Course 1, indicated by the similar average scores (Table 2) and a t-test found that the two groups did not differ (N = 51, t (49) = -0.518, p = 0.61).

Table 1 Course 1 reading comprehension scores (based on three periodical tests)

Group	N	Mean (%)	Median (%)	SD (%)
HM	27	82	85	11
HM-b	27	86	88	10
Typing-Digital	27	84	88	10
Total	81	84	88	11

Table 2 Course 2 reading comprehension scores (based on six unit tests)

Mode/Group	N	Mean (%)	Median (%)	SD (%)
HM-b	26	78	79	8
Typing-Digital	25	79	79	11
Total	51	78	79	10

4.2 Writing production and Hanzi output accuracy

Course 1 term-end timed impromptu essays

Essay length was measured by the Hanzi count of typed essays, and the Hanzi accuracy rate was based on the character count. The data included two short typed essays completed in class without support, and all examined cohorts were given the same topics, prompts, and time limits.

Essay length/Hanzi count. The total Hanzi (by characters) produced in the two essays were tabulated and group averages were computed. Typing–digital learners on average produced more Hanzi (*M* = 496, SD = 124) than HM (*M* = 425, SD = 116) and HM-b (*M* = 465, SD = 100) learners. The difference between typing–digital and HM was statistically significant (*N* = 54, *t (52) = -2.18*, *p* = .034). The Hanzi-count frequencies further revealed that 11% of typing–digital learners produced 700+ characters, whereas none from the other two groups did. The upper ranges (501 up) showed that typing–digital had a total of 40%, compared to 33% for HM-b and 26% for HM (see Figure 2-a).

Hanzi typing errors. These included typographical errors due to homonyms (e.g., 晚 for 完) and other misspelled or misused words (e.g., 中文 for 中国, 比 for 不). The average error rates of the three groups were all below one percent (0.4–0.6%), with an accuracy rate of 99.4–99.6% for each group. Since the distributions were skewed (non-normal), a Kruskal-Wallis H (ANOVA) test was conducted; no significant differences were found across the groups (*Mdn* = .004, *N* = 81, *H* (2) = 2.79, *p* = .248). However, the frequency distributions of each group showed that the proportion of learners who achieved 100% accuracy (zero errors) was 37% in typing–digital, which was considerably higher than that in HM (19%) and HM-b (26%) (see Figure 2-b).

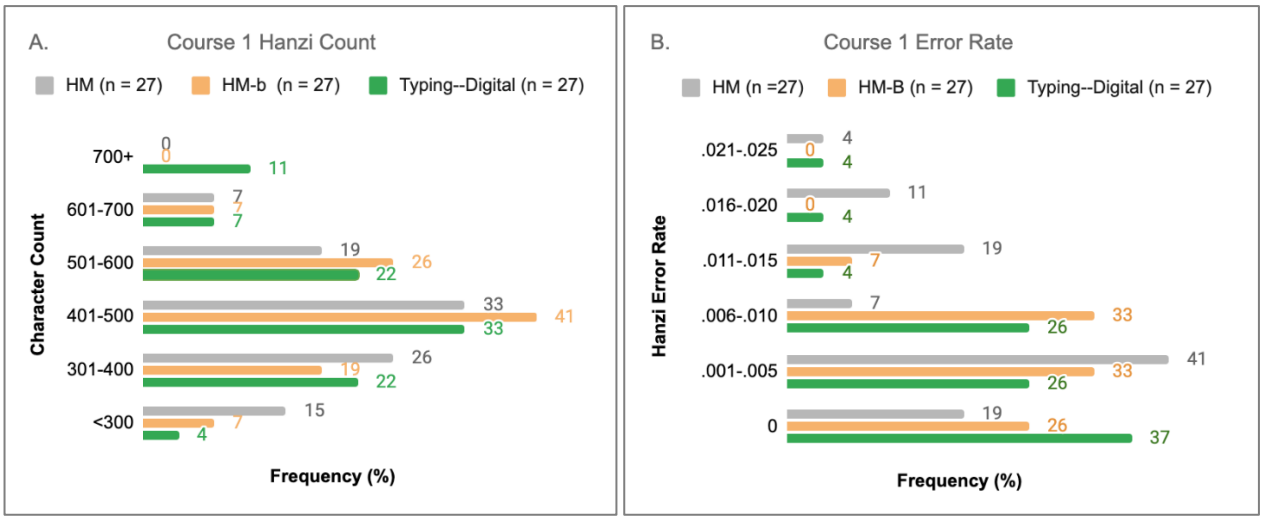


Figure 2-A. Course 1 essay length was based on the total Chinese (Hanzi) character production of two typed essays. The frequency represents the percentage of a group for each range.
Figure 2-B. Course 1 essay Hanzi error rate was based on the Chinese character count. .001 indicates 1 error in 1,000 characters. The frequency represents the percentage of a group for each range.

Figure 2 Course 1 Hanzi count and error rate frequencies across groups (two essays)

Course 2 term-end timed impromptu essay

Length/Hanzi count and Hanzi output accuracy rate were measured in the same way as in Course 1. To control the variables, only one of the two essays in Course 2, identical across all cohorts, was analyzed. All groups had the same essay prompts and used the same platform (Quia), however, the HM cohort completed the task outside of class with a longer

timeframe and permission to refer to resource materials. In contrast, the HM-b and typing-digital cohorts completed the essay in class without the support of any resources.

Essay length/Hanzi count. The total Hanzi produced in one typed essay was averaged for each group. As the results were skewed (non-normal distributions), the data were analyzed using non-parametric tests (Kruskal-Wallis H and Mann-Whitney U). Consistent with Course 1, typing–digital produced significantly more Hanzi (*Mdn* = 303) than HM (*Mdn* = 271; *N* = 52, *U* = 226, *z* = -2.051, *p* = .04). As shown in the frequency distributions (Figure 3-a), only 12% of typing–digital was in the below-250 range, compared to 32% (HM) and 30% (HM-b); and for the upper ranges (351 up), typing–digital was 24 %, compared to 8% (HM) and 20% (HM-b).

Hanzi typing errors. The results of typing errors in the Course 2 essay were highly consistent with those in Course 1, with similar median error rates: 0.3% (or 99.7% accuracy) for HM and HM-b learners, and 0.4% (or 99.6% accuracy) for typing–digital learners. A Kruskal-Wallis H (ANOVA) test found no significant differences across the groups (*N* = 78, *H* (2) = 1.26, *p* = .533). The error frequencies, shown in Figure 3-b, revealed that only 8% of typing–digital learners had a higher error rate (0.01 up), which was remarkably lower than that in HM (30%) and HM-b (12%).

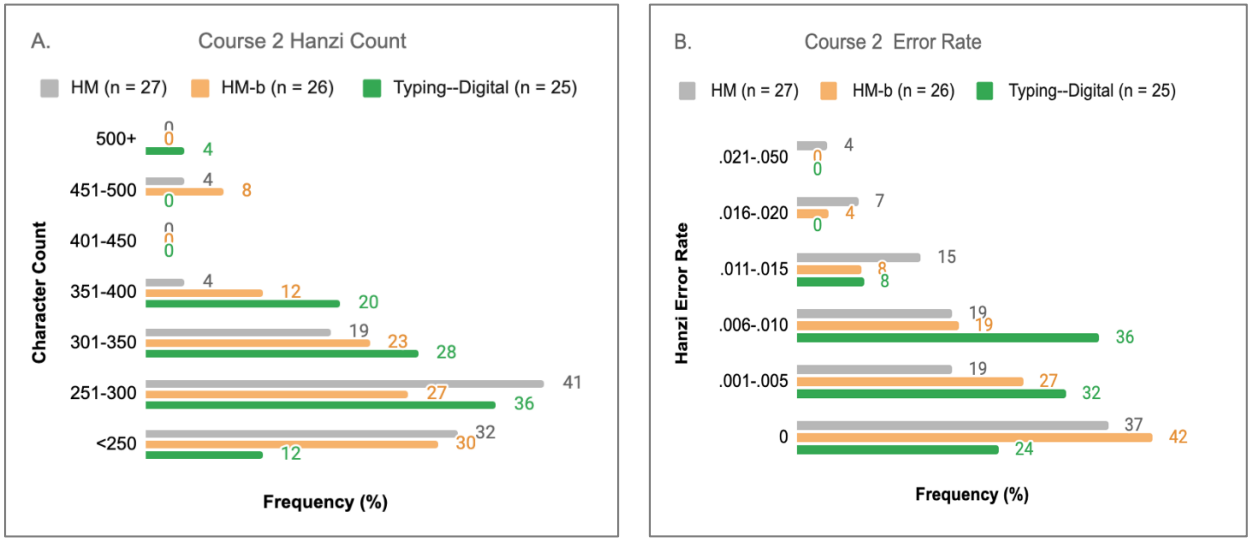


Figure 3-A. Course 2 essay length was based on the total Chinse (Hanzi) character production of one typed essay. The frequency represents the percentage of a group for each range.
Figure 3-B. Course 1 essay Hanzi error rate was based on the Chinese character count; .001 indicates 1 error in 1,000 characters. The frequency represents the percentage of a group for each range.

Figure 3 Course 2 Hanzi count and error rate frequencies across groups (one essay)

4.3 Contextualized word recognition (Hanzi and sound)

Course 2 reading–typing performance (five out of six unit-based tests)

Sentence reading-typing items were only used in the unit tests of Course 2 after 2016, therefore only two groups were compared: HM-b and typing-digital. In each reading-

typing task, students read 10–16 sentences from a paper sheet and typed the sentences verbatim on an online answer sheet within a set time limit. One of the six R-T records did not set a time limit and was excluded. Table 3 presents the score summary. A *t*-test determined that typing–digital did significantly better than HM-b (t (40.9) = -2.2, p = .034).

Table 3 Course 2 sentence reading–typing performance scores (based on five unit tests)

Group	N	Mean (%)	Median (%)	SD (%)
HM-b	26	76	77	17
Typing--Digital	25	84	86	10
Total	51	80	82	15

4.4 Long-term word retention (Course-end Hanzi assessments)

The Hanzi assessments available in digital form included 2016 to 2019 cohorts to examine learners' cumulative Hanzi retention through word recognition and sentence reading-typing tasks. Data were collected for these three tests: Course 1 Exit (Test 1); Course 2 Entrance (Test 2, a posttest of Test 1 after a 4-week interval), and; Course 2 Exit (Test 3). Paired samples were analyzed based on the available records of 26 HM-b and 25 typing–digital learners. The following items were measured: (a) identifying inappropriate words from word groups, and (b) typing out the sentences verbatim (20 in total) from a paper question sheet. HM cohorts had different written tests and the data were unavailable.

Results of Hanzi Tests 1 and 2: cumulative and retention tests (matched samples)

Records of HM-b and typing–digital learners in Course 2 (n = 51) were analyzed to determine the score difference between Test 1 and Test 2 (posttest) within each learner. The score summary is presented in Table 4. A Wilcoxon Signed–Ranks (WSR) matched samples test indicated that the Test 2 (posttest) scores were significantly lower than those of Test 1: (N = 51, Mdn = 65, T = 240, z = -3.3, p = .001).

Table 4 Cumulative word recognition and retention in matched pairs (Course 1 exit and Course 2 entrance)

	N	Mean (%)	SD (%)	Percentiles (%)		
				25th	50th (Median)	75th
Test 1 (Course 1 Exit)	51	74	20	62	81	88
Test 2 (Course 2 Entrance)	51	66	25	42	65	88

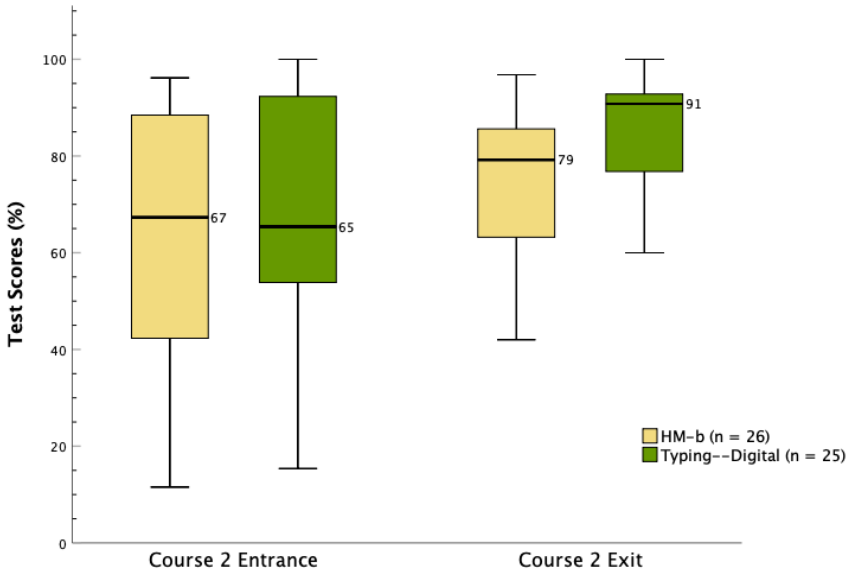
Results of Hanzi Tests 1 and 2: Cumulative retention tests (independent samples)

Mann–Whitney U tests were used to compare the differences in performance between the HM-b and typing–digital groups. For Test 1, no significant difference was

found (N = 51, *Mdn* = 81, U = 384, p = .26). In Test 2, the average performance regressed (as shown in Table 4 above); however, no significant difference was found between the two groups (N = 51, *Mdn* = 65, U = 344, p = .73).

Results of Hanzi Test 3: Cumulative word recognition (independent samples)

The program-end Hanzi test included words taught in both courses. The same groups for Test 2 were examined for Test 3. As can be seen in Figure 4, at the beginning of the course, there was no difference between the two groups. However, after a 14-week study period in Course 2, typing–digital (n = 25, *Mdn* = 91) did significantly better than HM-b (n = 26, *Mdn* = 79) in word recognition and sentence reading–typing (U = 460, p = .011).



Boxplot showing score distribution of the two Hanzi tests across the groups. Medians are labeled.

Figure 4 Cumulative word recognition performance (Course 2 entrance and exit tests)

5. Discussion

5.1 Summary of main findings

This study aimed to determine the difference in Hanzi learning outcomes in terms of reading, e-writing, and retention between typing-primary and handwriting-primary approaches. Reading comprehension and e-writing were compared between the typing–digital, HM, and HM-b groups. No significant differences were found in reading comprehension across the groups. However, typing–digital learners did significantly better in e-writing (essay length) and word recognition/retention than their HM/HM-b counterparts. These results confirm previous classroom-based observations that the typing-primary approach with a well-structured training program leads to better reading efficiency and e-writing production (Feng & Yang, 2013; Xie, 2011; P. Zhang, 2018). The outcomes of handwriting learners align with those of the previous studies on CSL beginners (Jiang,

2007; Wang, 2015) that more handwriting for beginners does not lead to better reading and writing performance over time.

5.2 Writing production and Hanzi accuracy

This study seeks to find out whether Pinyin-typing learners can achieve the same expected learning outcomes as handwriting learners, as measured by e-writing length and Hanzi output accuracy. As shown, the typing–digital learners produced significantly longer typed essays than their HM counterparts, while maintaining an equal level of Hanzi accuracy (99.95–100%). The HM cohort's e-writing production was significantly lower. At the end of Course 2, 73% of HM learners produced less than 300 Hanzi characters (low ranges) in one typed essay, compared to 48% of typing–digital learners. These outcomes were surprising given that the handwriting learners were allowed more time and resources during the writing task. These learners should not be considered as disadvantaged for typing since they had also practiced Pinyin-typing routinely; besides, typing is an easier task than handwriting as generally assumed by CFL teachers and students. It is possible that their shorter production resulted from the intensive daily orthographic practice: i.e., writing and memorizing the strokes of 10 characters a day had inevitably forced learners to slow down to focus on sublexical units. Presumably, this orthographic-based analytical routine may negatively impact the development of meaning-focused production that requires lexical-level and holistic processing. As a student reflected on Hanzi learning in the 2019 course survey, the handwriting process is indeed a hindrance to Hanzi learning and productive writing:

> [H]and-writing isn't integral to learning Hanzi. What I've found is that whenever I hand-write Hanzi, I end up mindlessly writing without really thinking. Even if I actively concentrate on what the word is, I get so caught up on making sure the word is written perfect[ly] that instead of learning how to recognize the word, I learn the task of writing instead. Typing, on the other hand, allows me to learn sentence structures and how to view and recognize Hanzi in relation to other words rather than individual words or the act of writing.

This also explains the typing–digital learner's impressive performance in e-writing. It is true that the intelligent Pinyin IME affords typing efficiency and accuracy. However, for a Pinyin IME to produce accurate Hanzi text, the input must first contain meaningful strings of syllables in acceptable Pinyin spellings. In this regard, the typing–primary learners benefited from the effect of phonological–visual encoding (Baddeley, 2003) and chunking (Ellis, 1996). Despite their issues with isolated characters (话 vs.说 or 语), they were able to quickly read Hanzi strings, and in most cases, differentiate target words from their homonyms (e.g., 吃完饭 vs 吃晚饭; 室友 vs 是有 or 师友). Evidently, for most learners, reducing or eliminating handwriting did not inhibit their Hanzi reading development. Rather, it promoted Hanzi learning since learners must constantly identify and match Hanzi words /phrases to their phonetic input. The outcomes also support Z. Zhang's (2009) assertion that sound-based typing can effectively raise the learner's meta-linguistic

awareness of: (a) Hanzi homonyms, and; (b) of the word/polysyllabic word, rather than a character, as a basic unit.

5.3 New evidence on learners' word retention

Typing-digital learners' successful word-level retention

Despite an anticipated decline in their word recognition at the beginning of Course 2 (after a four-week interval), typing–digital learners recovered quickly and did significantly better than HM-b learners in all sentence reading–typing tasks in Course 2, including the one in the final program-end assessment. These results contradict previously reported findings that handwriting led to stronger word recognition whereas typing only supported character-sound memory, not meaning (e.g., Guan et al., 2011). However, the findings align with the word-level observations (Lu et al., 2019) that the digital (without handwriting) condition resulted in better word recognition, offering new evidence that typing–digital learners were able to recall words (sound, form, and meaning) over a long period when typing practice was maintained. Clearly, the ease of using typing–digital tools helped sustain Hanzi maintenance as learners progressed to new materials, thus allowing for advancement in Course 2.

Baddeley's (2003) argument regarding the phonological loop as a useful aid for language learning also applies to written Chinese. The program-end learning outcomes suggest that recursive typing practice enhanced sound–meaning-form mapping, effectively facilitating word recall. It also suggests that the lack of phonological encoding and word rehearsal can impede word-level processing and retrieval. In addition, given the learners' relatively weak character knowledge, the existence of meaning cues that support word retrieval (e.g., Craik, 2002; Shen, 2004) also played an important role in successful word recognition performance, especially in the sentence reading-typing tasks.

Handwriting learners' weaker word-level retention

The inferior performance of HM-b learners in the Course 2 cumulative test indicates that regular character-level handwriting, even if with reduced load, does not enhance word-level memory. Three factors associated with handwriting may contribute to unsuccessful word retrievals. First, handwriting learners focus on visual stroke assembling without word–sound input. Despite a stronger character-level memory, the lack of phonological encoding and lexical-level rehearsal may lead to the word-recall failure, especially for typing tasks when the sound information is essential. Second, word-level memory may fade if learners dechunk words—writing only new or hard characters instead of whole words. Third, learners must keep up with new items as they progress, thus, exhausting their cognitive resources for maintaining old character and learning new items at the same time. These factors may also explain the previous findings from longitudinal studies on CSL beginners that rigorous handwriting practice led to declined word recognition and hand-reproduction performance (Jiang, 2007; Wang, 2015). Thus, besides the demanding cognitive load and limited Hanzi retention effect, an added caveat for prolonged handwriting practice is that it may weaken word recognition if the learner tends to practice characters rather than whole words.

5.4 Pedagogical implications and suggestions

The current findings offer the following considerations for CFL beginner-level Hanzi instruction.

1. The typing-primary approach optimizes beginners' learning outcomes. Although many factors can influence learning outcomes, a well-structured typing-primary model (e.g., Pinyin-typing coupled with Quizlet) is efficient and sustainable for most CFL beginners.

2. Handwriting can still provide additional assistance and satisfy beginners' curiosity. An initial familiarization of the basics of handwriting is necessary for all beginners to gain prerequisite knowledge, which also helps support the self-motivated handwriting needs of some learners. Nonetheless, the prolonged stroke-by-stroke memorization routine is counter-productive for most beginners and should be avoided.

3. For a typing-primary approach, structured Pinyin-typing training (e.g., input words and phrases instead of characters) and distributed practice (e.g., routine typing assignments throughout the course) are *essential* for learners to develop Hanzi fluency and accuracy. Distributed practice also provides repeated rehearsals necessary for Hanzi reading and retention. For example, weekly exercises, such as typing of words/phrases from audio and written cues and self-quizzing using audio-supported applications (e.g., Quizlet), increase learners' frequency of exposure to Hanzi text and enable effective word retrievals. Without such as systematic practice in place, the typing-primary approach may not achieve expected learning outcomes.

4. Would a balanced approach be better? Some teachers may prefer an integrated or a dual/mixed method for the benefits of both handwriting and typing. However, which modality takes the precedence can make a difference in learning outcomes. The key issue is the initial *encoding* mode and memory structure involved in the process (i.e., stroke- and part-based vs. phonological–visual, chunk-based). Therefore, it is suggested that a balanced/mix mode should put Pinyin-typing practice before handwriting, and make handwriting as secondary and use it selectively.

5. Radicals and components. For beginners, except for easily confused characters (e.g., 请 vs. 情, 问 vs. 闻), it is unnecessary to over-emphasize radicals and components of characters. In-depth orthographic and character information can be acquired after obtaining adequate basic words to help learners advance their knowledge of Hanzi. (See Ke, 1996 for an orthographic awareness model, and see Z. Zhang, 2009 for a phonic approach to character learning.)

5.5 Limitations of the study and future research

This study has several limitations. (1) It examined records of true beginners sampled from retrospective cohorts without randomization. The generalizability of the results is limited by the small sample size of each group and by the exclusion of learners with partial records and with Chinese or Hanzi experience. (2) The original assessments

were not specifically designed for experiments and, hence, confounding factors might exist. (3) The HM learners' performance analysis was only partially complete owing to a lack of comparable records (e.g., sentence reading-typing tasks). (4) The analyses for essay writing performance were limited to e-writing records due to a lack of handwritten data. In addition, the e-writing analysis was limited to the essay length and Hanzi output accuracy, which answered the research question pertaining to e-writing production in terms of efficiency and Hanzi accuracy. However, as L2 beginners' writing is multifaceted, learners' writing quality, grammar, and communicative appropriateness should be further investigated. (5) Being beyond the scope of this study, learner differences (e.g., auditory vs. visual learners) and other proficiency levels than beginners were not examined. Some learners may depend on handwriting to recognize and remember Hanzi. Therefore, the pedagogical suggestions provided above may not apply to all learner types and levels, especially those who are handwriting-reliant. Future research may delve deeper to gain more insights into these areas and explore learner-specific pedagogical solutions.

6. Conclusion

Since Pinyin-based typing-primary models were introduced in the CFL field in the early 2000s (e.g., He et al., 2008; Xie, 2005; Xu & Jen, 2004), the crucial role of Pinyin-based typing in L2 Hanzi learning has long been ignored, mainly owing to the misassumption that typing leads to poor Hanzi recognition and literacy development. This longitudinal study based on 1,440 records of true beginners' assessments has provided new evidence supporting the typing-primary approach: rather than hindering it, Pinyin-typing promotes Hanzi learning and use. Compared to their intensive or balanced handwriting counterparts, the typing-primary learners demonstrated: (1) comparable reading comprehension, (2) longer typed essays with comparable high Hanzi accuracy (averaged 99.6%), (3) better word- and sentence-level word recognition, and; (4) better cumulative word/phrase retention in course- and program-end assessments. Additionally, in the four-week interval between the two courses, typing-primary learners did not have more Hanzi attrition than balanced-handwriting learners. Evidently, most beginners receiving a structured typing-primary Hanzi training can achieve expected learning outcomes for reading, e-writing, and maintenance without handwriting. The results on reading and writing efficiency are consistent with previous preliminary reports on typing-primary practice (Feng & Yang, 2013; He et al, 2008, Xie, 2005, 2011; P. Zhang, 2018). Despite weakness in recognizing isolated characters, typing-primary learners can successfully read, retrieve, and retain Hanzi in meaningful chunks of words/phrases, if typing rehearsal is regularly maintained. In contrast, handwriting learners, who are generally stronger in character recognition, may fail in word-level performance, possibly owing to a lack of phonological and/or meaning support due to focus on sublexical learning (strokes and isolated characters). This observation is consistent with Lu et al's (2020) results on word-level retention with and without handwriting and extends previous findings that were based mainly on character-level experiments (e.g., Guan et al, 2011; Jiang, 2007; Xu et al, 2013).

To help fill in the gap in the literature, this study has examined CFL Hanzi instruction from cognitive and functional perspectives. Evidently, the typing-primary learners' success can be largely attributed to the phonological–visual route. Pinyin typing

affords sound-meaning-form mapping in meaningful chunks of words/phrases, while recursive typing rehearsals can consolidate and enhance the meaningful chunks in learner's long-term memory, which in turn facilitate the chunk retrieval and learning-use transfer. The effectiveness of this typing approach suggests that chunked phonological–visual processing, a key process for language acquisition (Baddeley 2003; Ellis, 1996, 2012) also applies to a morphological language like Chinese. As demonstrated in this study, the typing-primary approach with structured typing practice optimizes the speaking-reading integrated (语文同步) model and provides a logical, feasible, and sustainable solution to CFL beginners' literacy development.

While offering a preliminary look at a new and promising path, this study is nonetheless limited in scope and qualitative analysis. Future research is necessary to also examine the typing—digital learners' production (e.g., grammar, word usage, error types) to gain in-depth insights into the learners' learning outcomes as impacted by the transformation of Hanzi learning and assessment in digitally enabled procedures. Clearly, to perfect the typing—digital pedagogy across different proficiency levels, more design-based studies are needed to determine when and how CFL learners should acquire more Hanzi orthographic and character knowledge to further their literacy.

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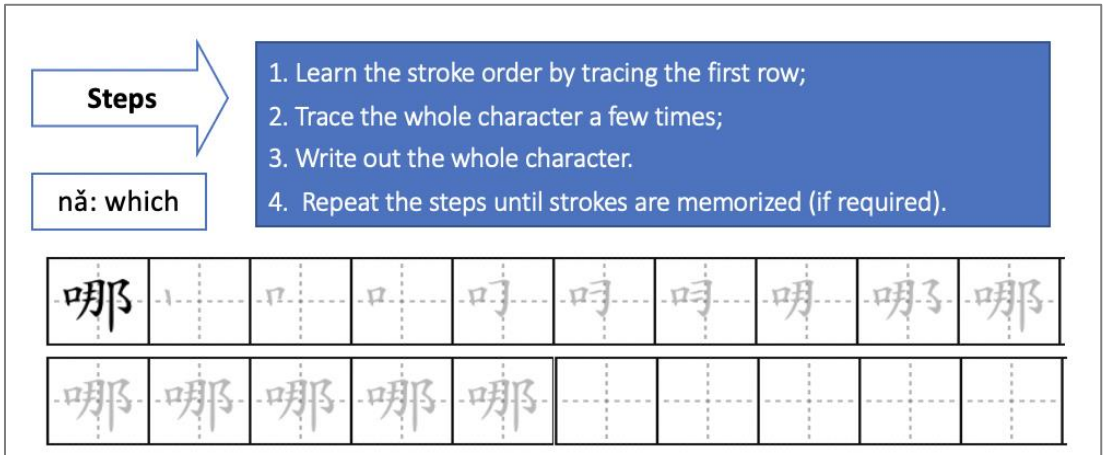
Appendix A

Figure A1

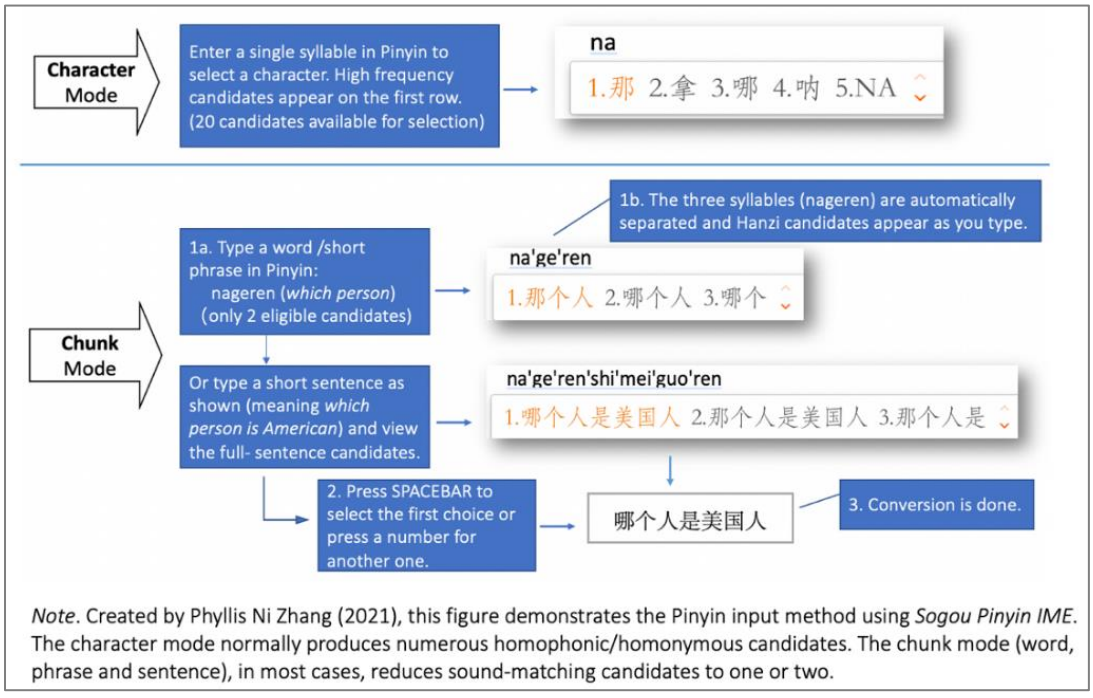
Typical Steps for Learning Chinese Characters (Hanzi) by Handwriting



Note. This example demonstrates typical initial steps for L2 Chinese beginners to learn Chinese characters (Hanzi) based on the traditional handwriting method.

Figure A2

Chinese Word Processing with a Pinyin-based Input Method



Note. Created by Phyllis Ni Zhang (2021), this figure demonstrates the Pinyin input method using *Sogou Pinyin IME*. The character mode normally produces numerous homophonic/homonymous candidates. The chunk mode (word, phrase and sentence), in most cases, reduces sound-matching candidates to one or two.

Appendix B

Table B1

Hanzi Practice and Requirement for Each Cohort

	General Hanzi Practice/Requirement	Daily Hanzi Practice/Quiz			Routine Assignments		Unit Tests	Final Essays
Cohort and Modality	**Course 1** (14 Weeks x 5 hrs)	New characters	Quiz/ handwrite	Quiz/ reading	Grammar exercises	Weekly exercises	Reading, grammar, vocab.	Timed
[Fall 2015] HM-primary (HM)	a. Daily handwriting and memorization; b. Regular typing for assignments	8-10	dictation 5 items	3 phrases	online, type	handwrite; type	handwrite; type	type
[Fall 2016] HM-moderate (HM-b)	a. Daily handwriting and memorization; b. Regular typing for assignments	4-5	copy 4 items	3 phrases	online, type	handwrite; type	type	type
[Fall 2017, 2018] Typing-primary	a. Daily audio-aided/Quizlet practice; w/minimal hand-copying/tracing; b. Regular tryping for assignments	10-15	copy 4 items	3 phrases	online, type	type	type	type
Cohort and Modality	**Course 2** (14 Weeks x 5 hrs)	New characters	Quiz/ handwrite	Quiz/ reading	Grammar exercises	Weekly exercises	Reading, grammar, vocab.	Timed
[Spring 2015] HM-primary (HM)	a. Daily handwriting and memorization; b. Regular typing for assignments	8-10	produce 5 items	2 phrases	online, type	handwrite; type	handwrite; type	handwrite; type
[Spring 2017] HM-moderate (HM-b)	a. Daily handwriting and memorization; b. Regular typing for assignments	4-5	produce 4 items	2 phrases	online, type	handwrite; type	type	type
[Spring 2018, 2019] Typing–Digital	a. Daily audio-aided/Quizlet practice; handwriting not required b. Regular tryping for assignments	10-15	none	2 phrases	online, type	type	type	type

Table B2

Grouping of Data

Records	Course 1 (true beginners)	N (81)	Tests Total	Surveys Total	3 Reading Tests	2 Typed-Essays	1 Hanzi Test	1 Entrance Test/Survey	1 Exit Survey
Fall '15	HM-primary (HM)	27	135	54	81	54	N/A	27	27
Fall '16	HM-moderate (HM-b)	27	162	54	81	54	27	27	27
Fall '17, 18	Typing-Digital	27	162	54	81	54	27	27	27
	Course 1 analyzed records (621)		459	162	243	162	54	81	81
Records	Course 2 (continuing beginners)	N (78)	Tests Total	Surveys Total	6 Reading Tests	5 Typing tests	1 Typed-essay	2 Hanzi Tests	1 Exit Survey
Spring '15	HM-primary (HM)*	27*	27	27	N/A	N/A	27	N/A	27
Spring '17	HM-moderate (HM-b)	26	364	26	156	130	26	52	26
Spring '18,19	Typing-Digital	25	350	25	150	125	25	50	25
	Course 2 analyzed records (819)		741	78	306	255	78	102	78
	Total analyzed records (1440)		1200	240					

* marked cases in Course 2, Spring '15 (N=27) indicates unpaired samples.

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Integrating Augmented Reality into a Task-Based Thematic Language Teaching Unit
(增强现实在任务型主题单元教学中的运用)

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Abstract: This case study explores ways that one type of technology, Augmented Reality (AR), are used with a task-based thematic unit to improve beginning language learners' speaking and listening skills. Researchers and practitioners have started to use AR in teaching languages. The few empirical studies that examined the use of AR in language teaching primarily examine whether AR can improve English language learners' vocabulary and their motivation in learning. It is still not clear how AR can be integrated effectively into the curriculum and no research has been done on how to use AR to improve foreign language learners' speaking and listening abilities. This study adopts the design-based research method, describes the design, development and implementation of an AR component that utilizes the app Post Reality in a task-based unit to improve students' speaking and listening, and examines students' perceptions of utilizing AR in this way. Data were collected using survey and a focus group interview. The results show that students benefit from this learning experience in terms of their speaking and listening skills. The study includes suggestions of ways to make improvements in the use of AR in language learning.

摘要: 此个案研究旨在探索如何将增强现实技术应用到任务型主题单元教学之中以提高中文作为外语学习者的听说能力。虽然已有学者和一线教学人员将这一技术运用到语言教学中，但现有的少数几个实证研究都着重于如何用它帮助学习词汇和加强学习动机。如何将其有效地整合进总体课程设计中，以及如何利用它提高外语学习者的听说能力，目前仍未得到应有的研究。本文采用基于设计的研究方法（设计本位研究法），详细描述旨在提高中文学习者听说能力而将增强现实技术中的后现实应用程序（Post Reality）融入任务型主题单元教学的设计、开发与实施过程，并考察学生对此设计的认知。问卷及焦点小组访谈的结果表明，学生的听说能力均有所提高。学生也对如何更好地运用增强现实技术提出了建议。

Keywords: Augmented Reality, task-based thematic unit, Chinese language speaking, Chinese language listening, curriculum design, design-based research

关键词: 增强现实技术、任务型主题单元教学、中文口语、中文听力、总体课程设计、设计本位研究

1. Introduction

Augmented Reality (AR), "a real-time direct or indirect view of a physical real-world environment that has been enhanced and augmented by adding virtual computer-generated information to it" (Carmigniani & Furht, 2011, p.1), has shown its promise in assisting language teaching and learning (Ramya & Madhumathi, 2017; Zhang, 2018). There is an "obvious connection between AR and current theories of second language acquisition which emphasize localized, contextual learning and meaningful connections to the real world" (Godwin-Jones, 2016, p.9).

Task-based language teaching (TBLT) focuses on using authentic and interactive activities that engage learners to use the target language in meaningful ways (Ellis, 2017; Nunan, 1989; Prabhu, 1987; Skehan, 1998, 2003). The underlying concept of TBLT is that learning is more effective when students focus on the task rather than on the language they are learning (Littlewood, 2004; Prabhu, 1987). TBLT has been proven to be an effective method in the field of English language teaching (Chacón, 2012; Macías, 2004; McDonough & Chaikitmongkol, 2007; Park, 2012; Robinson, 2001) and in teaching Chinese as a Foreign Language (CFL) (Zhang, 2019a, 2019b). Integrating AR into activities based on TBLT should be a productive endeavor that can result in great learning effects.

Studies in the past several years that examined the use of AR in language teaching mostly focused on whether AR could be used to improve English language learners' vocabulary. Many research questions remain unanswered, including how AR could be seamlessly integrated into the curriculum to improve students' learning and motivation; how AR could be used in improving different aspects of learning, such as culture, grammar, speaking, and listening; how AR could be used for students of different age groups and language levels, and; how AR could be integrated with different instructional approaches such as TBLT to make the learning more effective. Furthermore, little research has been done on how to use AR in improving CFL learners' speaking and listening abilities (Zhang, 2018).

To fill in the gap and to explore the feasibility of integrating AR into an activity designed with an established learning method, the current study focuses on describing how an AR project was integrated with TBLT, including the design, development, and implementation of the project, and explores student perceptions. of the use of AR in their listening and speaking practice. The findings of the study will contribute to the field of language education by offering an approach combining AR and TBLT to improve listening and speaking, showing a possible design for such an approach, and outlining the strengths and weaknesses students perceive in the approach.

2. Augmented Reality in language learning

2.1 AR and its categories

AR was first studied by Morton Heilig (1926-1997), while the name was coined by Tom Caudell in the 1990s (Zhang, 2018). The distinguishing feature of AR is that some virtual elements, such as pictures, videos, or 3D animations, are overlaid on the naturally existing environment. This blend of real-world and virtual elements in real time helps create an augmented "real" environment. According to Azuma (1997), AR systems have three important features: A combination of real and virtual dimensions, interactions in real time, and the adoption of 3-D.

AR systems are categorized into two types (Cheng & Tsai, 2012; Wojciechowski & Cellary, 2013): Location-based systems and image/object-based systems. Location-based AR uses geographical location as a trigger of a mobile device's GPS sensor for a virtual overlay (Carmigniani et al., 2011), whereas image/object-based AR uses an image or an object to trigger the superimposed virtual elements through a smartphone or tablet camera. Due to the technical challenges of using the shape of a real object as a trigger, the majority of applications in this category are image-based.

The review study by Bacca, Baldiris, Fabregat, Graf, and Kinshuk (2014) found that the image is the most commonly used form of AR in educational settings. In a review of publications from 2003 to 2018, Zhang (2018) identified ten peer-reviewed empirical studies in which the use of AR was examined in language education. Out of the ten studies, half of the studies used location-based AR and half used image/object-based AR. Bacca et al. (2014) suggested that the image/object-based AR's tracking technology was more reliable than location-based tracking and therefore led to a better user experience. This study focuses on the use of image-based AR to provide learners with a virtual scene in a real environment.

2.2 Related works

AR developed rapidly and has gradually been adopted in many areas of modern life such as advertising, architectural design, entertainment, medicine, and the military (Gurusubramani, SureshAnand, JeganAmarnath, Sathishkumar, & Sheela, 2019; Ha & Hong, 2016; Markouzis & Ressakis, 2016; Yaoyuneyong, Foster, Johnson, & Johnson, 2016; Vaquero-Melchor, & Bernardos, 2019; Von Itzstein, Billinghurst, Smith, & Thomas, 2017). It has also been used in all levels of education (Turkan, Radkowski, Karabulut-Ilgu, Behzadan, & Chen, 2017; Wei, Weng, Liu, & Wang, 2015). It has been shown to increase learning by enhancing problem solving, supporting collaboration and interaction, helping students better understand abstract concepts, improving learning efficiency, motivating learners, and increasing learning enjoyment (Bacca et al., 2014; Huang, Chen, & Chou, 2016; Deshpande & Kim, 2018; Dan & Reiner, 2018; Teng, Chen, & Chen, 2018).

The application of AR in the field of language education is a relatively recent endeavor. Zhang (2018) found that "the number of published studies about AR in language learning has progressively increased year by year" (p. 121). Since Zhang's synthesis study

was published in 2018, the number of peer-reviewed empirical studies on the use AR in language learning has almost doubled. However, there are fewer than twenty in total in the past decade that focused on using AR in language learning. About half of these studies used location-based AR systems (Ho, Hsieh, Sun, & Chen, 2017; Holden & Sykes, 2011; Liu, Holden, & Zheng, 2016; Liu & Tsai, 2013, Perry, 2015; Reinder, Lakarnchua, & Pegrum, 2015; Richardson, 2016; Sydorenko, Hellermann, Thorne, & Howe, 2019; Wu, 2019; Yeh & Tseng, 2020). The other half of the studies used an image-based AR system (Chen, Wang, Zou, Lin, Xie, & Tsai, 2020; Dalim, Sunar, Dey, & Billinghurst, 2020; Hsu, 2017; Ibraham, Huynh, Downey, Höllerer, Huynh,, & O'Donovan, 2018; Redondo, Cózar-Gutiérrez, González-Calero, & Sánchz Ruiz, 2019; Safar, Al-Jafar, & Al-Yousefi, 2017; Solak & Cakir, 2015; Santos, Lübke, Taketomi, Yamamoto, Rodrigo, Sandor, & Kato, 2016; Taskiran, 2018). This section examines the studies using image-based AR systems.

Out of the nine studies that used image-based AR systems, six examined the effect of AR-enhanced systems on learners' vocabulary or alphabet learning; two examined learners' subjective experience, such as the motivational effect and social-affective relationships; and one examined the relationship between the use of captions in the AR materials and the proficiency level of learners. Out of the six studies that examined students' vocabulary, four focused on learning English as a foreign language (Dalim et al., 2020; Hsu, 2017; Safar et al., 2017; Solak & Cakir, 2015), one on learning German words and Filipino words (Santos et al., 2016), and the other on learning Basque words (Ibraham et al., 2018). Three out of the six studies worked with pre-school, kindergarten, or third graders, and the other three worked with undergraduate students or graduate students.

In most of these studies, multimedia materials based on different concepts and underlying theories in the design were integrated in the designed AR system. Santos et al. (2016) treated AR "as a type of multimedia that is situated in authentic environments" (p. 1), and they applied multimedia learning theory as a framework for developing the application. They created a handheld AR system, which displayed different combinations of multimedia elements such as sounds, images, animations, and text in real environments. The use of this system was found to improve adult learners' retention of Filipino words and German words, their attention, and their satisfaction. Hsu (2017), however, designed two AR systems based on the way learners approached the system: either through a self-directed or a linear approach, i.e. a sequential way in which students proceed to the next learning step only after completing the previous step. One of the findings was that the AR educational system based on a self-directed learning approach did not restrict the learning sequence and provided more support in learning.

Ibrahim et al. (2018), on the other hand, designed ARbis Pictus, a novel system for immersive language learning through the dynamic labeling of real-world objects in AR. Learning in this study occurred in a controlled learning environment while learners used Microsoft HoloLens with an AR head-mounted display. The application was set up in a room where all the objects were placed. The learner could walk around the room with the head-mounted display to locate the object, see the labels, and interact with the labels to get multimedia information about the object. Their results indicate that this system is both more effective and more enjoyable for the majority of participants than flashcards.

Dalim et al. (2020) explored whether using a combination of AR and speech recognition technologies, called TeachAR, could enhance preschoolers' learning of English terms for colors and shapes and English words for spatial relationships and their enjoyment of learning. Encouragingly, AR not only helped increase the children's knowledge and learning enjoyment but also enabled young children to finish certain tasks faster. Solak and Cakir (2015) examined the efficacy of using some materials designed with AR technology to improve EFL undergraduate learners' motivation level in English vocabulary learning. Their results suggested that these materials had a positive impact on increasing learners' motivation towards vocabulary learning in the language classroom.

Safar et al. (2017) examined two apps, AR Flashcards Animals-Alphabet and AR Alphabet Flashcards, which presented English alphabet initials of different pets. When the pets were clicked, a three-dimensional letter would appear accompanied by the sound and animated movements of each animal. The use of these apps significantly increased the amount of kindergartners' interactions with the English alphabet lesson, which had a strong linear relationship to their scores on the alphabet test.

Chen et al.'s study (2020) examined the effects of captions in an AR-enhanced, theme-based contextualized learning activity on junior high school students' English learning effectiveness, motivation, and attitude. Their findings suggested that captions did not affect knowledge comprehension, but English proficiency played a significant role in it. However, students demonstrated positive motivation toward learning from AR-enhanced, contextualized learning. Redondo et al. (2019) showed that the use of AR improved three- to six-year old children's English language learning, increased their motivation, and helped them establish more positive socio-affective relationships. Taskiran (2018) used a game-based approach to AR in teaching EFL and found that this method provided learners enjoyable and motivating experiences.

While a majority of these studies showed the importance of using AR in vocabulary learning and in motivating students to learn the language, none have focused on how AR was implemented in teaching or if the way it was integrated maximized the students' learning. Most importantly, there are no studies investigating the results of using AR for practicing learners' speaking and listening skills. In order to find an effective way to implement AR in daily teaching and to examine the feasibility of appropriately implementing AR for the purpose of improving learners' speaking and listening skills, an exploratory study was needed.

As AR could provide contextual visualization and learning interactivity (Ibáñez, Di Serio, Villarán, Delgado, & Kloos, 2014; Teng et al., 2018), AR could be used to enhance the already established TBLT method of teaching, where tasks are designed to focus on meaning, learners, and authenticity (Ellis, 2003). In TBLT, technology should be utilized to promote a focus on meaningful communication and make the tasks more practical so that students gain pragmatic skills for their future real communication in the target culture beyond the classroom (Chapelle, 2001; González-Lloret, 2016). In this case, AR could be used to make a task more interactive and contextualized. Therefore, this study was designed to show how AR could be combined with TBLT in a real teaching context and discover if this design could benefit learners' speaking and listening skills.

3. Research questions

This study aimed to answer the following two questions:

1) When AR is integrated in TBLT with a focus on improving learners' listening and speaking skills, what is the learners' perception of the design?
2) What are the strengths and weaknesses of the design in improving learners' listening and speaking skills? What should be done to improve the design for future use?

4. Methodology

This study adopted the design-based research (DBR) method due to the nature of the research questions. AR was used in assisting language learning mostly in an experimental context. It was not clear how it could be integrated in a real teaching context to help maximize students' learning. Since Brown (1992) called for a migration of the effective interventions from "our experimental classroom to average classrooms, operated by and for average students and teachers, supported by realistic technological and personal support" (p. 143), DBR has been used by and for educators "to increase the impact, transfer, and translation of education research into improved practice" (Anderson & Shattuck, 2012, p. 16). The key features of DBR includes being situated in a real educational context, focusing on the design and testing of the intervention, collaborating closely between researchers and practitioners, and developing design principles that could "guide, inform, and improve both practice and research in educational contexts" (p. 16). DBR stresses the importance of iterative refinement and the continuous evolution of the design (Wang & Hannafin, 2005).

4.1 Participants

Fourteen second-semester CFL learners, eight males and six females, participated in this study. The group included 13 undergraduate students and one graduate student with diverse learning backgrounds, including engineering, linguistics, global resources, computer science, and business. None of these participants had used AR technology before. Out of the 14 participants, 12 completed the survey.

4.2 The design of the AR-enhanced task

Research shows that connecting the curriculum with real life using proper support motivates students in learning (Burden & Kearney, 2016). On deciding how the curriculum should be connected with the real world, "controlled task interactions, particularly those requiring a single and convergent outcome such as information gap tasks" are preferred over "opened-ended, such as opinion exchanges or free conversation" because the former provides "an optimal linguistic environment" for language learning (Nakahama, Tyler, & van Lier, 2001, p. 380). Considering these findings, it was important to find an AR activity that incorporated real-world interactions that related to a current learning unit in a structured way. A scavenger hunt at the university bookstore, a location that is easy for

students to access and has a variety of items for them to explore, was determined to be an ideal location that would incorporate well into the shopping unit.

Post Reality is an AR app that allows the user to turn a simple poster or a portion of document into an augmented reality experience. The interface of Post Reality is intuitive and easy to access, and it provides good management options for users. It takes a few seconds to install the app on a smartphone or tablet. Once it is installed, the app uses the device camera to scan a marker on a poster or a document. The marker is loaded with different contents such as text, animation, images, charts, or videos. When the marker is scanned, the virtual contents pop up on the smartphone or the tablet, allowing students to express themselves in a variety of ways by integrating multimedia with paper-based posters.

To help learners develop a higher level of proficiency, the fourth type of tasks in Ellis' (2017) classification was adopted, that is, tasks that are both focused and output-based. A task is focused when it is designed to "elicit the processing of specific, pre-determined linguistic features;" a task is output-based when it requires "speaking and/or writing to achieve the outcome" (Ellis, p. 510). This type of task provides opportunities for the negotiation of meaning while using pre-determined linguistic features. To make the task more engaging and collaborative, a pair/group project would be better than an individual project. Working with classmates could: (1) motivate students; (2) help them to learn from each other; (3) allow the creation of materials in different formats such as a conversational style, and; (4) save time because each student could contribute to completing the project.

4.2.1 Pre-task activity

Before beginning the activity, students learn all the new vocabulary about shopping, clothes, colors, prices and the related sentence structures for shopping. They also practice using these words and structures in communicative activities in pairs or groups in the classroom. They next go to the bookstore and find two items (one must be a clothing item), noting the price, color, and size of each item as well as details such as when the item is used and by whom. To prepare them for using the technology, students download and install the Post Reality app on their phone or a borrowed one from the language center at the university. The instructor/researcher demonstrates how a device downloads and uses Post Reality to scan and watch videos.

4.2.2 Task 1: Make a video presenting two mysterious items

In pairs or groups, students present the two items they have identified in an interesting format that does not mention the name of the object but that allows others to guess what the two mystery items are through their presentation. Reinder, Lakarnchua, and Pegrum (2015) pointed out that "designing AR tasks may encourage more use of descriptive language" (p. 254). To encourage the students to use as many different kinds of language as possible, especially language used in the context of daily conversation, the students are encouraged to use a conversational style in the video. The students write a skit about the two mystery items using correct grammar and vocabulary. They are instructed to

find a native speaker to proofread the script and give feedback. Their final skit has to be approved by the instructor/researcher for accuracy in expression. Each pair/group uses the skit to create a 1-3-minute video.

The sound quality of the video is particularly important because people need to hear it clearly in a public environment. Students' conversations in the video should be: clear and loud; use correct grammar, tone, and pronunciation, and; be fluent. The videos are then connected to the markers on a poster posted at the university store. Figure 1 shows the posters in the university bookstore. Each poster has two markers numbered in Arabic numerals.

Figure 1 Posters with markers (highlighted in yellow squares and rectangles) on the pillars of the university bookstore

4.2.3 Task 2: Use AR and locate mysterious items in the bookstore

In pairs or groups, the students go to the store with their phones, find the posters, scan the markers, watch the videos, locate the mystery items, take a photo of the items, and send the photos to the instructor/researcher.

4.2.4 Post-task activity

The whole class goes over the items in the photos and finds out if the items class members located are the items the groups presented in each video. Figure 2 shows the flow of the task design.

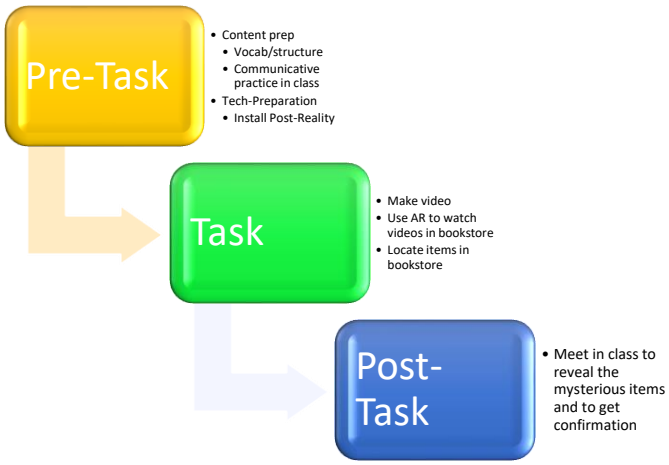

Figure 2 The flow of the task procedure

4.3 Procedures

This AR-enhanced task was the final component of the shopping unit. For other units (such as dining, transportation, and weather) students completed an in-class presentation.

The task lasted three weeks (week 6 to week 8 of the semester). Students had many opportunities to learn the unit vocabulary and structures in weeks 6 and 7 during the pre-task stage. At the beginning of week 7, students were given instructions for completing the task and a demonstration of how the AR app worked. They were asked to write their skit outside of class meetings. Students finished writing the skit in consultation with the instructor/researcher, got feedback from native speakers, revised the skit, and got approval from the instructor/researcher to shoot the video based on their finalized skit. The videos were then connected with the AR markers on the posters previously designed by a graphic designer. During week 8, the students found time outside of class to use AR in the bookstore to locate the items. At the beginning of week 9, the whole class spent 20 minutes looking over the items they located and confirming with their classmates that they found the correct items. See the figure 3 for the timeline of the project.

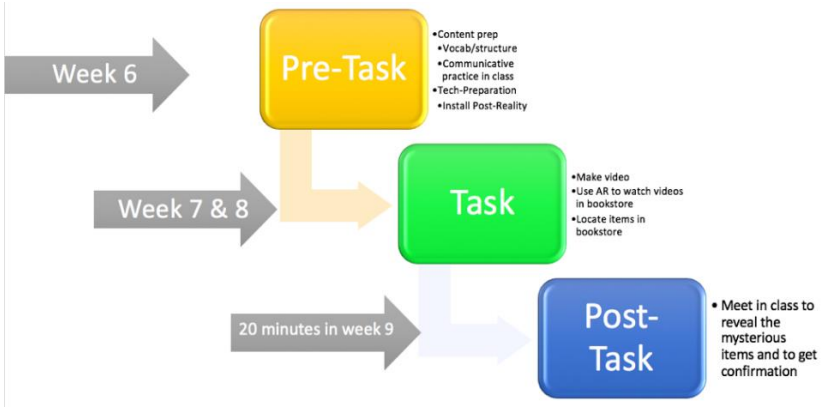

Figure 3 The timeline of each stage of the task

4.4 Data collection and data analysis

The researcher conducted a post-task survey and focus group interviews. The survey had five sections. The first section gathered demographic information. The second section asked multiple questions about the process of completing the project, such as the amount of time used (including the amount of time they spent on writing/revising/finalizing the skit, using AR and locating the items in the bookstore, and taking photos of the objects and sending the photos to instructor), challenges, and their enjoyment in the process of doing the project. The third section asked about the things that they liked or disliked about the project and why. The fourth section contained Likert scale items about what they learned from completing the project. The fifth section compared the project to the oral performance and in-class presentation, asking what advantages or disadvantages the AR project had for their learning styles.

An informal interview asking for students' opinions of the project efficacy and suggested improvements was conducted with a focus group. The data from the survey and the interview were read closely by the instructor/researcher to identify different themes (Corbin & Strauss, 1990). The different themes were compared and similar themes were grouped into a single category. A second researcher examined the data, and both researchers agreed on the themes and categories identified.

5. Findings and discussion

Results showed that during the Scavenger Hunt AR project, students spent about 4 hours in total to finish this project. They used about 31% of that time working on the skit, 25% of that time creating the video, 34% of that time watching their classmates' videos and locating items, and 10% of the time taking photos of the items they located and sending the photos to the instructor.

Six 2-minute long videos were created. Some groups used new vocabulary in order to make the video fun and coherent and contain enough specific information about the items. When there was new vocabulary, explanation of the new vocabulary was given in the video. These, along with their best pronunciation and tones, all had helped the other pairs/groups achieve a better understanding of the video content and therefore helped with their locating the items. As a result of careful preparation of the videos and careful attention when watching the videos, most groups located the right items described in each video. Figure 4 shows how the poster was used in the bookstore.

Figure 4 Using a phone to scan the marker on the poster to activate the video on the phone

To make the video engaging, some groups used props, professional microphones, and post-production sound editing. Group members underwent a process of negotiation to reach an agreement on how to present the information well and make it engaging while also making it hard to guess. Students used different creative means to describe the items in a detailed fashion without revealing the name of the items. For example, one group wrote a dialogue in which the customer pretended that he had forgotten how to say the name of the goods he intended to buy. Therefore, he had to describe the color, the usage, and the price of the object he wanted to buy to the clerk. In another video, a student asked for suggestions on what birthday present he could give to his best friend. The group members gave him two ideas without telling him what the name of the presents was, but instead carefully described the price, color, shape, and the uses of the items. In another video, the pair did a guessing game. They asked each other to guess what the object described was. During the guessing game, one asked what the color and price of the item were, what it was used for, when it was normally used, and so on. Figure 5 shows the photos some groups took after they successfully located the items.

Figure 5 Photos of items successfully located by one group

5.1 Students' perceptions

All students reported that they enjoyed doing the project, particularly the scavenger hunt. Students said that they "had never done anything like that for previous language classes." They thought that the most enjoyable part was to pick which items to describe and "the puzzle component of it" and seeing "what people found and how off or close they were." They also thought that the most fun part was to try "tricking people with difficult but locatable objects." While it being fun is one main reason that they enjoyed doing this project, there were other factors that played an important role.

First, students reported improved language skills through doing this project, with ten out of 12 students saying that this project was beneficial in improving their listening comprehension. One student said, "Listening to other people speak was the most beneficial part about the project since I got exposed to different accents and pronunciations, which helped my listening skill quite a bit." Another student expressed a similar view, "I'd have to say the listening was probably the most beneficial, because listening is the hardest part of learning a new language for me." They also reported that this project had helped her "understand how to ask questions and answer appropriately in Chinese." When asked whether doing this project had helped them improve their writing, speaking, and listening skills, they thought that all three skills improved through doing this project, with 2.6 out of 5 in writing, 3.33 out of 5 in speaking, and 3.67 out of 5 in listening. See figure 6.

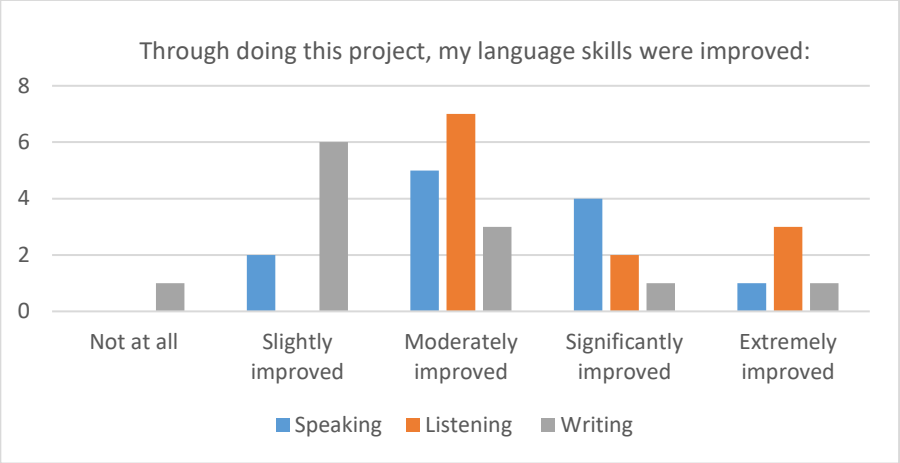

Figure 6 Students' self-reported improvement in different language skills

Second, this project gave students an opportunity to develop their social skills. A majority of students expressed that what they liked the best about this project was that they could work with a partner or in a group, "could see the creative parts of my friends," and could "hear and observe my peer's work." One student said that he liked this project because he could "make friends" and work together to "trick" other classmates and make it hard to guess the items. Most of them developed a great rapport with their groups because of the many interactive elements of the assignment.

Third, the project gave them an opportunity to build other skills, such as the technology skills when making a video and practical language skills when using their

shopping vocabulary to write the skits. In addition, the project connected class learning with the learners' real life. Some students really liked doing this project because it was an on-campus activity the required them to "go around campus" and "go to new places."

The fourth reason was the novelty effect. Four students liked the project because they got to "try something new," and "it was a nice change from the normal exam," and because of "the uniqueness in tech."

The last reason that students gave for enjoying this project was that it gave them an opportunity to create a video instead of doing the usual live, in-class presentation. Some students said that even though the video took longer than the in-class presentation, it put less pressure on them. They were able to rehearse, record, and delete until their video was satisfactory to them, which in turn, gave them the opportunity to practice more.

5.2 Challenges the students faced

Despite the fact that all students enjoyed doing this project, students did face a few challenges. One challenge was the amount of time that they had to spend creating the video and carefully watching each group's video. For instance, one student said, "[O]verall the augmented reality project was fun but probably took twice the time that the presentation did. Because of the time difference, I think I would rather do another oral presentation." Another challenge was posed by the limitation of the Post Reality app: its inability to rewind videos. Students "had to start videos all the way over if something was missed." Some students also expressed frustration with finding specific items because of their similarity in color, design, and price.

Despite the challenges they had in completing this project, when asked whether they would like to do similar activities in the future, a majority of the students said yes (see figure 7).

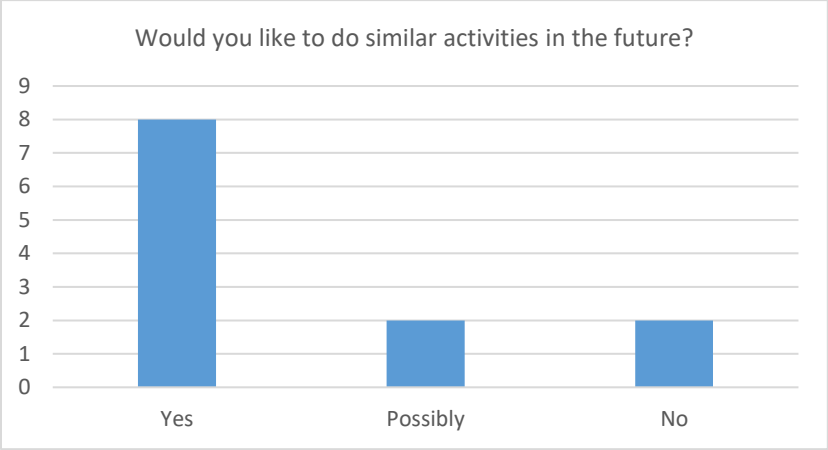

Figure 7 Students' intention to do similar activities in the future

Out of the nine students who said yes, three said that if they were to do the activity again, the app used should have a rewind function. The two students who expressed

reluctance to do a similar activity again also said that it consumed too much time, especially around the time of mid-terms. One student in the interview suggested that the teacher "maybe do not make points based on how well we find the items" because some movies were hard to understand.

These findings roughly correspond to students' answers to the question of whether they prefer this kind of activity to the oral presentations in class (see Figure 8). Nine people preferred this kind of activity and three preferred the oral presentation in class. While the major reason was that it was fun and that they could practice their listening and speaking skills more, another reason was that they were nervous about speaking in public: "Speaking in front of several people always makes me nervous, and when I feel nervous, I cannot show everything I prepared." On the other hand, the reasons that the oral presentation was preferred include: (1) they could "get experience talking in front of people"; (2) the in-class oral presentation made them feel "more pressure to not mess up" which motivated them to practice more; (3) they could get "immediate feedback," and; (4) it took less time.

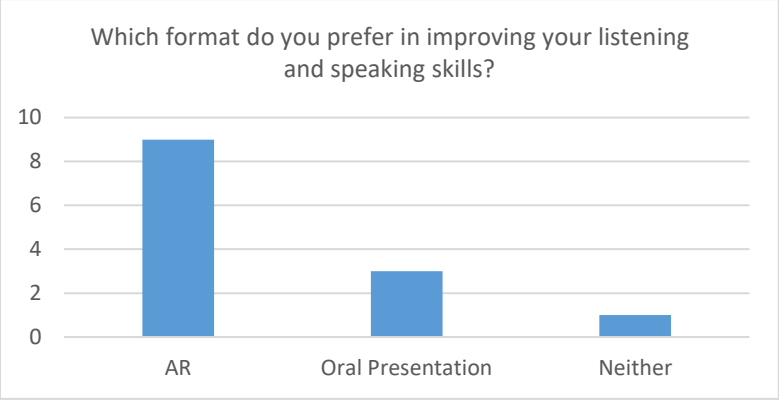

Figure 8 The preferred format of exercises for improving listening and speaking skills

5.3 Improvements needed

From the answers to the above-mentioned questions, the majority of students really enjoyed doing this AR activity, but it could be improved. First, the project could be scheduled to avoid midterm or final exam times. Additionally, students could be given more time to complete the project. Second, a better AR app should be implemented so that rewind functionality is available. With technology changing rapidly, some better-designed apps might become available. Third, each video created for the AR project should be reviewed more thoroughly by the teacher to be sure it is well made. This concern reiterates the need to give more time to the assignment and emphasizes how important a good learning community is to the learning of each and every person in the community. However, it is inevitable that some students will not have the capability to produce a video that all other learners can understand. To adjust for this difficulty, students should be allowed to select a few of the videos, perhaps 50%, to find the described items. This solution helps alleviate the first concern about the amount of time the project requires and reduces the consequences of lower-quality videos.

5.4 Design principles drawn

Based on the strengths and weaknesses of the design, some design principles can be drawn from this study. First, take advantage of the features of AR and apply them in real-life situations to give students more exposure to the target language and enable learning to move between formal and informal settings (Lai, 2017). Second, apply the AR features to make the pedagogical design more engaging and motivating and to enable interaction and collaborative learning (Chapelle, 2001; Warschauer, 1997). Third, choose the best AR tool free of charge that one can find to give students the maximum flexibility to meet their practical needs. Fourth, properly time the projects that require students to work collaboratively on authentic tasks to avoid the times when a majority of students are stressed during the semester. Finally, make sure that all the deliverables shared are error-free and of high quality so that students can maximize their learning from each other.

6. Conclusion

The AR-enhanced task-based learning project benefited the students' learning, especially their listening and speaking. It gave students an authentic purpose, which is, as researchers point out, one of the important features of TBLT tasks (Ellis, 2017; Nunan, 1989; Prabhu, 1987; Skehan, 2003). When they make the videos and complete the information-gap task, students use the target language to provide a close description of items and watch videos repeatedly. With an authentic purpose and their peer audience in mind, students sought various formats for their videos that would express what they wanted to convey. Because AR made the task authentic and engaging, students were motivated to finish the task. In the process, they improved their listening and speaking skills.

In addition, the AR technology used with TBLT not only offers convenience for students to connect classroom learning with real life, but also extends their learning beyond the classroom. AR used this way in completing a TBLT task in groups/pairs also enhances students' socialization while also being student-centered and communicative. Furthermore, they are required to ask a native speaker to proofread their skits before making them into a video. They also have to get confirmation from the other groups about whether the artifacts they found are the right ones or not. Sometimes they have to interact with the personnel in the store to make their scavenger hunt more effective. By collaborating with their partners and interacting with people outside of the classroom such as interacting with the shopping assistants in the bookstore and native speakers on campus, the students practiced their team-work skills and social skills. This way of using AR greatly increases students' opportunities to socialize with others both in the target language and in their native language.

This AR assignment also encourages student collaboration and creativity. These traits of the design satisfy the evaluative criteria set by Reinders and Pegrum (2017) for evaluating mobile language learning resources, which also apply to the use of AR. These criteria echo the calls for synergies between technology use and TBLT for the purpose of enhancing the quality of TBLT and promoting students' engagement in foreign language learning (González-Lloret & Ortega, 2014; Ziegler, 2016). In addition, being exposed to

the new technology (AR) and given the opportunity to use it in their learning enhanced their technological literacy. The way the AR was used in the project has also eased the anxiety and pressure some students would face in the other situations without using the AR, such as during in-class presentations. Even though the students spent relatively more time on the AR project than they would on an in-class presentation, they not only improved their language skills, but also enjoyed the whole learning process, were more motivated to learn, practiced their social skills, and improved their technological literacy.

This study used exploratory and design-based research methodologies to investigate whether an AR-enhanced task benefits learners' speaking and listening skills, discover students' perceptions of this task, and determine what can be improved in the design. The study shows one successful way of using the proven pedagogical method TBLT in a real, educational context to enhance learners' speaking and listening skills and give students greater convenience, enjoyment, and engagement in learning. The design described in this study along with the strengths and weaknesses of the design described in the results could shed some light on and provide some guidance for practice in similar contexts.

That said, this study also has limitations. For example, even though focus group interviews and post-surveys are the best methods to find answers to the research questions for this designed-based exploratory study, the students' self-reported views on their language skill improvements call for further confirmation which could be found in experimental studies in the future using pre- and post-assessments of their speaking and listening skills.

We have only begun to explore the learning affordances of AR and how to integrate AR in pedagogical approaches in real teaching context. Future studies could explore how AR can be used in other established pedagogical approaches such as project-based learning, theme-based language instruction, and other communicative-language instruction approaches. Researchers and practitioners could also collaborate with each other to find out the best way to integrate AR in improving other aspects of language learning, such as grammar learning, reading, and writing. It is also important to pay attention to the rapid development of AR technology and to new learning affordances AR technology might provide. New affordances could lead to more interesting studies.

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Evaluating the Impact of Virtual Exchange on a Chinese Language Class in Japan (Moodle 虚拟语言交流活动 在日本大学中文教学中的效果分析)

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Abstract: The present study examines the effectiveness of a Dual-Language Virtual Exchange (DLVE) on the development of students' intercultural sensitivity and Chinese language learning. The results revealed Moodle-enabled DLVE enhanced both the students' Chinese language learning motivation and their intercultural sensitivity, and students expressed a preference for the Moodle-enabled DLVE. This study is about the utilization of blended, traditional, and Moodle-enabled methodologies in teaching Chinese language in a Japanese university.

摘要：Moodle 是一个免费的开源课程管理系统。本研究旨在介绍日本一大学在汉语教学中对 Moodle 以及 Moodle 虚拟语言交流活动的应用，并分析了 Moodle 虚拟语言交流活动对学生们的汉语学习以及跨文化理解能力的影响。研究结果表明，大多数同学喜欢 Moodle 虚拟语言交流活动，而这种交流活动也提高了学生们的学习动机和对跨文化理解的敏感度，并促进了学习者对中国文化的理解。

Keywords: Chinese language, Moodle, virtual exchange, intercultural sensitivity

关键词：中文、Moodle、虚拟语言交流、跨文化理解的敏感度

1. Introduction

With increasing mobility of people on a global scale and the globalization of the world economy, the need to understand different cultures and worldviews is more important than ever. This has had a significant impact on education with the importance of intercultural understanding being emphasized in the Standards for Foreign Language Learning (MEXT Japan, 2012). In the field of foreign language teaching in Japan, how to foster students' intercultural skills is now a major focal point. To develop intercultural skills,

most tertiary education institutions have been relying on study abroad programs, but it is not easy to provide all students opportunities to go abroad. Fortunately, the advancement of technology tools and the internet have brought about new opportunities for foreign language learning and teaching. In the Chinese language course introduced in this study, an online Dual-Language Virtual Exchange (DLVE) program was embedded into the course to help students learn both Chinese language and culture through online communication with students in China. This DLVE program used Moodle discussion forums as the platform for that purpose. The present study aims to evaluate the impact of DLVE, particularly focusing on how this virtual exchange activity affects the development of students' intercultural sensitivity and its effects on Chinese language learning. This Chinese program is not a complete "distance-learning class," but more of a blended learning setup. We hope the experience of this class can contribute to future distance-learning classes and other learning environments.

2. Program description

2.1 The current Chinese program

The university where this study was carried out is located in the northern part of Japan. It is a regional university where students major in engineering. Over 600 first-year students are admitted to the university every year, most of whom are male. A second foreign language is a "compulsory elective" for the first-year students; they can choose from Chinese and German. There are around 300 students who choose the Chinese language as their second foreign language (their first foreign language is English). There are seven classes per academic year, with 40–50 students per class. Based on the desired outcomes of the university, the educational goal of the foreign language program is that through foreign language learning students will develop intercultural competence and a capacity for communication in foreign languages. In addition, the overall educational goal of the university is to develop students' independent/autonomous learning. Therefore, the Chinese language program aims to enhance students' language prolificacy and intercultural competence through student-centered independent/autonomous learning. In order to achieve the above objectives, as well as to promote teaching and instruction methods that minimize the adverse effects of growing class sizes and having limited resources, Moodle was used as a platform to make it easier to carry out flipped classes and mutual learning. In a flipped class, students learn new materials online outside the classroom (Moodle helps present the teaching materials prior to the class very easily); class time is then devoted to practice, reinforcement, and application. Online DLVE was embedded into the class as an assignment that students should complete for credit. This DLVE activity was expected to help students learn both Chinese language and culture.

2.2 Objectives of the Chinese language program

The Chinese language component of students' study is carried out over two semesters, with fifteen 90-minute weekly classes per semester. For first-year students, the Chinese language program is taught at the A1 level of the Common European Framework

of Reference for Language (CEFR, Council of Europe 2001). In the personal domain, students are expected to be able to talk about familiar topics using basic and simple expressions. For example, they should be able to introduce themselves, to talk about their hobbies and interests, university life, extracurricular activities, and so on. In the public domain, students are expected to be able to interact in a simple way, ask and answer simple questions about themselves, initiate and respond to simple statements in areas of immediate need, and deal with basic, routine situations in post offices, banks, train stations, and restaurants. For second-year students, the Chinese language program is an elective class. Students who want to continue learning Chinese language select the second-year Chinese class; their Chinese language level is around A1~A2. The present study was conducted with these second-year students.

2.3 Moodle and the Moodle-enabled International Virtual Exchange Project (IVEProject)

Moodle is a free and open source online learning management system (LMS). It is also the most used LMS in the world. Compared to other online providers that offer a single blog, wiki or open public forums and chats, Moodle combines multiple tools and activities for teaching and learning in one space (Warth-Sontheimer, 2008). It is widely used for blended learning, distance education, flipped classrooms, and other e-learning projects.[1] Students can access course details, class notes, a calendar, and other learning materials anytime and from anywhere. They can submit their classwork and assignments without actually going in person to the university. At our university, Moodle is used to make it easier to carry out flipped classrooms and mutual learning. The main functions of Moodle used for our Chinese language course are:

- Assignment submissions
- Discussion forums between Japanese students and Chinese students
- Video/audio files or links for the students to interact with
- Online quizzes
- Instant messaging for team member communication
- Announcement system which can be updated by the teacher

The Moodle Association of Japan was established by language teachers in 2008. The co-author of this article, Eric Hagley, was one of its founding members. For English language teaching, Moodle has become quite popular in Japan since 2008; however, over the 13 years since then, there have not been any research papers written on Moodle's use in the field of language teaching other than English.

We chose Moodle as the platform for the DLVE as it was already being used in the International Virtual Exchange Project (IVE Project). Eric Hagley is the lead of this project. According to the IVE project homepage, the exchange has students interacting asynchronously, with online communication taking place using the Moodle forums. The project is financially assisted by a Japanese government Kaken grant and also with the support of Hosei University. To date, 23 countries/regions have participated in different

[1] c.f. https://moodle.com/solutions/higher-education/

forms of VE, with participants from some 35 institutions throughout Japan. Participants post and reply using student-created text, audio, and video posts. They can also add links and other multimedia to their posts. DLVE is a type of VE where students from two different language backgrounds use their mother-tongue to assist the learner of that language in a mutually beneficial manner. Previously this has been called e-tandem. DLVE is one aspect of the International Virtual Exchange Project (IVE Project).

2.4 Moodle-enabled Virtual Exchange

Virtual exchange (VE) is a broad term for describing educational methods which engage students in online intercultural and/or collaboration projects. These programs are under the guidance of teachers or trained facilitators (O'Dowd & Lewis, 2016). In this research, an online DLVE program was embedded into our Chinese language course, and was expected to help students to learn both Chinese language and culture through communication with students in China. A variety of tools have been used to conduct VE. In recent years, VE projects conducted in the field of teaching EFL in Japan are increasing gradually. But most of them use platforms other than Moodle, and their scale is relatively small. There are a number of reasons for this: less access to suitable platforms, inter-operability issues between institutions, fewer interactions between faculty within and across different institutions, costs, lack of teacher training, and difficulty in assessing such interactions (Hagley & Harashima, 2017).

In this study, Moodle was chosen as the platform for three reasons. First, the VE activity presented in this article is asynchronous. Unlike synchronous activity, students were communicating with each other through writing in a discussion forum. Moodle-enabled VE gives students ample time to reflect with their partners, especially for students who have lower language proficiency. Kramsch (2014) makes the argument that although learners tend to improve their speaking skills through synchronous activities, the surface level of language used in these exchanges tends to preclude in-depth discussion. Therefore, for students who have lower language proficiency such as those in this research, asynchronous type activities are a good match. Ample time for preparing can avoid frustration in communication. It also helps students to engage in more in-depth discussions. Students who are not confident to carry out face-to-face or synchronous type communication could be happier using Moodle to do asynchronous VE activities. Second, students can receive support and advice from the teacher because this DLVE activity was a part of the Moodle-enabled blended learning class. Pedagogical interventions from teachers are needed to make our VE program more effective. Third, compared to other tools, a fairly large number of students can be enrolled in Moodle platforms, and a large scale VE can be conducted. Unlike other English-speaking countries, the number of students enrolled in Chinese language classes is very high in Japan, and there are many large Chinese classes with more than 40 or 50 students. Appropriate tools are needed for these large classes.

The Chinese students who took part in this DLVE activity were from a sister-school with the university where this research was carried out. The majority of those students were computer science majors who also take Japanese language classes. Around 200 second-

and third-year Chinese students and 150 Japanese freshmen students took part in this DLVE activity.

As mentioned in the previous section, textbook and audio files were uploaded to the Moodle course page where students were asked to learn the content of the textbook and prepare for the in-person class. In order to enhance the students' intercultural understanding, they were asked to do a presentation on the cultural topics (words) that appeared in the sentences of the text. They could choose any topics (words) they liked. For example, in one of the lessons, the dialog sentences were outlined in the following way:

你家在哪儿? (Where do you live?)

我家在上海。 (I live in Shanghai)

你有兄弟姐妹吗？ (Do you have any brothers/sisters?)

我没有。 (I don't)

我是独生女。 (I am an only child)

In this case, the students could choose "上海 (Shanghai)" or "独生女 (the only child)" as the keyword on which to do a presentation. If a student said they couldn't find a cultural topic, the teacher recommended some to them. When they prepared their presentation, they were asked to prepare it in groups of three. They also were asked to discuss this topic with their VE partners (the Chinese students), and report the results of what their Chinese partners said during their discussion.

When students conducted the DLVE with Chinese students, they were encouraged to use whatever Chinese they had learned rather than Japanese. The design of the DLVE followed a task sequence involving three phases: Information exchange; comparing cultural practices; and working on a collaborative product. At first the students were asked to do self-introductions with each other, then Japanese students were asked to discuss cultural matters related to their presentation with their Chinese peers. The students were not divided into groups; they were asked to attend the discussion of any topic they were interested in. Therefore, they had no fixed Chinese partner but just formed groups based on their favorite topics.

Teachers monitored the forums, intervened, or gave feedback to students when necessary. At the end of the exchange, students received academic credit for their work by making presentations about their collaboration with their Chinese partners.

The DLVE lasted 15 weeks, with about 450 topics created by both the Japanese and Chinese students. The topics included history, cuisine, architecture, traditional events, holidays, physical activities, education, travel, hometown, movies, songs, and animation.

3. Literature review and research questions

3.1 Intercultural competence

Monash University's Intercultural Lab (2020) states that "intercultural competence is the ability to function effectively across cultures, to think and act appropriately, and to communicate and work with people from different cultural backgrounds —at home or abroad." Such knowledge and ability are important to have nowadays as most people experience cultural exchange in their employment due to globalization and internationalization. According to the Nihon Keizai Shimbun (11th July, 2018), one in 10 young people in their 20s in Tokyo is a foreigner. In Japan, improving intercultural competence is also an urgent need in the field of education. Intercultural competence is not a naturally occurring phenomenon, and we must be intentional about addressing this at our institutions through curricular and co-curricular efforts (Byram, 1997). A great deal of research has taken place to study the learning of intercultural competence and its components. The origins of the concept can be traced to the 1970s (Hymes, 1972; Ruben, 1976; Hammer, Gudykunst, & Wiseman, 1978). Over the past 40 years, a large number of intercultural competence definitions and models have been developed. These authors include Kim (1991), Bennett (1993), Byram (1997), Chen and Starosta (1996; 1998; 1999; 2000) and Wiseman (2002).

According to Chen and Starosta (2000), the relationship between intercultural competence and intercultural sensitivity is as follows: intercultural competence is an umbrella concept which comprises the cognitive, affective, and behavioral ability of interactants in the process of intercultural communication. The cognitive aspect of intercultural competence is represented by the concept of intercultural awareness that refers to the understanding of cultural conventions. The understanding of cultural conventions will affect how we think and behave (Chen & Starosta, 1998). The affective aspect of intercultural competence is presented by the concept of intercultural sensitivity that refers to the subjects' active desire to motivate themselves to understand and accept culture differences (Chen & Starosta, 1998). And the behavioral aspect of intercultural competence is represented by the concept of intercultural adroitness that refers to the ability to get the job done and accomplish communication goals in real intercultural interactions (Chen & Starosta, 1996). This study used a questionnaire survey to study the development of the students' intercultural sensitivity—the affective aspect of intercultural competence. According to Chen and Starosta (2000), "individuals, who develop their intercultural sensitivity toward other cultures, can gain necessary knowledge, attitudes, and skills to communicate successfully in intercultural encounters. Therefore, cultural sensitivity is associated with greater potential for the development of intercultural competence." In other words, a person who is culturally sensitive has the capacity to recognize, acknowledge, and respect cultural differences. Hence, such an individual is considered culturally competent (Chen & Starosta, 1996). The importance of fostering students' intercultural sensitivity has been long emphasized in the field of foreign language education—the ability to overcome ethnocentric worldviews and to deal with cultural differences (Bennett, 1993). Another reason for choosing this intercultural sensitivity questionnaire survey was that it can easily be taken by a large number of students.

3.2 The effectiveness of VE

There is a growing body of research outlining the benefits of VE activities. With regard to the practice of VE (using tools other than Moodle), its effectiveness has been reported extensively in the field of foreign language teaching. For example, VE can promote foreign language pragmatic competence and grammatical competence, foster lexical capacity, and enhance oral communication skills (Abrams, 2003; Belz & Kinginger, 2003; Belz & Vyatkina, 2005; Cunningham, 2016; Kakegawa, 2009; Kim & Brown, 2014; Sykes, 2005). In the field of Chinese language education, a number of DLVE studies, most of which have made use of synchronous tools, have reported on the benefits of English and Chinese being used for VE (Chen, 2017; Zhang, 2016) to foster language development. Wang, Zou, and Xing (2011) used Wikis to improve the language skills of students in their DLVE and reported similar benefits. VE was also reported to contribute to the development of intercultural competence (Belz, 2003; Chun, 2011; Helm, 2009; O'Dowd & Ritter, 2006; Schenker, 2012). However, the vast majority of VE were among classrooms based in North America and Europe. VE has not yet been widely practiced in the field of Chinese language education (Luo & Ynag, 2018). Similarly, there have been a few studies reporting improvements in intercultural understanding due to DLVE between students in Western countries and China (Jin & Erben, 2007; Jiang, Wang, & Tschudi, 2014).

From the above review, we can see that existing literature has been largely dominated by America- and Europe-focused studies. None of these have looked at interactions between non-English learning environments nor non-Western contexts. There are few studies conducted in solely Asian contexts, let alone Moodle-enabled Chinese language teaching and VE between Chinese students and Japanese students. Ryder and Yamagata-Lynch (2014) reported that tensions arose among Chinese American partners, because of beliefs about learning language, preconceptions of the target culture, and lack of intercultural competence. Furthermore, unlike other tools used in the previous studies, the Moodle platform has special characteristics which have been presented in section 2.2. Therefore, there is a need to study VE that takes place in different contexts, which use a different tool. The lack of previous studies on evaluating a Moodle-enabled VE program for Chinese language classes is the motivation for the authors to conduct this research.

3.3 Research questions

This research builds on the understanding that blended learning has become an integral part of language learning (Gruba & Hinkelman, 2012). The basic framework for this study is educational program evaluation. According to Patton (1997), program evaluation is the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programming. The effectiveness of an educational program can be estimated by to what extent this program achieved its intended educational goals. There are various aspects of the DLVE that should be evaluated. But due to space limitations, this study will only focus on two aspects: to what extent did this DLVE achieve its intended educational goal and the level of satisfaction among participants. Since the educational goal of the Chinese class is to enhance the students'

Chinese language proficiency and intercultural competence in this study, we only focus on the intercultural sensitivity aspect, which is perceived as a foundational element with greater potential for the development of intercultural competence. Thus, there are three research questions in this article:

(1) Does the DLVE affect students' Chinese language learning? If so, how?
(2) Does the DLVE affect students' intercultural sensitivity? If so, how?
(3) How do students feel about the Moodle-enabled DLVE?

4. Research Methods

A mixed methods approach was used, including both quantitative and qualitative data. In the present study, quantitative data was used to measure the students' Chinese language test scores and intercultural sensitivity. Qualitative data was used to answer questions related to whether the Moodle-enabled DLVE had any impact.

4.1 Participants

The participants in this study were Japanese students who learn Chinese as a second foreign language in their second year at a Japanese university. A total of 38 students participated in this study, among whom 32 students were male and 6 students were female. All the students were majoring in engineering. The students' language proficiency in Chinese was roughly around A1~A2.

4.2 Instruments

4.2.1 Term end test

As the students participating in the DLVE had limited Chinese language skills and relied on Japanese for much of their DLVE communication, instead of analyzing the impact of the VE on their detailed Chinese vocabulary and grammar, we only analyzed the average score of their term end test.

This study was based on the data for the class of 2019. In 2018, a traditional face-to-face class (without using VE activity) was conducted. 37 students attended the 2018 class. We used the same teaching approach and had the same educational goals in both these two years. Both groups started in first year with zero Chinese proficiency and received the exact same amount of instruction: the same teacher and same textbook (from lesson 1 to lesson 16) in the first year. Therefore, the two groups had basically the same proficiency at the beginning. The same paper-based final test was given to both in 2018 and 2019. There was no way the students in 2019 could have attained copies of the 2018 exam. In order to reveal the impact on students' test performance, it would have been better to create a control group and do a comparative study between the control group and the experimental group. However, in our university, there is basically only one second-year class every year, so we could not create a control group. We chose to control the above

experimental conditions as much as possible and compare students' performance on tests between the 2018 and the 2019 class. An unpaired t-test was conducted to examine whether there was any difference in the test scores between these two classes.

4.2.2 Intercultural sensitivity questionnaire survey

The quantitative tool to measure intercultural sensitivity selected for this study was developed and validated by Chen and Starosta (2000). The 24-item questionnaire was used to measure aspects of intercultural sensitivity. This tool looks at one overarching construct of intercultural sensitivity and the five constructs that measure it. In the present study, the questionnaire was adapted by the authors in order to consider the effectiveness of DLVE interactions instead of face-to-face interactions. For example, we changed the original statement "I find it very hard to talk in front of people from different cultures" to "I find it very hard to communicate with people from different cultures." For every construct, there are a number of items used to test it. One example item from each of the constructs is shown as follows: (1) Interaction Engagement (seven items, "I am open-minded to people from different cultures"); (2) Respect for Cultural Differences (six items, " I don't like to be with people from different cultures (reverse coded)") ; (3) Interaction Confidence (five items, "I find it very hard to communicate with people from different cultures"); (4) Interaction Enjoyment (three items, "I often get discouraged when I am with people from different cultures"), and; (5) Interaction Attentiveness (three items, "I try to obtain as much information as I can when interacting with people from different cultures"). The scale ranged between 1 (totally disagree) and 5 (totally agree). The choices for responding to each statement is a 5-point Likert scale: totally disagree, disagree, not sure, agree, and totally agree. In order to test the construct validity of intercultural competencies, reliability was measured for the results of the pre-program survey using Cronbach's alpha. Cronbach's alpha was 0.71, which is in the acceptable range. The questionnaire survey was conducted both before and after the program. A paired t-test was used to analyze if there were significant changes in the development of intercultural sensibility between the pre- and post-program.

4.2.3 Students' satisfaction survey

At the end of the term, a post-program survey was used to elicit students satisfaction with and views on the overall Moodle-enabled DLVE program. In order to achieve a more comprehensive and perhaps nuanced understanding of the impact of DLVE, we collected qualitative research data from the students. Three open-ended questions asked for students' perceptions of their Chinese language proficiency and intercultural sensitivity development: (1) Do you think the Moodle-enabled DLVE influenced your Chinese language learning? If so, how? (2) Do you think the Moodle-enabled DLVE influenced the development of your intercultural sensitivity? If so, what facilitated this change? (3) Other. Students were asked to describe their experiences with the Moodle-enabled DLVE and explain the most valuable, interesting, and difficult experience in their learning process.

These qualitative data allowed us to get a comprehensive data capture and to answer questions which may not be susceptible to investigation through simple pre- and post-test

methods. Qualitative content analysis was used to analyze the qualitative data.

5. Results

5.1 Influence on Chinese language learning

Two surveys were conducted to verify how the Moodle-enabled DLVE influenced students' Chinese language learning. One was a comparison of term-end test scores between the 2018 and 2019 cohorts. The other was an open-ended questionnaire survey (the first question of the students' satisfaction survey), which was conducted only at the end of the term. The students were asked to write how the Moodle-enabled DLVE influenced their Chinese language learning. The results of the comparison of the test scores is reported below, and the results of the open-ended questionnaire survey is reported in section 5.3. Table 1 shows the mean and standard deviation for the term-end test scores for 2018 and 2019 cohorts. The mean score for 2019 was higher than 2018. Results of the unpaired t-test indicated that the term end test scores of 2019 were significantly higher than the scores of the 2018 cohort ($t(73) = 4.19$, $p < .01$, $r = .44$).

Table 1 Comparison of term end test scores for the 2018 and 2019 cohorts

	2018 (N=37) Mean SD	2019 (N=38) Mean SD	t	p
Term-end test score	74.16 10.15	83.47 9.7	4.19*	.00

Note: *p<.01

Needless to say, there are a lot of factors which could have affected students' test scores from these two-academic years, so it may be hard to say that the Moodle-enabled DLVE was the only factor that influenced the scores of the term-end tests. However, given the fact that, at the very least, course content, educational goals, and test content were the same, and all the students started to learn Chinese with zero Chinese proficiency and received the exact same instructional treatment (the same teacher and the same textbook in the first year), it can be argued that DLVE had a positive impact on students' Chinese language learning. A detailed discussion about how it was affected will be given in Section 6 in conjunction with the qualitative study.

5.2 Changes in students' intercultural sensitivity

In order to clarify changes in the students' intercultural sensitivity before and after the program, two questionnaire surveys were conducted: One was an intercultural sensitivity questionnaire survey, which was conducted before and after the program; the other was an open-ended question (the second open-ended question of the student satisfaction survey), which was only conducted after the program. As indicated in Table 2 below, the results of the paired t-tests revealed that the mean values (n=38) of both the total intercultural sensitivity score and the five sub categories' scores in the post-survey were higher than those in the pre-survey. The values of standard deviation in the pre-survey were

consistent, however, for the values in the post-survey; the "interaction engagement" and "interaction attentiveness" items showed greater standard deviation values. This means the students' perceptions on the development of these two categories was not consistent and opinions spread over a wider range. Nevertheless, there was still a significant increase in the five sub categories of intercultural sensitivity (t (190) =8.02, P<.01, r=0.5).

Table 2 Pre- and post- intercultural sensitivity scores

	Mean (Pre-)	SD	Mean (Post)	SD	t
Interaction Engagement	2.32	0.51	2.81	0.75	6.86*
Respect for Differences	2.57	0.5	3	0.62	6.27*
Interaction Confidence	2.58	0.5	2.99	0.64	6.50*
Interaction Enjoyment	2.47	0.5	3.08	0.68	6.49*
Interaction Attentiveness	2.68	0.47	3.19	0.67	7.34*
Total	2.52	0.5	2.99	0.64	8.02*

Note: N=38, *P <.01

5.3 Results from the student satisfaction survey

When the students were asked how the Moodle-enabled DLVE influenced their Chinese language learning and the development of intercultural sensitivity, they gave specific comments. Responses to the open-ended questions were categorized using content analysis. Overall, the comments were mostly positive, with a few neutral opinions. There were almost no negative opinions. Therefore, the comments were roughly divided into four groups: (1) comments showing a positive influence on Chinese language learning; (2) neutral comments on the influence on Chinese language learning; (3) comments showing a positive influence on intercultural sensitivity, and; (4) other. The results were reported with examples of comments from the students. A summary of the comments of the open-ended questions is shown in Table 3.

Table 3 Summary of the open-ended questions

	Number of students(N=38)	Percentage
Positive comments on the effects on Chinese learning	12	42%
Neutral comments on the influence on Chinese learning	22	57%
Positive comments on the effects of understanding other (Chinese) cultures.	37	97%
Other	2	5%

For the results of the open-ended question "how did the Moodle-enabled DLVE influence your Chinese language learning," 42% of the students wrote positive comments; 57% of students wrote neutral comments. Most of the positive comments were that students like the Moodle-enabled DLVE, and they thought Moodle was convenient for language learning. In terms of the impact of DLVE on Chinese language learning, apart from the answers we expected, the students did not say that the DLVE activity improved their Chinese language proficiency directly. On the contrary, they said "because I used Japanese almost exclusively during the discussion, it may not have a direct impact on my Chinese language proficiency." For the language used in the DLVE, a lot of students mentioned their difficulties with Chinese language usage. Some students even became very pessimistic, saying "The Chinese students' Japanese is really very good, I must say I cannot write the same level of Chinese messages as they wrote in Japanese"; "I have studied Chinese for more than one year, so I felt very sad that I couldn't say(write) Chinese. At first, I tried my best to use Chinese with my Chinese partner, but the discussion became complicated little by little, and in the end, we had to use Japanese to communicate with each other, so I had no choice but to use Japanese again." However, along with the above pessimistic statements, there were also statements that showed a positive influence on Chinese language learning. Some students said: "the online virtual exchange activity made me feel that I wanted to learn more Chinese"; "I really hope I can discuss these topics with the Chinese students in Chinese someday"; "Seeing the Chinese students working so hard to learn Japanese made me want to do the same." It seems that the experience of language exchange enhanced the students' motivation to do more and do better in Chinese language learning. Some students even said: "We have been exchanging messages by writing so far, but it would be nice if we could meet the Chinese students and exchange opinions face-to-face in the future."

Regarding how the Moodle-enabled Chinese language teaching influenced the development of intercultural sensitivity, in contrast with the influences on Chinese language learning, the students were clear in expressing their positive opinions. Overall, students reacted very favorably to the DLVE activity using Moodle. Thirty seven (or 97%) students wrote positive comments on its effectiveness for the development of their intercultural sensitivity. Most students agreed that using online DLVE was an effective way to develop their intercultural competence.

> "I used the virtual exchange activity for preparing my presentation, I think it was good for me because I rarely had a chance to talk with non-Japanese people so far. In addition, I was able to understand various things about Chinese culture by asking questions, and I was able to get real information that is not written in books or the Internet."

> "I thought it was important to understand and accept the common sense of China, the common sense that we take for granted in Japan now may be completely insane in a foreign country. In this way, if you pay attention to the differences between other cultures and your own, you will be able to understand different cultures in a positive way."

> "Before coming into communicate (sic) with the Chinese students, I had heard that the Chinese are anti-Japanese. I was scared. In fact, when I came into communicate (sic) with them, I found them to be nice people."

Some students commented that: "The language exchange with Chinese people was great, but I was also surprised to see there were so many different opinions expressed during the discussion with my Japanese classmates, and I was able to confirm that so many different cultures existed even among the same Japanese students." One of these students even argued that: "I found that Japanese culture is not the same for everyone. I started to think about what Japanese culture is, I can understand my own culture better now."

Two students wrote comments on "other." These two students perceived that Moodle-enabled DLVE had improved their digital competence. One student said she was not good at operating computers at first, and she felt it was very troublesome at the very beginning. However, she started to use Google Docs when she prepared a presentation with her Japanese team members. They learned to jointly create texts in their teams. She also learned how to upload files to the Moodle discussion forum and commented: "I have never used these things before I attended this Moodle-enabled DLVE."

6. Discussion

The aim of this research is to determine the effectiveness of learning Chinese language and culture through Moodle-enabled VE. A mixed methods approach was adopted, using quantitative data to measure the impact on students' Chinese language learning and intercultural sensitivity, and qualitative data to answer questions related to why Moodle-enabled DLVE had such impacts. The results revealed that DLVE projects improved students' attitudes toward understanding, appreciating Chinese culture and language, and increased their desire to continue learning Chinese. Furthermore, students became more aware of their own culture and had opportunities to see it from an external perspective.

Our quantitative data show that the average test score of students in the class with Moodle DLVE was significantly higher than those in the class without Moodle DLVE. If we only considered this result, it would seem that the achievements of the class without Moodle DLVE were surpassed by students in the class with Moodle-enabled DLVE. However, from the qualitative data we found that students gave comments to the effect that the DLVE activity enhanced their motivation to learn more and improve their Chinese, which could be a potential factor that led to better test scores. The current research is a pilot study and did not examine the cause and effect relationship between test scores and factors that contribute to test score improvements. In this current study, we could not create a control group to do a comparison with the experiment group because we only had one second-year class in our university. As computer mediated VE language learning will continue to play an important role in Chinese language teaching and learning, there is a need for further investigation on its effectiveness. In future studies, a control group plus performance tests (speaking/writing test) should be carried out. Both the test scores and the characteristics of the speech/writing should be analyzed.

Regarding the development of intercultural sensitivity, from the results of the quantitative analysis, we can see that both the total intercultural sensitivity score and the five sub-categories' scores in the post-survey were significantly higher than those of the pre-survey. This result revealed that over the 15 weeks of the Moodle-enabled DLVE, the students enhanced their intercultural sensitivity significantly. This result confirms most of the previous DLVE studies in which English and other languages were used. The university is located in the countryside and for many of the students, this DLVE offered a first-time opportunity for the students to communicate with target language speakers. Therefore, the achievements of DLVE may have been more pronounced. For the results of qualitative analysis, most students said they were satisfied with the DLVE with the Chinese students. This experience expanded their cultural perspective and enhanced their intercultural sensitivity to other cultures.

During the process of the DLVE activities, students discovered information about both China and their own country-Japan. Hagley (2020) states that through a VE both groups of students showed gains in the knowledge of their own culture. Understanding one's own culture is a first important step for students to become open to and understand other cultures. Unlike the previous study (Ryder & Yamagata-Lynch, 2014), there were no reports of strained relationships with Chinese students, which may be due to the fact that they are both Asian and the cultures are more similar to each other, or because of the ease of use of the platform being used.

Last but not least, students perceived that Moodle-enabled DLVE had improved their digital competencies since Moodle provides a safe environment to experience challenges with regard to technology use.

7. Conclusion

While feedback from students alone may not be the best way to conclude if a program or teaching method is successful, knowing the students' perceptions can help instructors to consider how to improve their program. The reported positive perceptions with the improvement in Chinese learning motivation and development of intercultural sensitivity shown here suggest that the use of DLVE in Chinese language learning is beneficial. Chinese is increasingly being taught in countries where English is not the medium of instruction. Therefore, studies such as this one, where Chinese and Japanese are used, are an important addition to studies in which English and Chinese were the languages used in research. This study also adds to the body of research being developed on the use of LMS in language education.

As cultural knowledge should be experienced to be truly appreciated (Byram, 1997), DLVE, as discussed in this paper, can assist teachers in ensuring students experience real interactions with students from other cultures. This research shows that foreign language learners are eager to have chances to experience another culture in a real communicative context. Therefore, teachers need to bring real examples of the target

culture and language into the classrooms. Moodle-enabled DLVE activities can provide such opportunities to them.

It is hoped that the results of this study will be useful to institutions trying to integrate technology into their educational programs. Technology-assisted teaching methods can help not only minimize the adverse effects of growing class sizes and limited resources, but also deal with any unexpected situations — as was the case with the Covid-19 pandemic that broke out in 2020.

It is also hoped that this article can help Chinese language educators to add knowledge about how to build students' intercultural sensitivity by incorporating online VE activities. Unlike study abroad programs, Moodle-enabled VE is low cost and easy to conduct. Although it may not provide the same experience as in-person study abroad programs, it is more accessible for those students who don't have the chance to physically go abroad. For those who are interested in participating in such a project, the IVE Project platform may be appropriate.

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虛擬實境科技運用於語言學習的理論背景與華語教學範例 (The Theoretical Foundation of Virtual Reality Assisted Language Learning and Its application in TCSL)

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摘要：在現代，虛擬實境的技術其實已開始運用在各個領域。在華語教學中，學習者如果能在真實的語境中進行學習應當是最理想的學習狀態，但這樣的學習環境在真實世界裡往往需要克服多重阻礙才能偶一為之。反觀虛擬實境技術能打破教室的圍牆，帶學生體驗不同的場景與文化語境，虛擬實境科技可以讓教學實現新的可能性。本論文首先將分析虛擬實境輔助學習的相關理論，並嘗試提出一個虛擬實境輔助語言學習的理論架構，文中也介紹一個將虛擬實境科技運用在華語教學的範例，透過使用者經驗的訪談中瞭解虛擬實境輔助語言教學的學習本質，受試者對於此種虛擬實境的學習方法感到高度興趣且給予正面的評價。最後我們歸納出此種學習方式的優缺點，並對教學應用及未來研究方面提出具體的建議。

Abstract: In recent years, virtual reality (VR) technology has been applied in many fields. In Chinese language teaching, learners can learn contextualized language and then generate better learning results when learning in real contexts. In this respect, virtual reality technology is of great value because it can help learners to go beyond the boundary of classroom limitations and experience different scenes and cultural contexts virtually. This paper first reviews relevant theories underpinning VR-assisted learning, and outlines a theoretical framework for VR-assisted language learning. It then shares a qualitative study about using VR in Chinese language learning. Preliminary results suggest that learners are highly motivated to use VR to learn Chinese. Finally, suggestions for teaching practice are provided.

關鍵詞: 虛擬實境，多模態學習，俱身學習，華語教學，全景影像

Keywords: Multimodal learning, embodied learning, virtual reality, TCSL, panoramic image VR

1. 前言

據研究指出，全球教育用的虛擬實境產值將由 2018 年的 6.6 億美元，增加到 2026 年的近 131 億美元 (Fortune business insights, 2019)，更有學者認為虛擬實境是 21 世紀最具代表性的教學輔助工具，因為 VR 可以幫助記憶、產生同理心，進而增進對特定的情境、人與事件的理解，這是其他工具所無法達成的，並且已經被應用在解剖學、自然災害、歷史、海洋生物學、數學、世界地理等領域的教學之中 (Rogers, 2019)，未來的蓬勃發展相信是指日可待。我們認為將虛擬實境運用在語言教學中並不是為了趕流行而做，其實虛擬實境可以為教學帶來許多益處，例如讓學生與虛擬人物對話以克服跟真人說外語焦慮；讓學生在擬真的文化情境中練習使用外語。我們更可以打破教室的圍牆，用虛擬實境帶學生到國外或許多現實生活的場景中進行學習，特別在這個肺炎疫情限制了眾人行動的時代，虛擬實境科技可以讓教學實現新的可能性。本論文首先將分析虛擬實境輔助學習的相關理論，並提出一個虛擬實境輔助語言學習的理論架構，最後介紹一個將虛擬實境科技運用在華語教學的範例，從中探討此一應用的優缺點，並對實務應用方面提出具體的教學建議。

2. 虛擬實境的學習理論

此一小節將探討運用虛擬實境技術於教學中的學習理論，包括多模態學習與俱身學習理論，並介紹虛擬實境輔助語言教學的應用趨勢。

2.1 多模態學習 (Multimodal teaching and learning)

多模態理論 (multimodality) 隸屬於社會符號學 (social semiotics) 的範疇，它緣起自倫敦大學學院的符號學家 Gunther Kress 教授延伸 Michael Halliday 的功能性語言學所發展出來的符號學與方法學的論述。符號，就像語言一樣，是一種義意的承載體。語言其實也是一種符號，但社會符號學家研究是語言以外的其他符號。下面的論述主要來自於 Kress 等人運用多模態理論對教與學所做的詮釋與研究 (Kress, Jewitt, Ogborn, & Tsatsarelis, 2001)。

在字面上多模態 (multimodal) 與多媒體 (multimedia) 的概念看似雷同但其實不然，因為 mode 並不等同於 medium。關於這兩者之間的區別，Kress 認為，媒體 (medium 或複數形的 media)是傳遞訊息的媒介，它具有物理性的存在，也可說是「將意義製造成訊息的形式並傳播的科技」(Jewitt & Kress, 2003) 。 在多媒體的概念中，媒體可包含文字、圖像、視訊、音訊、動畫等不同形式的媒介。而模態 (mode)是一種產生意義與傳遞意義的資源，亦可以看成是一種意義產生系統。一種媒體可能具有多種模態。以音訊或聲音為例，它可以具備有語音、音效和音樂等不同模態。每一種模態都有它在意義呈現和溝通上的可能性與限制。

模態有許多不同的種類，例如言談、圖像、手勢、動作、文字等。每一種模態都能各自產生意義，而在同時間，它們又組合成意義的整合體。每一種模態的意義

再現能力 (representing) 有不同的可能性與限制，一個符號的製造者(例如老師或是學生)必須知道身邊有哪些可用的模態以及它們在呈現意義上的可能性與限制。Kress 把教學視為是一種運用模態的修辭學 (rhetoric)，教學的工作就是找出與運用不同的模態，結合出一個最有效的意義再現組合體。例如在教學的歷程中，教師要時時考量現在所教的內容以什麼樣的模態組合最適合呈現，比如用口說的、圖像的，還是其他的模態 。而學習也是一種模態的修辭學。作為一個符號的製造者，學生在學習的歷程中也是在運用它們所知的各種模態符號再現出學科的知識或是概念。而這些再現 (representations) 包括外顯的(例如文字、口說、圖畫或是模型)，以及內在的——將外面的世界(或閱讀的文本)內化成自身的知識(這點或許可用心理學的基模 (schema) 概念勉強說明，雖然 Kress 並未使用這個名詞)。

多模態的學習觀點認為，學生從老師身上"習得"知識的這個概念把學生在學習上的角色邊緣化了；而老師"輔助"學生"發現"了知識的這種說法則是把老師的角色邊緣化了。學習是一種轉換式符號生成的動態歷程，而在這歷程中包含了教師與學生的涉入。亦即，在師生互動的教學歷程中，不論是老師或是學生都不斷地運用不同的模態製造符號，意義因此而被形成、流動、交換與再塑造，而這些符號與意義的轉換就成了學習的"證據" (evidence)。此外，不同的模態有不同的物質性 (materiality)，因此也牽涉到不同感官的運用。從一種模態符號所接收到的訊息可以透過不同的感官再現成另一種模態。例如從圖像所接收到的意義可以用口說的方式再現；從口說語言所感知到的意義也可以用圖像的方式再現。

教學是一種意義的傳遞，意義的傳遞不只是靠語言，而傳統的教學過度依賴語言。人們對於一些模態的理解程度不一，因為有人不懂這些模態的文法 (grammar)。例如老一輩的人可能看不懂漫畫，因為他們不懂得漫畫的圖文配置與圖像表現的規則或稱"文法"。多模態的學習研究告訴我們，傳統的教學過於倚賴語言模態，有些模態可能比語言更適合傳達意義但卻未被運用。每個學生對於不同模態的感知與運用程度不同，模態提供了看世界不同的角度，因此多模態的教與學可以為不同的學生帶來更多學習的可能性。這個觀點可以呼應心理學上關於認知型態的論述。例如有些學生擅長透過文字來理解，有些人較適合透過口說講解，有些人對圖像較有感，而有些人則需要透過操作來學習才能達到最佳的學習效果。

以實際應用面來看，Kroll 在她的教學語法課中嘗試進行了多模態教學，她在她的教學中加入了豐富的音調、臉部表情、手勢以及幽默。她認為這些多模態的策略運用可以降低學生的情感過濾，讓學生感覺被接受，吸引學生的注意力，也可以變成學生課後複習時的記憶來源。用鏡像神經元的理論來解釋，因為多模態的學習必需運用到不同的感覺接受器，激發了學生腦中的不同部位，因此加深了學習的記憶 (Kroll, 2013)。

2.2 俱身學習 (Embodied learning)

俱身學習的簡單定義是將身體作為一種學習的工具。傳統的學習過度強調大腦的運作，而俱身學習認為身體也應該包含在學習的活動裡。俱身學習被視為是一種

建構主義，學習者可以利用身體來建構知識與意義。在此理論裡，所謂的「身體」可以包括軀體、感覺、心智與大腦，也可以說是一種全人的概念，包括感覺動作系統與身體動作都可包含在學習的歷程裡。這一領域的研究有很多是以劇場、舞蹈、手勢來進行不同學科的教與學活動 (Leventhal, 2013)。

俱身學習探討的是身體、智性與情緒之間的關係。在我們一般的學校教育中，大腦常常被過度強調，並且優於身體。身體的智能常常被忽視，甚至不認為身體是有智性的，因此與學習並不相涉。運用身體與感官來學習可能只停留在學前教育，之後的學習階段如果再用這類的教學法可能會被視為幼稚而不恰當。但道理是否真的是如此？研究俱身學習的學者們可能無法同意，因為他們已經證明俱身學習可以應用在許多學科，而且是不同年齡階段的學習者身上 (Dixon & Senior, 2011; Xu, Kang, & Yan, 2021)。

一些學者用多模態識讀 (multimodal literacy) 的觀點來看待身體，他們認為身體也是一種多模態的材料與場域用來組織與產生教學意義。身體也像書本、圖片或多媒體文本一樣，具有「頁面」或「螢幕」可以被用來書寫與閱讀意義。在俱身學習的情境中，教師與學生不斷的用身體將資訊編碼、解碼、理解、轉型、紀錄與重新規劃 (Katz, 2013)。對這些學者來說，學習與教學不只是智性的，它同時也是身體的、情緒的、心理的與社會性的活動。相較於其他研究可能著眼於文字與圖像，俱身學習的研究者聚焦於研究感官與身體的活動在教與學中所扮演的角色，或者說，他們關心的是在社會與文化脈絡裡，意義產出歷程中的身體面向 (Katz, 2013) 。

一些人類學與神經心理學的研究證實，情緒與推理兩者間具有不可分割性。人類若缺乏情緒與感覺的輔助就無法進行同理 (empathy)、推理 (reason) 或思考 (Katz, 2013)。或許在我們的教育制度與教學中應該要設法讓學生在情緒與感覺上更加投入，不應該只重視學生的智性與大腦，同時應關照到他們的身體、感覺與情緒，將他們視為一個完整的全人來進行教學與教育。手勢與姿態在俱身學習中佔有一個重要的位子。Katz (2013)引用了一些研究說明手勢或姿態 (gesture) 在溝通行為中的重要性。它甚至可以引導學習與認知上的改變。更有研究證明教學者運用手勢的輔助可以增學生對數學課的理解。

傳統的教學步驟常常是讓學生先觀察再模仿，但是鏡像神經元 (mirror neuron) 的研究告訴我們，學習的發生其實在於結合視覺-動作神經感覺，它出現在概念形成、語言調節與模仿之前。神經學上的學習研究，特別是有關鏡像神經元的理論，有助於解釋多模態學習或俱身學習對學生的助益(Kroll, 2013)。簡言之，有人把教學簡化成好記的三個步驟：Tell me, Show me, Let me (do) (Buteyn, 2018)。然而鏡像神經元的研究挑戰了這樣的做法，因為動手做的步驟應該在教學的一開始就可以加入。這裡所謂的融入可能是認知上的、情感上的融入，然而俱身學習的概念更加強調身體上的融入，而且是在教學的一開始就應該這麼做 (Lindgren & Johnson-Glenberg, 2013)。

Kroll 在他的教學文法課中讓學生使用不同的色筆與形狀標記不同的子句與詞性，這樣簡單的示範與操作讓學生對本來覺得困難與無聊的文法課變得有趣，甚至在課後的作業中他們更發展出自己的顏色和形狀標記方法。由此學生們不只學到了一種學習策略，更提升了他們的學習動機、自信與對自己作業的驕傲。在課後的回饋中學生也反應這樣的動手作方式讓他們覺得有趣，也讓他們學會了視覺化的學習方式。簡言之，多模態與俱身學習的方式讓學習變得更容易、更有趣，也讓學習持續得更持久 (Kroll, 2013)。在華語教學中，利用身體來輔助學習對老師來說並不是新鮮事，例如我們教學生運用手勢來輔助四聲的發音，此外利用全身肢體反應法(Total physical response，TPR)來學習華語也有不少研究(陳華安、陳添來，2019。陳雅齡、陳志嫕，2008)。值得一提的是，上述這些俱身學習法採用的多是刻意去使用身體來幫助學習，而我們認為在虛擬實境科技的輔助下，俱身學習擁有不一樣的特質，因為學習者是自發性的在學習中運用身體。

綜合而論，多模態學習是從社會符號學的層面探討在學習的歷程中，意義如何透過不同的模態來呈現、傳遞與理解，而俱身學習則是從物質的層面探討身體如何被運用來促進學習的效果，學理的基礎則是俱身認知心理學 (embodied cognition)。兩套理論是以不同的層面來研究學習的本質，因為身體也是許多模態表達的載體，因此這兩套理論之間有密不可分的關係。我們認為，多模態理論可被用來分析虛擬實境教材裡的多模態對話情境，而俱身學習理論則可用來檢測在虛擬實境的學習情境下，學習者如何運用身體來融入學習。

3. 虛擬實境輔助語言學習的發展趨勢

3.1 虛擬實境輔助語言學習的相關研究

虛擬實境 (virtual reality, 簡稱 VR)科技結合了電腦圖像技術、電子科技與資訊科技，是一種硬體與軟體系統的結合，用於產生出一種擬真的世界。VR 的三大特徵為：沉浸、互動和視覺真實感。沉浸指的是體驗者必須戴上頭戴式的顯示裝置，由於使用者看到的是 360 度的立體環繞式影像，頭戴裝置類似一種眼罩，能夠隔絕螢幕以外的視野，再加上耳機與資料手套，使用者便能在此空間中所獲得的身歷其境的感受，這類的身臨其境的感受並非是來自於現實世界裡的事物，而是透過電腦等高科技設備所虛擬建構生成的，當中涵蓋了視覺、聽覺、觸覺甚至是嗅覺及味覺。互動指的是人與此環境之間的雙向互動。使用者可以透過擺頭、視覺控制、鍵盤、觸控螢幕、搖桿等輸入工具與機器和虛擬環境進行互動，例如移動其中的物體，進行射擊遊戲等。視覺真實感指的是電腦圖像所產生出來的擬真畫面，它不是真實的事物，但讓人產生真實的感覺 (Sala, 2016)。

虛擬實境應用在語言的學習上也有不算短的歷史，過去十年運用桌面型 VR(或稱虛擬世界 Virtual World、虛擬環境，Virtual Environment) 來進行外語教學的研究也不算少，或有學者特別將此領域簡稱為 VRALL (Virtual Reality Assisted Language Learning) (Berns & Reyes-Sánchez, 2020)。早期的虛擬實境華語教學應用使用的皆是

以桌面型虛擬實境作為媒介，特別是第二人生 (Second Life，簡稱 SL) [1]這個多人社交/遊戲 3D 平台為主。在華語教學界，3D 虛擬環境被證實可用來促進學習者的俱身認知，例如在 Lan, Fang 與 Legaut (2015) 的研究中，31 位完全不懂中文的美國大學生被招募來參與中文字彙學習實驗，研究結果顯示，傳統 2D 圖文配對學習法在起始階段雖然較具優勢，但運用「第二人生」3D 虛擬環境學習字彙的方法在後期階段呈現出加速學習的效果。此外，陳慶萱 (2011) 研究 SL 華語教學之師生觀感。鄭琇仁等 (2010) 在華語師資的培訓課程中，將第二人生作為培訓的平台，指導華文系學生此平台上對著美國大學生進行華語教學，發現這些華語師資生對此新科技的興趣與評價頗高，但技術上的問題卻也不少(鄭琇仁、戰紅、陳慶萱，2010)。其他如籃玉如等研究者 (Lan, 2014, 2015; Lan, Fang, Legault, et al., 2015; Lan, Kan, Hsiao, et al., 2013; 呂伯寧，2016) 運用 SL 進行了一系列華語和英語教學方面的研究，目標為字彙、聽力、口語、和寫作方面的訓練。這些研究為早期虛擬環境的外語教學法建立了優良的典範與理論論述。在此特別說明的是，虛擬環境同樣具有互動性與沉浸性，但這樣的互動性與沉浸性其實是被框限在電腦螢幕裡。而本文所謂的「沉浸式虛擬實境」是指必須採用頭戴式裝置來體驗的虛擬實境，使用者感受到的是「無縫空間的沈浸感」(曾靖越，2018)，後者在經驗與設備的層面與前述的虛擬環境有所區隔，而且使用者是透過自己的身體來進行俱身學習而非透過化身 (avatar)。因為此種無縫沉浸式虛擬實境的設備與技術的要求普遍較高，因此在語言教學上的研究並不多見。但隨著軟硬體的進步與價格普及化，運用沉浸式虛擬實境來進行研教學已經不再遙不可及。

在 2016 年後，沉浸式虛擬實境技術的發展更加成熟，設備的價格也更加親民之後，VR 在外語教學上的應用也有了新的風貌。綜觀國內外的相關研究，虛擬實境科技在外語教學上的應用可歸類如下：一、用電腦 3D 建模的方式搭建學習情境或遊戲。例如賴怡臻(2017)設計了一套 VR 遊戲幫助華語學習者進行字彙的學習，發現學習者對此方法產生極高的學習動機。二、運用線上平台建構虛擬的場景進行學習活動。例如有研究者運用 CoSpaces[2] 的平台搭建虛擬空間，實施任務型教學法後發現學習者的聽力語口說能力提升皆高於對照組，其學習動機與滿意度也十分正向(何欣樺, 2019)。三、運用 360°影片作為語言學習的補充或發想素材 (Ebadi & Ebadijalal, 2020)。例如有研究者運用 Google Cardboard 加上 Expeditions APP[3] 作為工具，在大學高級中文班裡請學生擔任嚮導，用中文帶領同學虛擬遊覽 expeditions 裡的中國名勝古蹟，研究發現學生因此對這些景點與當地文化產生了高度的興趣，他們在參考了 APP 裡的介紹後，進一步深入研究，因此在口頭導覽中也用上了較高級的詞彙，例如：避暑勝地。此外，VR 工具的使用也降低了學生報告時的緊張感 (Xie , Ryder, & Chen, 2019)。余鎮綸 (2019) 透過拍攝 360°環景照片，在 Roundme[4]

[1] Second Life 網站：https://secondlife.com/ ； Second Life 介紹：https://en.wikipedia.org/wiki/Second_Life

[2] CoSpaces 網站：https://cospaces.io/edu/

[3] https://sites.google.com/tcsnc.org/tcs-g-expeditions/home?authuser=. Google Expeditions App 在 2021 年 6 月已終止服務並下架。

[4]Roundme 網站： https://roundme.com/

平台上進行編輯之後，讓學習者搭配 VR 眼鏡體驗在地文化。文秋心(2019)則利用360°影片提升學習者的寫作構思質量。四、運用市售現成的語言學習虛擬實境課程。例如戴孜伃等人(戴孜伃, 2019; Tai, Chen, & Todd, 2020) 運用 Mondly VR app [5]輔助英語教學，發現實驗組比對照組在字彙的測驗上有較好的表現。五、利用 360°全景相機，搭配 VR 眼鏡、iPad、筆記型電腦等設備搭建一個虛擬實境教室，透過錄製或直播語言學習課堂的上課實況，遠端的學生則可透過手機加上 VR 眼鏡連線到此課堂進行學習(葉為兵、劉士娟、& 宋飛，2017)。

3.2 虛擬實境輔助語言學習之理論架構

依據前述理論探討並結合二語習得理論的相關概念，我們嘗試對於虛擬實境輔助教學的學習本質提出了以下的理論架構(圖 1)：

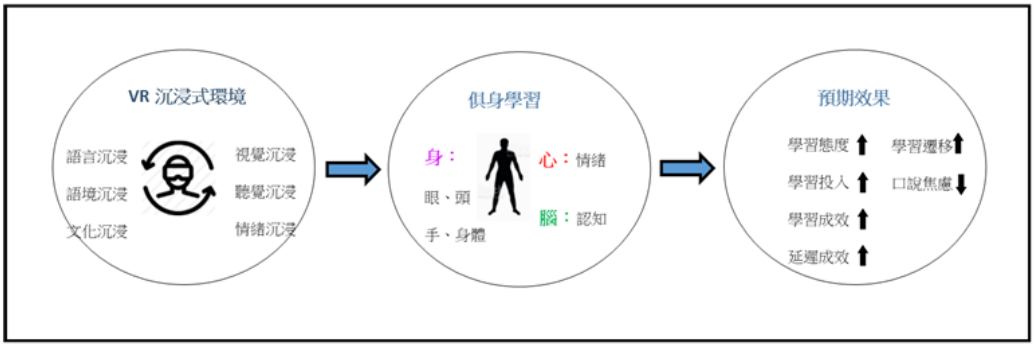

圖 1 虛擬實境輔助語言學習理論架構

(1) VR 沉浸式環境

我們認為，在適當的器材使用之下，VR 的學習環境可以達成使用者視覺方面的沉浸、聽覺方面的沉浸，以及情緒方面的沉浸。在適當的學習教材設計之下，外語學習者可達到語言、語境與文化方面的沉浸感受。

(2) 俱身學習

虛擬實境的訊息是以多模態的方式來呈現，而在前述的沉浸式學習情境之下，學習者可以達到結合身、心與腦皆融入的俱身學習狀態。理想的研究情境中，我們認為俱身學習的證據可以透過以下指標的測量：一、身體指標。我們可利用眼動儀測量學習者眼神是否聚焦在教材上。但如果受試者頭帶著頭盔顯示器 (HMD)，在技術上可能有執行的困難度，然而我們能做到的是記錄受試者頭部轉動、手部動作、身體姿勢，以及身體位置移動等身體融入學習標。在心理指標部分，我們可透過情緒投入 (emotional engagement)問卷來測量。在大腦指標部分，我們可用認知融入 (cognitive engagement)問卷題目來測量。

(3) 預期效果

[5] Moondly VR 網站：https://www.mondly.com/vr

依據前面的理論分析，我們認為如果能夠適當的運用虛擬實境科技於外語教學，將有可能獲得以下的學習效果：因為科技的新鮮感，學生會有較高的學習興致與動機；俱身學習的狀態讓學生更深刻投入於學習活動並有較佳的延遲成效；擬真的語境讓學習效果能有效遷移至真實情境；與虛擬人物對話有助於降低學生的口語焦慮。綜合以上因素學習的效果將可有效提升。

4. 應用虛擬實境輔助華語學習範例

4.1 選用推廣性高的教學設備與技術

如前所述，目前的虛擬實境科技在外語教學上可以用不同的方法來進行，但在實際的教學應用中必須要考量設備、技術門檻、時間與預期成效等多方面的限制，因此在實際的課堂中我們尚未見到普遍的應用。然而，運用沉浸式虛擬實境科技來輔助語言學習並不一定都需要昂貴的設備和高技術門檻。以筆者所進行過的實驗為範例，只要具有消費型的全景相機和手機 VR 眼鏡，一般的華語老師皆有能力製作自己的 360°影片 VR 教材，讓學生進行沉浸式虛擬實境語言學習。

我們在 VR 科技的選用上是基於以下仔細的考量：第一、如果使用 3D 建模的方式製作素材可以為課程量身訂製，但製作的門檻極高，需要委外給廠商製作，使用上所需的高價 VR 以及電腦設備也非一般學校或老師有能力負擔，因此研究的成果很難進行推廣。第二、如果運用像 CoSpaces 的平台，使用的門檻應該較第一種方式低一些，老師可以自由創造自己想要的 3D 空間，因此可搭配教材的需求自行建構，然而這類模組式的虛擬環境倡建平台，在素材內容的視覺風格上偏向卡通式或遊戲式，對兒童來說也許具有吸引力，但對成人學習者來說可能略顯幼稚，使用者自建的空間也無法達細緻的擬真效果。第三種選擇是採用市面上的 VR 語言學習 app，優點是商業產品具有一定水準的製作品質，運用了先進的互動式的科技，但學習的內容固定，可能無法配合課程的需求與班級學生的學習程度。基於以上種種考量，我們最終決定以 360°影片來做為學習素材。實景影片有絕佳的真實效果，製作的較為簡單，設備成本也較低，利用手機 VR 眼鏡或 VR 頭戴式一體機(如 Oculus Go)就有極佳的沉浸式效果，若要在多人的班級教學中使用也可以用平價的 Google Cardboard 取代。本範例所使用的教材乃運用 360 全景機自行拍攝，並將此教材用的全景影像儲存在手機中，讓學生可以帶著手機 VR 眼鏡進行學習。這些技巧對無科技背景的語文老師來說，只要稍加訓練，人人都能設計與製作符合自己課程需求的素材，也可以低成本的在多人的班級中使用，因此具有很高的實用性。

4.2 教材設計簡介

基於上述關於技術、成本與實用性等三方面考量的結果，我們決定以 360°攝影機來拍攝我們的虛擬實境華語教材。在此研究中我們嘗試設計了兩種不同的虛擬實境華語學習輔助教材，一種為被動觀看式教材，另一種則為互動參與式教材。被

動觀看式教材又可分為兩種形式：360°全景照片以及 360°全景影片。而互動參與式教材則只有 360°全景影片一種形式。關於教材的內容與設計方式說明如下：

4.2.1 被動觀看式教材

被動觀看式教材的使用目的是要跳脫教室圍牆的限制，將學習者帶入一個與學習主題相關的目標情境裡，並利用此情境裡的人事物來進行語言方面的學習。教材又可設計成靜態影像以及動態影像兩種形式。以下以本研究所設計的「Ubike 租借」單元進行說明。

1. 360°全景靜態影像。製作的方法非常簡單，我們帶著全景攝影機，找了一個適合的 Ubike 租借站拍攝全景照片作為教材。當學生帶著 VR 眼鏡觀看此照片時會有身歷其境的感覺。他可以隨意轉動頭部觀看上下四方的景象就像他站在現場一樣。與此靜態教材搭配的教學策略是由老師在一旁口頭引導與提問，例如: 請說說看現在的天氣如何? 在藍色的路燈桿旁停了什麼顏色的車子? 灰色地磚上的白色箭頭指向什麼方向? 你在這裡還看到了麼？請描述一下。學生聽著老師的問題練習到了聽力，而後藉由觀看他四周的影像來尋找問題的線索，最後透過回答問題來練習口語表達，因此是一種高度情境式的學習。

2. 360°全景動態影像。在此動態影片裡，主角人物來到了 Ubike 租借站，一邊用口頭說明，一邊示範如何租借腳踏車。影片教材的目的在於讓學生能夠臨場式的去感受從租借、騎乘腳踏車到歸還一系列一氣呵成的動作，透過影片中的影像與聲音提供一個仿真的情境讓學生去體驗。影片中人物的對話和說明構成了情境式的語言學習素材。在學生觀看 VR 影片過後，老師可請學生回答租借及歸還的步驟為何，以及影片情境有關的問題來做口語方面的練習。使用 VR 眼鏡觀看全景影片能使課程更為生動有趣，活潑的方式亦可減緩學生在回答問題時緊張的情緒，並能使之更明白租借 U-bike 的完整流程，並習得與之有關的詞彙與句型。

圖 2 360°VR 影片截圖畫面

4.2.2 360°互動參與式情境對話教材

此種教材只能以動態影像的方式來製作。我們嘗試設計了兩個單元：「買衣服」與「吃冰」。每單元的內容都分成兩大部分，前半段是對話示範，後半段則是對話練習。以「買衣服」的單元為例，故事情境裡有三個人：店員、顧客與同行的朋友，其中同行的朋友即是由戴著 VR 眼鏡學習的學生來扮演，因此在拍攝時我們必須把攝影機架設在同行的朋友所站的位置。影片一開始，顧客因為要買衣服所以跟店員會有一段對話，這段對話示範了買衣服的流程。之後，店員會轉向這個同行的朋友(攝影機)，並展開互動式的問話：「請問您要買什麼？」「這裡有襯衫，您覺得還可以嗎？」「好，這樣子三百塊。謝謝。」拍攝時，在每一句的問話之後都必須預留適當長度的停頓時間，好讓觀看的學生回話後再進行下一句問話。

4.3 教學流程

在本研究中，我們將這些虛擬實境的教材定位為語言課的輔助教材，也就是說，它們是搭配著語言課的教學來使用。因此，我們將教學的流程設計成三大階段：語言學習階段、VR 輔助學習階段，以及引導練習與評量階段。

在語言學習階段，教師運用設計好的 PPT 以傳統的方式進行語言教學，或是學生利用紙本的講義來學習課程主題相關的語言內容。在第二階段的 VR 教材內所使用到的詞彙、句型或語法也會預先在此一階段學習。

第二是 VR 輔助自主學習階段。在此一階段開始之前，教師必須指導學使用 VR 眼鏡，包括正確的佩戴方式，調整好鏡片的焦距、設定好適當的音量、請學生坐在旋轉椅上或是站立在周圍無障礙物的空間中進行操作等準備工作。圖 3 呈現的是實驗時學生所使用的 VR 眼鏡。學生透過 VR 眼鏡看到的是沉浸式的全景影像。在此一階段，老師的角色較屬於協助者，主要的工作是讓學生觀看影片來進行自主學習，若學生遇到設備操作上的問題則需從旁協助。至於靜態影像的教材，建議老師在一旁給予口頭上的指引，藉此告訴學生觀看的重點。例如：找找看 Ubike 的租借站在哪裡。數數看這裡有幾輛 Ubike。如果使用的是互動式對話教材的話，學生除了專看影片之外，還必須與 VR 影片裡的人物進行對話練習。

圖 3 學生使用 VR 眼鏡

第三階段是引導練習與評量階段。此時學生會透過 VR 眼鏡觀看一段全景影片，內容是主角人物示範與說明租借及歸還 Ubike 的流程，或是發生在服飾店裡的買賣過程。影片的形式除了可提供豐富的情境訊息(包括視覺與聽覺訊息)之外，更非常適合用來教導程序性知識，例如如何租借 Ubike，如何買衣服等。在學生觀看完影片之後，老師可提出一些問題讓學生進行延伸練習，教師也可以藉此檢驗學生的學習成效。例如：你在影片裡看到了什麼？影片裡的人是男生還是女生？大約幾歲？穿什麼顏色的衣服？租借 Ubike 的第一個步驟是什麼？店員拿給你看的那件衣服好看嗎？你將來想不想借 Ubike？為什麼？老師的角色在此時是利用提問來引導學生進行延伸練習，若有必要可以讓學生重複觀看影片來回答問題。學生回答問題的表現也可以當成此課程的口語評量成績。換言之，在此過程之中，學習者必須運用身體與感官來解讀虛擬實境中的多模態訊息，教師也可以請學生用不同模態的方式(如口說、書寫或表演)來呈現他們的學習成果。

4.4 研究問題與方法

4.4.1 研究問題

為了深入了解與印證虛擬實境輔助語言學習的原理與學習本質，我們招募了外籍大學生來進行教材的試用，希望透過使用者經驗分析的方式來嘗試回答以下問題：一、虛擬實境輔助華語學習教材是否能提升學習動機？為什麼？二、虛擬實境輔助華語學習教材如何能引發俱身學習？三、虛擬實境輔助華語學習的優點為何？四、針對本研究所使用的教材有何改善建議？

4.4.2 研究方法

為了深入瞭解虛擬實境華與輔助教材的實用性與優缺點，我們找了大學修讀大學部華語課程的十位外籍生做為教材的試用者，他們的華語程度介於初級與中高級程度之間，基本資料表列如下：

表一 受試者背景資料

受試者代號	性別	國籍	程度
A1	女	印尼	初級
A2	女	泰國	初級
A3	男	越南	初級
B1	女	越南	中高級
B2	女	越南	中高級
B3	女	帛琉	初級
B4	女	諾魯共和國	初級
B5	男	聖克里斯多福	初級
B6	女	日本	初級
B7	男	泰國	初級
B8	女	南非	初級

研究的步驟是，首先，研究人員簡單說明了研究的目的，並給予受試者紙本的講義使其了解教材的主題與以及相關的語言學習內容。接下來在研究人員的指導之下請受試者試用本研究的虛擬實境華語輔助教材。編號A開頭的受試者試用的是被動觀看式教材，編號B開頭的受試者適用的是互動參與式情境對話教材。在試用完成之後，受試者接受了開放式問題的使用者經驗訪談。考慮到受試者的語言程度不同，我們請他們自己選擇使用中文或英文來進行訪談。結果中高級程度受試者採用的是中文訪談，而初級受試者採用的是英文訪談。在訪談開始之前我們徵得了受試者的同意進行全程錄音。訪談的內容在謄寫成逐字稿之後，並搭配研究者的觀察做三角檢測，最後以主題式的方法來進行質性分析。

4.4.3 研究結果

透過訪談逐字稿的分析加上研究者觀察的結果，我們歸納出以下的研究發現：

(1) 科技新鮮感引發學習興趣

透過訪談資料發現，幾乎所有的學生都對虛擬實境式的學習方法感到興趣，典型的回答如下：

> *I think it is very interesting, I never use this machine to study to learn the lesson before. (A2).*
> *(The) advantage is more interesting, if you learn just by writing and teaching on the whiteboard. It' s boring. But VR is like watching a movie and I can talk to them, so it's interesting (B4).*
> *因為一般的.....(媒體)，就是很傳統的那一種，就是..好像是以前都有用過了，所以你用 VR 的時候，你看比較生動一點，然後...就是覺得是新的，你就有興趣一點。(B2)*
> *The students will get motivated to study because of the new technology. (A2)*
> *Because it's new and easier to use. VR makes me feel more interesting (B3).*

因為大部分的受試者都是第一次體驗虛擬實境，相較於傳統的學習方式，他們對於這項新科技感到新鮮有趣，不可否認，新奇感是讓他們產生興趣的主要原因。

(2) 真實感與互動性有助於學習遷移

關於虛擬實境輔助語言學習的優點，受試者認為這樣的學習有助於將學到的語言運用在日常生活情境，而原因就在於它的真實感與互動性。

> *VR lets me feel like I'm in there. It's helpful when I go shopping. I know how to ask. The video is the same as real life. If I go to buy the clothes and the salesperson asks the same question I can answer it (B3).*
> *VR is more interactive, it can connect with people. When they ask me, I can talk to them. It gives us a chance to let us talk. Traditional is more individual, you have to study by yourself, or act the character s by yourself. (B4)*

> *I think VR is more practical. It's real and close to my life. VR has conversation, so I could know how to respond. (B5)*

影片式的虛擬實境能夠將真實世界的場景搬到學生眼前，沉浸式的影像與聲音讓學生感覺有如身歷其境，加上角色扮演式的互動對話設計，猶如真人對話的模擬，有助於將所學的語言內容與技巧遷移至課程外的真實情境。

(3)克服口說恐懼

受試者 B8 在訪談中提到了語言學習者的口說恐懼，而虛擬實境的真實感也讓她在對話練習時也感到不小的壓力：

> *It's such as a pressure. But I would consider it. Because it let me feel like a real situation. I think if you are learning to speak Chinese, you don't have to know difficult thing, you just need to know how to use in your daily life. I think is easier. For example: I want to know how to order food or take a taxi, but the person in the VR they ask me the question let me feel too scared to make a mistake. In the real life if the seller asks me in Chinese, I will say "English? Ok, I'll ask someone else, bye. "(B8)*

她說一般學習說中文時可能只學一些日常生活用的簡單對話，所以不是很難。在(台灣)真實生活的情境裡，如果店員用中文問她，她會反問對方是否懂英文。如果對方不懂英文，她就會找懂英文的人買。然而，VR 裡面的人物用中文問她，她反而覺得害怕，因為怕說錯，所以覺得有壓力。這段回應顯示出外籍學生在面對中文母語者時的確會感到說中文的焦慮，虛擬實境的擬真感同樣會帶給她壓力，然而在現實生活中她可以採取一些迴避的策略，避免掉說中文的壓力，而在虛擬實境她發覺無可迴避，必須要以中文回應，因此會感到有點壓力。我們接著問受試者 B8 這樣的 VR 教材是否有助於她將所學的對話運用在生活之中，她說 *Yeah, because it's always too scared. But with VR then we can … (practice)*。受試者 B8 的論述其實代表虛擬實境教材可以充分模擬真實的情境與語境，學習者第一次使用難免會感到壓力，但若是經過多次的模擬練習之後，我們相信這樣的焦慮感會漸漸降低，最後能使學習者在面對真人時更有自信。

其他的受試者也表示，虛擬實境的教材可增加他們開口說中文的機會，學習之後他們會想要去外面試看看，因此在未來面對同樣的狀況時能有開口的勇氣，有助於他們增進日常生活語言的運用。

> *VR is more interactive, it can connect with people. When they ask me, I can talk to them. It makes chance to let us talk. (B4)*
> *I think VR is more practical. It's real and close to my life. VR has conversation, so I could know how to response. (B5)*

(4) 俱身學習：身體與情緒融入

除了頭腦以外，俱身學習強調的是增加身體與心理(或情感)層面融入學習的狀態。受試者們在訪談中有多人提到了「身歷其境」的感覺，例如：*VR let me feel like I'm in there(B3).* 或是 *You feel like you are right in the situation. (B7).* 我們認為這種身歷其境感是引發俱身學習的關鍵。

以身體的融入來說，依據研究者的觀察，戴上虛擬實境眼鏡進行學習時，每位受試者都會自然地轉動頭部以觀察四周的情境，若是以站立的方式來配戴，受試著甚至會以走動的方式想探索四周的環境，如此利用身體主動探索訊息的方式與被動式的觀看一般影片的學習方式有明顯的差異。更值得一提的是，學習者看一般的影片學語文時不會想要與影片裡的人物對話，但是在互動式設計的虛擬實境裡，受試者會自然想要回應情境裡面人物的問話。

> *This one is just like watching the movie, and it's so interesting watching it. and you can talk (B4).*
> *I feel like I'm the person in the video, and it is like the real people talk to me (B6).*
> *I feel like I'm in the situation, you need to try to answer (B7).*

其實受試者在試用教材之前並不知道裡面會有互動式對話的橋段，雖然不見得每個人都好意思開口說，但當他們觀看到這一段時都知道自己應該回應 VR 裡人物的問話。我們進一步探究為什麼他們知道應該回應這些問話，受試者表示，因為裡面的人物是面對著自己問問題，而且在整個情境的氛圍與人物的表情和動作等整體研判之下，他們知道自己被期待著要回話。受試者的回答可以證明，虛擬實境的教材內容結合了多種模態，在聽覺的部分包含語速、聲調、口氣、停頓等模態，在視覺的部分包括環境、物品、人的姿態、動作表情等，以及人物與自身之間的空間相對位置等模態，受試者在進行學習時是以一種綜合解讀的方式來理解這些多模態訊息所傳達出來的整合意義，並進一步思考在這樣的情境和語境之下應該如何回答當下的問話，而受試者的回答就成了此多模態學習的成效或證據。

除了身體的融入之外，情緒的融入也是沉浸式虛擬實境可以達成的效果。在(3)克服口說恐懼的那一段落裡，我們說明了虛擬實境的對話如何帶給受試者心理壓力。此外，受試者也提到了虛擬實境所帶來的一種特別的心理狀態：專注。

> *I think you cannot get distracted with it. Because there is no small thing around you that try to get your attention, like your phone. So I think you have to focus because that is all you see. (B8).*

頭戴式虛擬實境的特點是與外界隔絕的沉浸式感覺，使用者無法看到這個情境外的其他事物，如果加上耳罩式耳機，就連外界的聲音都可以被隔絕在外，因此會讓人變得非常專注。專注是一種心神投入的表現，能為學習帶來正向的效果。

(5) 高滿意度與採用意願

整體而言，幾乎所有的受試者都給與虛擬實境學習法極高的評價， 所有受試者皆表示如果未來還有機會的話，他們想要嘗試用虛擬實境來學習更多的主題，更給了研究者不少拍攝主題的建議，由此可知他們對於這種學習方式十分喜愛與滿意，主要的理由包括這樣的學習方式很有趣、很新鮮、很真實；不必走出教室就可以體驗不同的情境；所學可以實際運用於生活中；學習時可以非常專心；可以學得比較快等等。

> *Actually, for me it is good already because it is a new way for me. If I believe if it's well improved in promotion, many people will like it and it is so useful. (A1)*
> *I don't think there is a bad. Everything is good. Because it's new, and it's more… real. (B3)*
> *I think you can learn faster in this way, because you can talk. You can do listening and then you can talk. (B4).*

(6) 缺點或待改善之處

除了優點之外，我們同時也詢問了受試者關於這套教材的缺點語改善建議，他們給了以下的答案：戴眼鏡的人使用起來不太方便；影片的解析度不太夠；影片中的環境雜音太大；缺乏字幕；有些人可能會覺得頭暈；器材操作上不太熟悉；設備可能太貴因此不適合運用在人數較多的班級等等。以上的這些使用者意見都可作為我們後續改善的參考。

5. 虛擬實境輔助語言學習的益處

綜合本文前半段的理論探討，以及本文範例受試者經驗的分析發現，沉浸式虛擬實境是輔助語言學習的絕佳工具，理由如下：

(1) 沉浸性：在語言教學中有一種方法叫做沉浸式語言教學法，也就是說教師必須要使用目的語來交目的語，完全不能使用學生的母語來補助，而學生也只能使用目的語，並完全生活在目的語的情境之中，這種方法可以在短時間內讓學習者的語文程度大幅提升。基於虛擬實境的特性，沉浸式的情境非常容易達成。它不只能帶來語言的沉浸性，還可以營造出環境、文化、感官，甚至是情緒等多方面的沉浸性。

(2) 互動性：虛擬實境是比一般多媒體教材能夠帶來更真實感的互動，學習者除了能夠與情境中的物體互動，更能遠距跟真實人物的化身進行言語溝通。互動帶來趣味感，並且讓學生有主導權與自主性，能夠促進主動學習 (active learning)。

(3) 多感官融入：虛擬實境能夠產生多感官的刺激，愚弄人類的大腦，讓我們以為自己處在一個似真實假的情境，進行似真實假的活動。藉由操弄多感官的刺激，俱身學習或身體記憶的效果可以達成，因此能達到較佳的語言學習效果。

(4) 情緒融入：心理學告訴我們，情緒可以影響我們的記憶與學習。第二語言習得理論大師克拉申也告訴我們，人人都有一個情感過濾器，例如當人們在緊張的時候外語的訊息會被我們隔絕起來，不容易進入我們的大腦，導致學習成效降低(劉頌浩，2007)。 因為虛擬實境能夠有效引導(愚弄)使用者的情緒，如果有好的教學設計，虛擬實境應該可以降低學習者的情感過濾機制，達到有效的語言輸入，進而在自然且無壓力的情緒下學好外語。此外，高沉浸式的虛擬實境帶給使用者高度投入感 (Kaplan-Rakowski & Wojdynski, 2016)，因此也有助於學習者專心於學習任務。

(5) 學習遷移：傳統課堂的學習模式常常會有學習低度遷移的現象，也就是說，學生在課堂內的練習也許沒有問題，但走出課堂之外，卻無法有效運用所學語言在實際的情境之中。在本研究裡，360VR 將再現一個真實的情境，學生必須與真人影像或化身進行互動，因此能產生較佳的學習效果。或有人說，老師把學生帶到實際情境進行教學的話效果不是更好？何須用到 VR 設備。我們不否認真人實境教學有更好的學習成效，但實境教學需要花費大量的人力、金錢與時間，況且有些地方不見得能帶學生去進行教學演練，例如飛機座艙。將無法觸及的情境用虛擬實境的方式重現，可以用較低成本的方式克服教室環境的限制，並達到學習遷移的效果，這也是使用 VR 輔助教學的主要理由之一。

6. 教學建議

(1) 使用 360°照片製作華語教材的優點，限制，與注意事項

360°全景照片教材的優點是讓學習者以更加貼近生活的情況下學習，以影像形式作為材料，讓學習者更加詳細的解讀圖片上的細節、漢字、及思考。與動態影像素材相較，靜態照片的優點是較適合進行閱讀方面的教學與任務，學習者能夠在安靜的狀態下，從容地觀看與尋找靜態畫面裡的訊息。特別須注意的是，應盡量使用高畫質 360°相機，因為畫面的清晰與否會影響到學習成效，特別是文字方面的訊息。如果學習的內容需要閱讀情境裡面的文字，如告示、海報等，需在拍攝時把攝影機的位置擺在這些文字的近處，方便學習者清楚地觀察影像的細節與文字，也因此才能達到教學者預期的學習效果。

(2) 使用 360°影片製作華語教材的優點，限制，與注意事項

360°影片教材的優點是讓學習者以更加貼近生活的情況下學習，以影片形式做為材料，讓學習者更加融入真實的融入生活，透過影片呈現，可以更加的讓學習者的觀察無死角，在觀看的過程中可以隨時依據需要自由的選擇自己想觀看的視角，再加上聲音的訊息，更能營造出更沉浸式的真實感。影片的清晰度也跟 360°攝影機的等級有關，除了尋求使用較高畫質的攝影機來拍攝之外，在下載影片時也請記得下載最高解析度的版本。此外，在動態的影像中要閱讀情境裡的文字並不容易，

因此建議在後製時透過編輯軟體加上文字重點提示，如果是對話的內容，建議加上字幕方便學生理解。此外，在拍攝時需注意應盡量避免晃動以及快速移轉攝影機，導致學習者來不及觀看，甚至會造成他們頭暈，因此放慢畫面轉換的速度也是一項重要的注意事項。簡言之，我們認為 360°影片教材的製作應該比一般的影片教材具有更慢的拍攝與內容進展的步調。另外，在聲音的部分請記得盡量尋找安靜的地方進行拍攝。若是無法選擇安靜的地點，建議讓影片主角配戴麥克風，或是在後製時把影片的環境背景雜音消音。因此，在選購器材時，高品質的收音克風、高畫素、高防震效果等都是選購 360 攝影機時要考慮的重點。

7. 結語

虛擬實境的技術在近幾年有重大的突破，隨之而來的教學應用更是方興未艾。此篇論文探討了應用虛擬實境科技輔助語言學習的相關理論，並提出了一個整合性的理論架構，提供給有興趣的研究者做為參考。在論文的第二部分，我們介紹了一個應用虛擬實境於華語教學的範例。基於這個範例，我們發覺運用 VR 於華語教學有以下優點：可以使學習內容更加融入於生活中，不僅讓學習者提高專注力，也可以讓學習者增加認同感，或把所學實際用於生活中，在逼真的語境中學習華語。全景的沉浸式視覺呈現也有助於學習者進行多方面的觀察。然而，虛擬實境的設備也帶來了許多限制，因為學習者戴著 VR 眼鏡，因此教材只能著眼於聽力、口說與閱讀的部分，對於手寫的訓練較難達成，然而手寫部分可以在投影片教學階段或是後續的學習活動來補足。

綜合之前所述，學生受試者對於此虛擬實境科技表示具有創新性及有趣的好感，透過此方式讓學習過程不再感到無聊，而視覺效果的確也讓學習更有效率。當然，虛擬實境應用與於語言教學的方法不只一種，我們相信在未來相關技術將會更加成熟，設備的價格也會更加親民，技術的門檻也會考慮到普羅大眾，可選用的內容也會更豐富多元。本論文只是運用教師自製教材的虛擬實境輔助華語學習的初探式研究，規模不夠大是本研究的限制。未來我們將在此基礎上發展新的方法並進一步檢測其學習成效，期盼能對虛擬實境輔助語言學習的應用有更深入的了解與貢獻。

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同步和非同步應急遠程中文教學：大學和中學教學實踐分享 (Effective Practices of Synchronous and Asynchronous Emergency Remote Chinese Language Teaching)

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摘要：本文是兩位於美國任教的中文教師[1]，分享為應對新冠疫情所實施的應急遠程教學。文章先簡介兩位老師在 2020 年春季學期所教課程以及在中文教學方法上共同遵循的幾項基本原則；然后將教學實踐分為（1）人際溝通為主的同步網課以及（2）理解詮釋和表達演示為主的非同步網課，說明如何規劃和進行遠程教學，並探討線上教學模式下語言測驗的挑戰且分享實例，文末提出對此次應急遠程教學的省思。筆者們強調，21 世紀的外語教學，應該打破傳統實體課程和線上課程的二元化思維，在實體課時就有效地融入線上教學工具，融入兩者優點，以提升語言學習的成效。

Abstract: This article reports how two Chinese language instructors, teaching at a private grades 6-12 school and a university respectively, transformed face-to-face courses into an online format Spring 2020 due to the global Covid-19 pandemic. First, both instructors' instructional contexts and pedagogical principles are briefly stated. Second, the instructors share their experience on how to conduct emergency remote teaching, categorized into a synchronous format with an emphasis on the interpersonal mode, and an asynchronous format with an emphasis on interpretive and presentational modes. Online testing is also discussed. The authors reflect on their experience of emergency remote teaching and argue that it is time to blur the traditional boundary between face-to-face teaching and online teaching and make the best use of the advantages each can offer in order to improve students' learning outcomes. It would also make smoother the transition between face-to-face and online teaching.

關鍵詞：應急遠程中文外語教學、科技融入外語教學、習得為導向的外語教學

Keywords: Emergency remote L2 Chinese teaching, technology integrated language teaching, acquisition-driven language instruction

[1] 本文出刊時，李怡慧已轉換至國立陽明交通大學任職。

1. 引言

2020 年的三月，美國因新冠狀病毒疫情逐漸嚴重，為了確保師生們的健康安全，並減緩疫情的發展，各地中小學和大學先後宣布暫停實體課。中文外語課和其他學科一樣，老師們必須在短時間內，將面授實體課轉換為百分之百的遠程學習（remote learning），讓教學能在疫情影響下繼續進行。

Hodges 等人（2020）稱此種因為危機或災害而暫時施行的遠程教學為應急遠程教學（emergency remote teaching）。此種教學模式難以設計出一個完善的線上教學環境，因為以一個大學的線上課而言，通常需要六到九個月的準備時間。然而，應急遠程教學突然實施，老師們必須快速將原本的面授實體課轉換成全線上教學模式，在有限的時間和資源下，老師們需要發揮問題解決的能力，讓教學得以繼續，因此，常態下的遠程教學和應急式遠程教學不可混為一談。

本文分享兩位於美國任教的中文教師為應對新冠疫情所實施的應急遠程教學，這兩位教師分別為執教於一所私立中學和一所公立大學。如上所述，應急遠程教學的規劃和實施過程倉促，因此，本文分享的教學內容和方法尚有進步空間，但透過經驗分享，希望能激發尚未善用線上教學工具的外語老師們，重新審視自己的課程規劃。

本文先概述兩位老師該學期所教課程，以及在中文外語教學方法上所遵循的幾項基本原則，來幫助讀者判斷本文分享的線上教學策略是否適用於自己的教學情境。再者，依美國外語教學協會（ACTFL）的溝通（communication）目標，分為以人際溝通（interpersonal）模式為主軸的同步網課，以及以理解詮釋（interpretive）模式和表達演示（presentational）模式為主軸的非同步網課，分享具體的應急遠程教學經驗，並探討網課下語言測驗的挑戰並分享實例。文末是針對此次應急遠程教學經驗的省思。

2. 所教課程和教學原則

本文作者之一的陳老師在私立中學任教，該學期所教授的中文課包括初中部的六年級中文、七年級中文、八年級中文，及高中部的中文一和中文二。班級人數從七名到十四名不等。六年級和七年級都是初學者，未完成的單元包括職業與生活作息；八年級中文及中文一尚有課堂用語單元；而中文二則還有飲食單元。因此，本文分享的教學內容主要限於學生語言水平在初級（Novice）到中級初等（Intermediate-low）範疇。實體課程的時候，每週一門課的課堂上課總時數是 210-280 分鐘，課後作業的練習時間為 90-120 分鐘，以鞏固上課所學。但是三月中旬網課開始後，學校為顧及學生的身心健康，每週每一門課的上課總時數降為 150 分鐘，分兩次上，作業的時間也縮短為 70 分鐘。為了能在縮減的上課時數內達到最佳的學習效果，教學內容就必須有所取捨，刪除了筆順練習等操練為主（drill-based）的教學活動，保留語言能力為主（proficiency-based）的教學內容。

再者，由於私立學校的學生大多來自社經地位優勢的家庭，學生平時上實體課時，就時常使用個人的筆記型電腦或平板電腦，因此，當學校進入應急遠程教學時，學生在網絡和電腦等硬體設備上皆不成問題。此外，校方在大流行的初期，就已經著手應對。在情勢吃緊的三月初，學校立即集結各方資源，在最短的時間內訓練老師及學生如何使用 Zoom 此一視頻會議軟件，且明確列出簡單明瞭的網課課表及網課規章。由於有完善的軟、硬體設備及技術支援，加上家長及學生的高度配合，網課出席率高達百分之九十九以上。

本文另外一位作者李老師是在美國一所中型的公立大學任教，該校並無中文主修只有輔修項目。當學校進入應急遠程教學模式時，李老師的兩門中文課分別為初級對話課和中級中文課。兩門課皆為小班制，都只有六名學生。學校公布進入應急遠程教學模式時，正好是放春假前的星期五，除了春假一整週的緩衝期外，學校還將春假後的那一週停課，讓老師們有比較充足的時間準備進入遠程教學。應急遠程教學模式正式開始時，學期只剩下五週和一個期末考週，初級對話課正要進入學期的最後一個單元：旅遊單元，中級中文課則只剩下教科書裡的兩課。兩門課皆是每週三次五十分鐘的課，在應急遠程教學時，兩門課都是以每週同步（synchronous）或非同步（asynchronous）方式交替上課，若教學內容沒有一定需要和學生交流互動，就以非同步網課進行；同步網課時的教學安排則是強調人際溝通，並照著實體課時相同的時段進行。

兩位老師合著此文的原因之一,是因為在中文教學的教法、教學設計和教材安排上有相同之處。第一，最重要的教學原則皆以 Krashen（1982）的語言習得理論為依歸，強調提供大量且適合學生語言程度的可理解輸入（comprehensible input），學生透過聽懂所聽和讀懂所讀的過程，語言習得（acquisition）也就自然地逐漸發生。因此，兩位老師在各個班級都是依照美國外語教學協會（ACTFL, 2010）的建議，盡可能讓課堂 90%以上的時間都是使用目標語（中文）進行溝通。並且借用詞彙表、提供背景知識、畫畫、手勢、臉部表情、動作、調整語速等方式提供有助於理解的增補（Comprehension-Aiding Supplementation），不但提高學生對語言輸入（input）的理解性，也能讓語言輸入更有趣(Krashen et al., 2018)。

第二，在單元設計的學習目標上，兩位老師都是使用能力描述（Can-Do Statements[2]）的概念，羅列出每個單元學生應該發展的語言表現（performance），讓每次上課都具有目標性（purposeful）。符合美國外語教學協會（ACTFL, 2015）所強調，發展學生功能性（functional）的語言能力（proficiency），教學和評量都以學生所具備的語言水平能夠完成什麼樣的任務（be able to do with language）為依歸。

在教材的組織上，兩位老師在實體教學時，都已善用學校的學習管理系統（learning management system），將許多教材都放在線上，除了手寫作業外，大部分的作業都是透過學校的學習管理系統，外加少數幾項線上教學工具。因此，當學

[2] 關於美國外語教學委員會 Can-Do Statements 的說明：https://www.actfl.org/resources/ncssfl-actfl-can-do-statements

校進入應急遠程教學模式時，除了 Zoom 以外，沒有要求學生學習新的線上教學工具。

即使在線上教學模式下，兩位老師仍然延續上述實體教學時的基本教學原則，並且都是以同步教學和非同步教學為基本架構，分類並安排自己的教學內容。在同步教學時，善用師生能即時互動且可以見到彼此的可貴時間，教學活動就以人際溝通模式為主軸；在非同步教學的網課或是線上作業時間，則是著重培養學生閱讀和聽力這兩方面的理解能力，或是寫作和口語表達的能力，也就分別是溝通標準下的理解詮釋模式和表達演示模式。無論是同步教學或是非同步教學，最重要的原則皆是盡可能提供大量可理解性語言輸入，並和學生做有意義、有目的的互動，教學內容是要適合學生語言程度並能提高學習動機和參與度，單向式的講課或是機械式練習，不論在線上教學或實體課中，都不是本文兩位老師所認為對語言習得有效的教學方式。

3. 應急遠程中文教學的具體教學設計

3.1 以人際溝通模式為主軸的同步網課

3.1.1 延續關懷型的學習共同體

本文的兩位老師在平時上實體課時，固定會透過活動來增加師生之間以及學生之間對彼此的了解，進而尊重彼此，以建立一個互信互愛的學習共同體（learning community）。比如說，開始上課後的首要活動，不是小考或是馬上進入課文，而是和學生交流，分享週末做的事情、學校最近舉辦的活動、或是新聞事件。單字和句型的學習即透過偶然學習（incidental learning）發生。以李老師的中文課為例，曾有一位學生在分享週末發生的事情時說到，開車超速被開了一張罰單。因為詞彙和句型的侷限，該學生用中英文穿插的方式描述，而老師作為一位語言輸入的提供者（input provider），此時就可以透過自然的互動溝通，協助學生說出他想描述的生活事件，並在白板上寫出新的詞彙，比如說「超速」、「罰單」。接著，老師會向全班做一個調查，問問誰平時也有開車，誰覺得自己開車有一點快、誰收過罰單，老師也分享自己是否有被開罰單的經驗。語言學習自然就能以學生自身生活經驗為起點，在這過程中，不使用直接糾正（explicit correction），而是藉由重述（recast）的方式提供語言輸入，讓學生聽到自己想傳達的想法或情緒感受怎麼用中文表達，學生的情意濾網（affective filter）（Krashen, 1982）降低了，語言習得的效果才能提高，學習共同體也就在這生活經驗自然地交流過程中建立起來。

同步網課依然強調學習共同體的維繫，這在應急遠程教學時尤其重要，因爲日常的生活模式突然被打斷，師生們都承受著新的精神壓力。兩位老師不約而同地在應急遠程教學時進行的第一個活動都是和學生們彼此寒暄。實務的做法是，老師先真誠地分享自己生活中的「好消息，壞消息」，接著引導學生們輪流分享他們在疫情下的生活改變和學習方式，以及心理層面的情緒。比如說，有學生談及因無法外出而失眠的困擾、不少學生都表示不喜歡網課因為不能和朋友見面；但是，也有學

生分享因為居家隔離而嘗試了新的事物，比如說縫紉和做飯。這個活動不但凝聚學習共同體，且具體實踐人際溝通模式，因此非常適合在同步網課進行。

圖 1 用於「好消息，壞消息」活動的虛擬背景

若是班級人數比較多，則可以使用 Zoom 裡的投票（poll）或注釋（annotate）功能，使用適合學生的語言程度，收集學生的意見。比如說，在初級高等（Novice high）水平的班級裡，老師可以提問：「疫情對你的生活方式有什麼樣的影響？」確定學生理解題目後，提供數個選項：「對我的生活方式有好的影響」、「對我的生活方式沒有太多的影響」、「對我的生活方式有不好的影響」讓學生投票。收集投票結果後，請數個學生嘗試用短語或句子列舉是哪方面的影響，也可以請有同感的學生使用舉手功能表達。Mentimeter[3]裡的字雲圖功能也是另一個非常適合用於收集學生想法的線上工具，讓學生直接輸入詞彙成為一個字庫。

李老師上線上課時，會同時開啟一個可以全班共同編輯以及分享的班級 Google Docs 或 Google Slides，將上課提到的新詞彙、全班共同創作的故事，或是要每個學生打出來的句子，全都收集到一個共享檔案。學生課後需要複習時，可以很方便地直接到這個共享檔案找到資料。也可以用 Google Translate 做生詞表，將新詞彙做即時的翻譯並提供漢語拼音。但缺點是，有時翻譯出來的意思不是對話溝通裡所要傳達的意思，此時就是機會教育的最佳時機，讓學生知道翻譯軟件的侷限。

英國	yīngguó	United Kingdom
外國人	wàiguó rén	Foreigner
工作	gōngzuò	jobs
珍珠	zhēnzhū	pearl
奶	nǎi	milk
好喝	hǎo hē	Delicious
便宜	piányí	Cheap
方便	fāngbiàn	Convenience
樹	shù	tree
吃飯	chīfàn	eat
午餐	wǔcān	lunch
日本餐館	rìběn cānguǎn	Japanese restaurant
可愛	kě'ài	lovely

圖 2 用 Google Translate 做的網課生詞表，放在班級 Google Slides 以供複習

[3] Mentimeter 的網址 https://www.mentimeter.com/

上同步網課的時候，為了想要達到實體課自然互動的效果，陳老師會要求每位學生都把手機或電腦上的麥克風打開，但是由於網絡速度的快慢不同等因素，學生們發言的連續性無法和實體課時一樣流暢，有時候會尷尬幾秒鐘。為了讓氣氛輕鬆和諧，陳老師的作法是請三位同學擔任小幫手的工作。他們得依據每位學生的回答，適時地說「真的嗎？」、「糟糕！」、「我的天啊！」，或者「太好了！」這樣一來，整個分享的過程瞬時間變得有趣許多，而且可以確保每位學生都專注聆聽同學的分享。

3.1.2 執行單元 Can-Do Statements 中的人際溝通模式

在進入教學單元前，老師需要釐清有哪些 Can-Do Statements 是著重在人際溝通模式，才能善用同步網課的寶貴時間。以李老師的初級對話課為例，因為學生的語言水平還在非常初級的階段，所以課程安排上，是先一週非同步網課，接著再一週同步網課。在非同步網課時，老師在 The Chairman's Bao[4]，從 HSK1 和 HSK2 的語言水平中，挑選和中國旅遊有關的新聞錄製教學影片，旅遊景點盡量挑選差異性比較大，或是比較有話題性的，有利於在下一週的同步教學時增加討論的參與度，同步網課時的 Can-Do Statements 就可能是：表達旅遊和飲食的偏好、討論決定是否要去某一旅遊景點或是餐館用餐，這些都是強調讓學生表達自己想法和意見的人際溝通模式。

比如，李老師挑選的一則新聞是希爾頓在西藏的林芝開了一家高級酒店。在為了非同步網課錄製的教學影片中，除了向學生介紹講解這則新聞外，也到該酒店的網站介紹飯店裡的基本設施和房型，也藉由 Google Maps 介紹西藏的地理位置，讓學生在聽和讀這則新聞時，能從中自然地學習詞彙和文化知識，並在學校的學習管理系統 Canvas 出幾題閱讀理解的小考題目，以確定學生有完成課前準備。學生的背景知識和語彙建立起來後，同步網課時就請學生分享討論，如果全班去西藏旅遊，大家想不想住在這一間酒店、住幾天、哪一天住可以節省費用。藉由屏幕分享功能，帶著學生們進入該酒店的網站，查看房型和費用，討論有多少人想去或不想去住、原因為何。當學生表達想法卻受限於中文的語言能力時，老師就能立即重述，提供語言輸入，協助學生表達想法，發揮同步溝通的正向功效。

3.1.3 持續行之已久的例行活動

如前文所述，陳老師在實體課裡有很多小幫手，有的是老師指派的，有的是學生們依照自己喜好選擇他們想擔任的角色。比方說「警察」負責維持上課秩序，得適時地用中文說「請安靜」；天使負責關心其他學生，有人打噴嚏的時候得用中文說「保佑你」。在網課時，這些小幫手依然執行他們的工作，例如，由班長領頭的開頭儀式，以及由小老師帶領天氣預報，這些例行活動有助於讓學生一上課就將思維轉換成中文模式，並輕鬆地建構起一個互助的學習環境。

[4] The Chairman's Bao 的網址 https://www.thechairmansbao.com/

具體的做法是，上課時間一到，班長準時帶領全班連說帶演地念「上課歌謠」，然後班長一聲令下：「站起來」，請全班起立後，班長帶頭說「老師好」，全體同學跟著說：「老師好」；接著，班長說「同學好」，全體同學跟著說「同學好」；接下來，班長說「大家好」，全體同學則說「班長好」，班長可以說他想說的任何問候語，包括「早上好」，「下午好」等，全班同學則依班長說出來的問候語做適當的回應。最後，班長請全體坐下，再由小老師向全班進行天氣預報的問答。

在天氣預報活動進行前，老師可以先打好例句及引導句，再配上不同天氣的圖片，截圖之後做為 Zoom 的虛擬背景，引導小老師問問題，並協助其他學生回答問題。例如，「今天是幾月幾號星期幾？」、「這週是第幾週的網課？」、「今天天氣怎麼樣？」、「現在溫度幾度？」等。依照每班學生的語言水平，陳老師還會設計不同的引導句型，從簡單的「今天早上___（晴天/下雨/風很大等等）」到比較複雜的「明天雖然___，但是___。」，或者「明天不但___，而且___。」

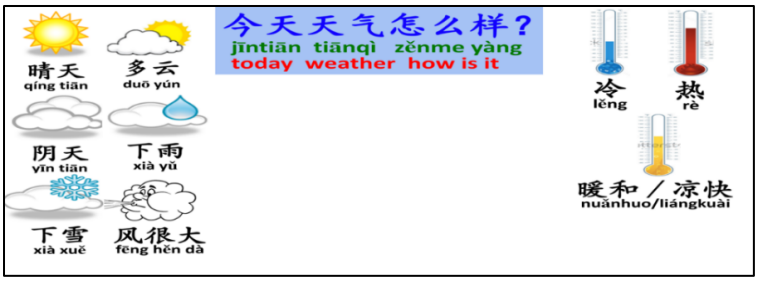

圖 3 老師自製用於 Zoom 的虛擬背景

上實體課時，班長和小老師是由玩「剪刀石頭布」活動勝出的兩位學生所擔任的，每兩個星期為一任。由於網課模式的侷限，可以改用網上免費的 Wheel of Names[5]，先輸入學生的名字，設定好之後，每次上課時就使用它來選出新的班長和小老師，方便又省時。

此外，陳老師在平時實體課時，會穿插大腦休息（brain break）此一活動。網課開始後，每一節網課是 75 分鐘，對六、七年級的學生來說，要坐在電腦面前用高度的專注力持續這麼長的時間，更加容易感到疲倦。因此在課堂時間的安排上，會每 15-20 分鐘，就讓學生站起來動一動。依照上課內容，給予時間長度從 5 秒到 3 分鐘不等的任務。比如說：做十下開合跳的體操、比賽誰最快找到某種指定的物品、介紹家裡的寵物、找家人的照片、介紹家人給同學認識、到冰箱尋找某種食物。

另外，練習正念（Mindfulness）也是一個不錯的方式。正念就是指透過冥想和呼吸調節等方式，藉由讓身心平靜下來並從新回到當下，拉回學生的學習專注力。網絡上有很多有關正念的視頻[6]，取得方便。

[5] Wheel of Names 的網址：https://wheelofnames.com/

[6] 比如說方形呼吸法 https://www.youtube.com/watch?v=n6RbW2LtdFs，或是放鬆呼吸練習 https://www.youtube.com/watch?v=gLbK0o9Bk7Q

3.2 以理解詮釋模式為主軸的非同步網課

非同步網課時間，李老師會使用 Zoom，根據課文內容錄製教學影片給學生觀看。以中級中文課為例，每兩週就要上完教科書裡的一課。進入新的一課時，第一週以上述的方式進行同步網課，重點在於學習目標中的人際互動模式，並引起學習動機，生詞和單字盡可能在自然互動中帶入。第二週的非同步網課時間，則是請學生觀看老師依據課文錄製好的教學影片，然後完成線上小考。

因為是每週三次五十分鐘的課，所以將課文分三次錄製。在錄製時，使用 Zoom 裡的屏幕分享功能，開啟電子版的課文，在解說課文時，不是以平鋪直敘或是逐字逐句翻譯的方式進行，而是先將與課文相關可加以延伸的視頻、圖片或地圖等真實材料（authentic materials）的視窗都準備好，以方便隨時切換。比如說，有一課的課文內容是雲南旅遊，在上課前，就先將 Google Maps 的視窗準備好，介紹雲南的地理位置和觀光景點時，就可以搜尋給學生看；也在 YouTube 將想要和學生分享的視頻準備好，播放時，可以使用 MovieTalk[7]此一教學技巧，將影片靜音後，藉由老師以類似旁白的方式，一邊播放和暫停影片，一邊描述，以提供大量的可理解輸入。如前所述，有新的詞彙時，建議切換到 Google Translate 或是 Google Docs 的視窗，做一個詞彙表分享給學生，以利學生複習。

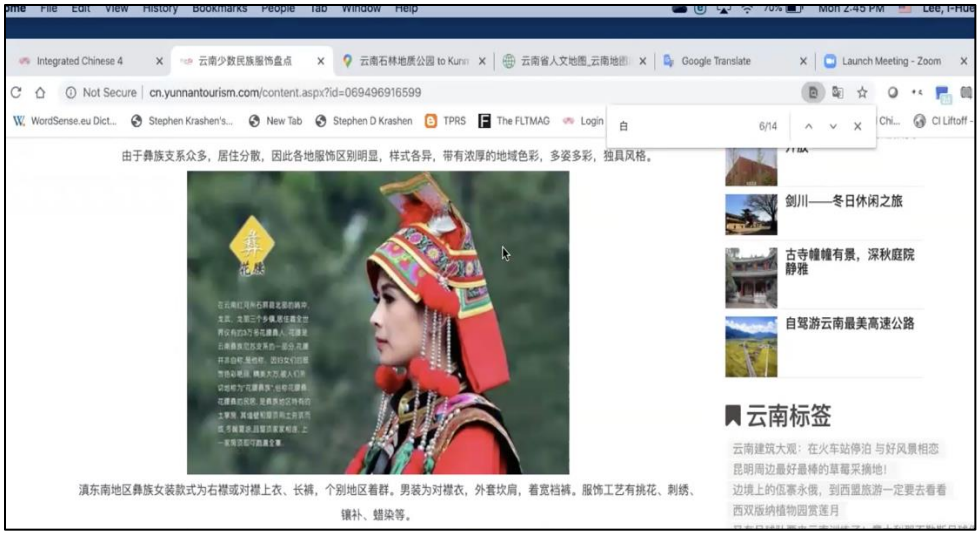

圖 4 錄製課文教學視頻時，切換視窗，帶入真實材料

每次錄製的教學視頻約 30 分鐘。為確保學生有看視頻，且認真聽懂老師所說的內容，學生在看完視頻後，還需要在 Canvas 回答老師針對每個視頻內容出的小考題目。這些題目，除了涵蓋對課文內容的理解，還會加入一兩題老師在視頻裡談及的事。比如說，老師在 YouTube 選的旅遊視頻裡，介紹到雲南料理通常偏辣的文化知識，在用 MovieTalk 此一教學技巧給這段視頻加旁白時，老師會刻意談及自己不喜歡吃辣的食物這件事情，這就成了一題測試學生是否真的有看視頻的小考題

[7] 想多了解 MovieTalk 此一教學技巧，可參考 https://comprehensibleclassroom.com/how-to/movietalk/

目。也可以讓學生看完上課的視頻後，根據單元的 Can-Do Statements 延伸出任務型的（task-based）作業。比如說，請學生到影片錄製為主的學習社群網絡工具 Flipgrid，錄製一個簡短的視頻，根據課文和視頻裡介紹的景點，選一個自己最想去的地方，簡短描述該地點的特色並說明原因，並請學生回覆兩到三位同學錄的視頻，這就自然延伸出一個非同步的人際溝通模式作業。

此外，EdPuzzle[8]、Playposit[9]和 Padlet[10]等，都是兩位老師除了學校的學習管理系統之外，推薦使用的免費線上互動教學工具，非常適合用於非同步網課中以聽為主或是以閱讀為主的理解詮釋模式。以 Playposit 為例，老師先在網上搜尋符合學生語言水平且內容有趣的影片，在影片中除了穿插問題以確定學生理解所觀看的內容以外，也可以透過錄製旁白或是加上文字註釋，以提供鷹架（scaffolding）協助學生理解影片內容。除此之外，老師也可以透過報表，更了解學生的學習成效。

3.3 以表達演示模式為主軸的非同步網課

Flipgrid 是一個非常適用於非同步網課時指定學生完成表達演示任務的軟件，也適合用來評量學生的學習狀況。比如說，在初中部的同步網課裡，陳老師先透過個別化的問與答 (Personalized Questions and Answers) 活動，示範面試的情境，將生詞自然地帶入句子中。在提供充分的可理解輸入後，再將學生分組放在 Zoom 的分組討論室 (Breakout Room) 裡，讓學生彼此進行練習。為了引導學生如何問問題以及給予更多的可理解輸入，老師會事先在 Flipgrid 錄製示範影片，並將問句打在 Flipgrid 裡，這樣一來，學生在練習的時候，就可以一邊看著影片，一邊依據老師建議的問題面試同學。之後，學生的回家作業是用 Flipgrid 錄製一段影片，介紹自己在課堂裡所面試的同學，或者找一個自己最喜歡的布偶娃娃或毛絨動物做道具，一人分飾兩角。陳老師也在各個不同水平的班級裡，依照課程內容，給予不同展示與講述 (Show and Tell) 任務。比方說，中文一的學生在 Flipgrid 分享他們最喜歡的課，並解釋他們為什麼最喜歡這門課，以及上課的時候做些什麼活動；中文二的學生則是介紹自己最喜歡吃的中國菜，包括菜名及做法。

這些影片不僅是學生學習成果的展現，而且可以當作互相激勵學習的平台。在學生上傳影片之後，陳老師會要求學生觀看其他同學的視頻，給予其他同學正向的反饋。可以從簡短的「我喜歡你的視頻」到分享自己類似的經驗。這時候這項活動就從表達演示模式轉化成人際溝通模式，而且有助於建立一個關懷型的學習共同體。

由於這項活動是在非同步網課進行的，老師不能隨時從旁指導或立即回答問題，所以步驟和細節的交代及成果目標的釐清就非常重要。老師能以書面方式將步驟及疑難排解（troubleshooting）羅列清楚，甚至外加視頻示範，讓學生看到老師所期

[8] 網址：https://edpuzzle.com/
[9] 網址：https://go.playposit.com/
[10] 網址：https://padlet.com/

待的學習成果，Flipgrid 可以幫助老師同時做到這兩件事，建議老師們不妨好好利用這個免費的線上工具。

3.4 網課下語言測驗的挑戰與範例

對於此次的應急遠程教學，不少老師討論到線上測驗的困難度。比如說，要如何同步線上監考全班學生以防止作弊，或是要如何測出學生在沒有任何輔助工具下中文的手寫能力。其實這些問題的根本思維，依然是如何將傳統強調記憶和背誦的紙筆測驗原封不動的搬到線上進行。事實上，線上教學和測驗雖然有其挑戰，但是線上教學不但能打破實體課中時間和空間的侷限，也提供了善用線上教學工具的可貴機會，讓老師們能夠重新檢視自己語言測驗的方式和目的。比如說，是否應該加重學習過程中的形成性評量（formative assessment）而非總結性評量（summative assessment）；或是取消詞彙小考和填空題，取而代之的是任務導向測驗。

如前所述，當前語言教學應該重視學生的功能性語言，因此，語言測驗應該轉型為溝通式任務（communicative task）。根據 VanPatten（2017）的想法，任務可大可小，而且分成兩大類，分別是語言輸入導向（input-oriented）任務，也就是聽和閱讀這兩方面的詮釋理解能力；另一類是語言輸出導向(output-oriented)任務，也就是在說和寫上語言的產出。此外，任務的內容和難易度要依學生的語言水平而定，對於語言水平在初階的學生，給予的任務應該著重於詮釋理解模式，隨著學生語言水平的提升，給予的任務就適合增加以語言輸出為主的任務。不論任務為何，著重點要在意思（meaning）層次的詮釋或/和表達，而且要有溝通性目的（communicative purpose），任務的內容可能是聽一則天氣預報後決定明天要穿什麼，或是錄一段影片向新進的國際學生推薦該校。

以下是如何在線上進行期末口試的技術層面分享。在和學生的腦力激盪下，陳老師因為此次應急遠程教學而首次嘗試了結合 Zoom 和 Flipgrid 在線上對全班學生進行個別期末口試，這項新嘗試讓線上口試測驗能非常有效率地完成，因此在此做經驗分享。

在口試開始時，請學生先將 Zoom 靜音，這樣一來，學生只會聽到老師的對話題目，但是在回答問題時，同學之間不會聽到其他同學說的答案，因此不會互相干擾。接著，請學生開啟 Flipgrid 的錄影功能，但請學生不要戴耳機，這樣才能錄到老師的問題。接著，老師就同步向全班學生說出口試題目，依照答案的長短，留給學生適當的時間回答老師的問題。比如說，在初級中文班裡，老師在 Zoom 同步向學生問第一個問題是：「請問你叫什麼名字？」學生聽到題目後，就在 Flipgrid 錄下答案，老師在十秒後，接著問第二個問題：「你今年幾歲？」老師的問題和學生的答案都能在學生自己的 Flipgrid 完整錄下。對話考試結束後，老師就到 Flipgrid 聽每一位學生的回答。此人際溝通期末口試方式，不但全班同步進行，還能清楚錄到每位學生自己的答案，是非常有效率的方式。此外，這個方式體現人際溝通模式裡所強調在自然情境下發生（spontaneous）的，能夠實際測出學生在沒有事前背誦或照稿唸出情形下的語言表現。

4. 應急遠程教學的省思

危機即是轉機。本文的兩位老師，都因為此次的應急遠程教學開始了全線上教學的新嘗試，雖然有些措手不及，但在挑戰中也獲得新的學習機會。以下分享對此次應急遠程教學經驗的省思。

首先，雖然這個世代的學生們被視為數位原生（digital native），而大部分的老師則被視為是數位移民（digital immigrant）(Prensky, 2001)，但是，不要過於高估學生們使用網絡進行學習的能力。Winke & Goertler (2008)的研究也顯示，學生的電腦識讀能力（computer literacy）在以個人使用為目的與在以學習或專業為目是不同的。也就是說，學生可能善於使用手機和網絡來進行社交活動，但不一定熟悉如何透過網絡來學習。因此，學生和老師一樣，都需要時間來學習如何使用線上教學工具。我們建議除了提供清楚易懂的步驟外，最好還能帶著學生操作一次，讓學生能從做中學，並錄製示範短片，讓學生更具體清楚地知道要如何完成老師指定的作業。

此外，線上學習需要學生有更強的時間管理和自我學習的能力。應急遠程教學不僅給老師們帶來不少挑戰和挫折，學生們也因為面授實體課的突然取消，以及疫情所帶來生活和學習上突然的轉變和各種新的挑戰及壓力，學習的參與度和成果都可能下降。如 Hodges 等人（2020）所言，這些困境都是在應急遠程教學下可預見的。他們建議，非同步教學可能因此比同步教學合適，在作業提交的截止日期和課堂規定上也須提供彈性。

本文兩位老師認為同步教學與非同步教學在應急遠程教學時是同等重要，但是網課期間，確實由於沒有老師時時刻刻在身邊，就比較容易出現鬆散懈怠的現象，所以師生之間就更需要通過電子郵件溝通。可以先發給學生，提醒他們哪裡沒有做好，如果學生在限期內沒有改善，在中學任教的陳老師會再發一個郵件給學生並通知家長，因為學校裡的家長都很支持老師，是老師最好的盟友，只要他們知道自己的孩子學習出了問題，都會盡量配合老師。因為學校和家庭的緊密合作，陳老師在學期末收到不少家長的電子郵件，感謝她讓家長們從旁參與孩子的教育，協助學生們順利地度過了這個非常時期。也有不少學生表示，即使因為疫情而突然轉成線上課，中文課依然充滿樂趣。下面的截圖是一封陳老師的學生在應急遠程教學時的來信。

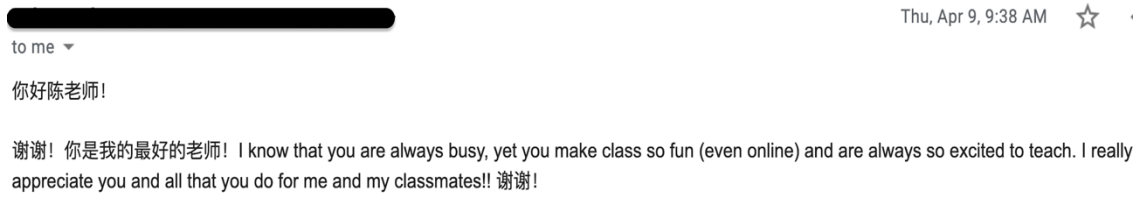

圖 5 線上中文外語學習仍然可能充滿樂趣

第三，老師要善用但不濫用科技。因為此次疫情，使得許多老師們不得不正視科技融入語言教學此一議題。本文的兩位老師在平時實體課時，就已經將許多教材和作業放在學校的線上管理系統，因此，當應急遠程教學開始時，就不會像不用線上管理系統或是只用線上管理系統登記成績的老師們那麼手忙腳亂。更重要的是，老師們在使用科技融入教學時，不該盲目地濫用科技，而是應該先檢視自己的教學目標和內容，釐清有什麼功能是學校的線上管理系統無法提供的，再去補充額外的線上教學工具，才能做到 Tochon & Black（2007）所強調「適合教學的科技融入」（pedagogically appropriate technology integration）。

第四，老師平時就要建立自己的專業學習網絡（professional learning network），不斷進修、互相分享。在此次的應急遠程教學期間，在美國有許多外語教師團體都提供不少免費的資源和學習機會，協助外語老師們進行線上教學。在 Facebook 和 Twitter 等社交媒體平台上，也有許多外語教師無私地分享實用的線上教學技巧。在二十一世紀從事教學的老師們，不該孤軍奮戰，而是不斷地從自己的專業學習網絡中成長精進。

最後，本文分享的有效教學實例，不應該被視為一體適用於所有的教學情境中。比如說，在陳老師所任教的中學，由於學生的高社經地位背景，線上教學必要的電腦硬體和網絡資源，對該校的師生而言不成問題。但這些可能是在低社經社區學校任教的老師們首要克服的困境；李老師教授的對象是大學生，且班級人數少，因此班級管理上不需特別費心。此外，兩位老師的教學設計，皆是以美國外語教學協會的五大標準（5C）架構出標準本位（standards-based）課程，尤其強調溝通目標，並建基於更深層的外語習得理論。因此，當其他老師們在採用本文分享的教學範例時，不但應該要知其然，更應該知其所以然，知道這些教學設計背後的本質和原理原則，檢視自身所在的情境脈絡和教學目的，以及自己的教學信念和原則，如此一來，更可能延伸出符合自身教學情境和個人教學特質的創意性變化。

雖然 2020 年春季的應急遠程教學已經告一段落，但老師們應該從此次的經驗中，好好檢視自己的教學方式和內容。在實體課時，就應該以學校的線上管理系統為基礎，過濾並補充需要的線上教學工具，如此一來，當要網上教學時，許多教材就隨手可得；善用線上教學工具也可以讓平時實體課中沒有來上課或學習落後的學生有了自主學習的網上教材。

總結，本文兩位老師對此次應急遠程教學最大的省思是，在二十一世紀從事教學的教师，不應該再侷限於二元化思考，認為實體課和線上教學是兩種完全不同的教學方式，而是應該在實體課時就建立起完善的線上教材，融入兩者優點，以提升語言學習的效果，也能讓實體課和線上課之間的轉換更為順暢。

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