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Articles

- Intelligibility of Chinese Synthesized Speech and Learners' Attitudes towards Its Use in
CSL Learning and Instruction: A Preliminary Study
(中文合成语音的可理解性及学习者对其在中文二语教学中应用的态度初探).....1
Wang, Yanlin, *Texas Tech University* (德克萨斯理工大学)
Da, Jun, *Middle Tennessee State University* (中田纳西州立大学)
Yin, Chengxu, *University of Notre Dame* (圣母大学)
- The Design of a Web-based Placement Test for College-Level Chinese Language
Programs
(论大学中文项目网上分班考试的设计).....17
Qian, Zhiying, *Florida State University* (佛罗里达州立大学)
- Design of Synchronous Remote Teaching of A Chinese Language Class: Theory and
Practice
(设计同步远程中文语言课堂：理论及实践).....39
Bao, Yingling, *Indiana University Bloomington* (印第安纳大学)
Chen, Yea-Fen, *Indiana University Bloomington* (印第安纳大学)
- Columns**
- Chinese Online Teaching and Learning: The CMU OLI Chinese Online Program
(网上中文教与学: CMU OLI 网上中文课程).....64
Wu, Sue-mei (吴素美), *Carnegie Mellon University* (卡内基梅隆大学)



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Intelligibility of Chinese Synthesized Speech and Learners' Attitudes towards Its Use in CSL Learning and Instruction: A Preliminary Study¹

(中文合成语音的可理解性及学习者对其在中文二语教学中应用的态度初探)

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Abstract: Text-to-Speech technology has the potential to produce audio materials for instructional purposes. Before the technology can be used as a technological assistant tool to aid second language instruction and learning, there are second language acquisition and pedagogical questions that need to be addressed. This study investigated the intelligibility of Chinese synthesized speech and CSL (Chinese as a second language) learners' attitudes towards the use of Text-to-Speech technology in second language learning and instruction. Data from a survey with 39 beginning and intermediate level participants from three different American universities showed that CSL learners were able to distinguish between audio recordings made by real persons and those made by computers, and found Chinese synthesized speech intelligible. At the same time, those participants also agreed that Text-to-Speech technology could be helpful and welcomed the use of the technology to assist their Chinese language learning. These findings support the idea that CSL instructors can now experiment with current Text-to-Speech technologies in their classroom instruction so that a better understanding of the effects of Text-to-Speech technology on second language acquisition and issues involved in its instructional use can be achieved.

¹ Results reported in this paper are part of a research project titled *The use of speech processing technologies for beginning and intermediate level CSL (Chinese as a Second Language) learning and instruction* approved by the IRB of Middle Tennessee State University (Protocol ID: 22-1120 2q). Preliminary analysis of results from this study was first presented at the 2022 Chinese Language Teachers Annual Conference by Chengxu Yin, Jun Da, and Yanlin Wang under the title *The use of speech processing technologies for novice- and intermediate-level CSL learning and instruction*.

摘要: 语音合成技术在合成教学听力材料方面具有潜在的应用前景。然而, 将其直接用于辅助二语教学之前, 有必要深入研究其在二语习得和教学法方面的相关问题。本研究采用在线问卷探讨两个问题: 其一是基于二语学习者视角的中文合成语音的可理解性; 其二是在二语习得及教学中使用语音合成技术时, 中文二语学习者持何态度。来自三所美国大学的 39 名初、中级中文二语学习者自愿参与了本研究。问卷数据显示对于真人录制的音频和计算机生成的音频, 中文二语学习者能够加以辨别, 并能听懂中文合成语音。同时大多数参与调研的学习者均表示语音合成技术有助于提高他们的外语听力技能, 支持教师在二语教学中使用语音合成技术。本研究提出现阶段二语教师可以在实际教学中尝试使用语音合成技术, 这样可以更好地了解其在二外习得中有哪些效果, 以及在教学使用中有哪些问题。

Keywords: Text-to-Speech technology, synthesized speech, intelligibility, learners' attitudes, learning and instruction of Chinese as a second language

关键词: 文字转语音技术、合成语音、可懂度、学习者的态度、中文二语教学

1. Introduction

Text-to-Speech technology (TTS) refers to the conversion of digital text into speech by computers. Computer-generated speech, or synthesized speech, can be pre-recorded or produced in real time. Since the invention of first general (English) text-to-speech systems in the 1960s (c.f., Wikipedia, n.d.), the technology has gone through several decades of development and matured. It is now readily available as a general-purpose consumer technology and in multiple languages including Chinese, and it can be found on mobile or other smart devices and is embedded in a variety of software applications and services. With easy access to the technology and its capabilities, consumers have adopted it for real world use in a variety of settings. It is not infrequent to find, for example, video clips dubbed with artificial voices on YouTube or other virtual universes such as bilibili where the technology is used in place of real human voices for convenience of production or due to privacy concerns. As TTS technology is becoming ubiquitous and welcomed by consumers, second language learners will most likely encounter it in real-world communications. Accordingly, it is now the time to examine the feasibility of applying the technology for second language learning and instruction.

1.1 Instructional audio materials production in second language learning and instruction

In second language instruction, audio materials used for language development come from two main sources: authentic materials made by native speakers for native speakers' consumption, or customized materials authored by instructors or other speakers for learning purposes. The latter is more often found in beginning and intermediate level classes where learners' language proficiency is limited, and it is more challenging, if not impossible, for instructors to find and adapt authentic materials that would be suitable for this specific group of learners and fit the curriculum design. In the traditional way of producing such instructional audio materials, instructors would record audio materials themselves or find someone else for help. This method of producing audio materials is often time consuming, or sometimes even hard to do because of the lack of personnel (imagine there is only one instructor available to record a conversation) or the lack of availability of the developers.

While the inconvenience and difficulty in recording audio materials by instructors themselves has limited the availability and quantity of suitable listening materials for learners, instructors often receive requests from learners, especially from auditory learners, for additional or supplementary audio materials to reinforce print-based or digital texts for a more robust learning experience. Given the amount of time and labor required to record audio with human voice, these requests are often not met (in full) in practice.

In contrast to recording audio with human voice, computers can generate audio from digital texts easily and efficiently. The convenience afforded by the Text-to-Speech technology makes it an appealing alternative to produce audio materials for second language learning.

1.2 The use of TTS in second language learning and instruction

Text-to-Speech technology was first applied in education as an assistive technology for disabled students such as reading systems for the blind (Taylor, 2009). As an assistive technology, it is mostly used by learners who are native speakers. By enabling auditory input, it helps those learners who would otherwise be deprived of access to learning materials or other inputs. It also helps learners gain or improve other skills such as reading literacy. For example, Wood, et al. (2017) conducted a meta-analysis of prior research on the effectiveness of the technology on reading comprehension and found it modestly effective. When it is used by native speakers, there is less concern if the audio generated by the computer is natural. Robotic speech (sometimes with erroneous prosody and/or pronunciation) is tolerated as long as the synthesized speech is intelligible and does not negatively affect real world communications.

In contrast to the use of Text-to-Speech technology by and for native speakers, when the technology is to be used in second language education, synthesized speech,

whether pre-recorded or generated in real time, is most likely to serve as a language role model for second language learners and will interact with learners directly where computers have increasingly become participants in real world communications. Such a functional change brings about a series of second language acquisition and pedagogy questions that have to be addressed if the technology is ever to be applied in second language learning and instruction. For example, is synthesized speech intelligible, and does it sound natural and authentic to non-native speakers? Will second language learners welcome the use of TTS technology for their language learning? In what ways can synthesized speech help second language acquisition?

Prior research has explored some possible applications of Text-to-Speech technology in second language education and its related issues. For example, Bione et al. (2016) reported that EFL (English as a foreign language) learners hold a positive view towards the pedagogical use of TTS, and that they would like to use the technology as a learning tool. Kent (2021) investigated the potential of a voice-user interface in TESOL (Teaching English to speakers of other languages) and reported that participants found it acceptable. Cardoso et al. (2015) reported that synthesized speech was equally effective as human speech when it was used in a listening perception task. Liakin et al. (2017) found that the pedagogical use of mobile TTS technology was helpful in complementing and enhancing the teaching of L2 pronunciation of French liaison.

Text-to-Speech technology is also found to be useful for the development of other second language skills. Huang and Liao (2015) reported that digital materials enhanced with TTS technology helped ESL learners' vocabulary learning and improved their motivation. Proctor et al. (2007) found that the use of TTS reading aloud functionality was associated with vocabulary development and reading comprehension gains.

As compared with prior research on other second languages (mostly ESL, or English as a Second Language), there are, to the best of the authors' knowledge, very limited studies on the use of Text-to-Speech technology for learning Chinese as a second language (CSL). Soon et al. (2020) studied the intrapersonal and interpersonal perceptions of 119 Chinese language learners at a large Malaysian university towards the use of Pinyin TTS system developed by the authors themselves and found that those learners had a modest positive perspective and agreed that the system helped improve their pronunciation. Yeh (2014) conducted a multi-case study of five K-12 Chinese language teachers on the use of Text-to-Speech, Speech-to-Text, and machine translation technologies in their classroom instruction and reported that the attitudes of teachers, administrative support, and ease of use and access to technology were the key factors in the teachers' actual use of the technologies.

Since the sound systems of human languages differ from each other, and speech engines rely on language specific models and parameters to produce audio output, there is the need to (re-)investigate the same issues with the Chinese language and to determine

whether similar findings from prior research on other languages such as ESL are also applicable to learning Chinese as a second language (CSL).

1.3 Objectives and research questions of this study

Given the very limited scope and nature of previous research in the case of CSL, this study is designed to investigate two underlying issues that inform whether further exploration of the use of TTS technology for CSL learning and instruction is warranted. The first has to do with intelligibility: Can beginning and intermediate level CSL learners distinguish between audio recordings made by a human and those made by a computer? Can synthesized Chinese speech produced with the current off-the-shelf consumer technology be understood by CSL learners, especially those at the beginning and intermediate levels? Even though the current consensus among native speakers is that synthesized speech is not perfect and its deviation from natural human speech can be easily identified, it is necessary to confirm if second language learners, especially those CSL learners at the beginning or intermediate level, also find synthesized speech intelligible.

The second issue is related to CSL learners' attitudes: What are the attitudes of CSL learners toward the use of synthesized speech for their Chinese language learning? It has long been understood that attitude correlates positively with language learning outcomes (c.f., for example, Gardner, 1968). In the case of using synthesized speech for CSL learning, it will be interesting to explore whether CSL learners hold a positive or negative attitude when they are able to differentiate between human speech and computer-generated speech. A negative attitude will likely affect the adoption and effectiveness of synthesized speech for language acquisition when it is used in learning materials by the instructors or when learners encounter it elsewhere (such as in the digital universe where native speakers are producing increasingly more of such audio materials).

If TTS technology is ever to become a viable alternative for producing audio materials for second language learning or serve as a positive language role model, it is expected that synthesized speech should be equally intelligible to second language learners as to native speakers, and at the same time, be welcomed by second language learners as a technology to aid in their second language learning.

2. This study

This study invited Chinese language learners as volunteers from three American universities to investigate whether CSL learners, especially those at the beginning and intermediate levels, can differentiate between audio recordings made by humans and those made by a computer, and their attitudes towards the use of synthesized speech in their Chinese learning. It was hoped that the data would help to explore the feasibility of using synthesized speech in the teaching Chinese as a foreign language.

2.1 Participants

In total, 42 students from the University of Notre Dame, Middle Tennessee State University, and Texas Tech University were recruited to participate in the study. After data collection, it turned out that 3 out of those 42 participants were native or bilingual heritage speakers. Their data were excluded in the final data analysis in order to maintain the homogeneity of the samples and to guarantee the reliability of the results.

Although the data was collected across three American universities, the participants' achieved similar beginning or intermediate level Chinese language proficiency due to similar course settings, requirements, and teaching pace. At the University of Notre Dame where *Integrated Chinese* is adopted, both the beginning and intermediate level Chinese classes meet five times per week. At Texas Tech University, the beginning level Chinese classes also meet five hours per week, whereas the intermediate level classes meet three times per week. Similar to Texas Tech University, classes at both the beginning and intermediate level at Middle Tennessee State University meet three hours per week. The latter two universities use the same textbook *Chinese Link* for instruction. Students from the University of Notre Dame and Texas Tech University were either majoring or minoring in Chinese, while all participants from the Middle Tennessee State University were non-major or non-minor students at the time when the experiment was conducted in Spring 2022.

Among the 39 participants that were included in the final data analysis, 17 students were recruited from the University of Notre Dame, 10 from Middle Tennessee State University, and 12 from Texas Tech University. Twenty-eight students were taking beginning level Chinese language classes at their respective universities, 10 were taking intermediate level Chinese language classes, and 1 student didn't report the Chinese language class he/she was taking. At the time when this study was conducted, the beginning level students had all completed one semester of classes, either 45 (3 hours/week) or 75 (5 hour/week) hours of class instruction, and the intermediate level students had completed three semesters, either 135 (3 hours/week) or 225 (5 hour/week) hours of class instruction. Although the course settings among the three universities were different, it is safe to consider all participants' language proficiency to have been at either the beginning or intermediate level. None of the participants were advanced-level learners.

In terms of previous experience using speech processing technologies in their native languages, 37 out of 39 (95%) participants had used smart devices such as iPhone, Google TV and/or Amazon Echo, etc. Thirty-six participants (92%) were aware of the voice-enabled functions in their native languages on the smart devices. Thirty-two (82%) participants were aware that some video clips on YouTube were dubbed with computer-generated speech in their native languages, and thirty-three participants (85%) had watched video clips or heard audio clips that were dubbed with computer-generated speech in their native languages. As compared with their experiences in using speech processing technologies in their native languages, a large portion of participants also had similar

experiences in Chinese speech processing technologies. Twenty-six (64%) participants had watched video clips or heard audio recordings dubbed with computer-generated speech in Chinese. Twenty-five (64%) had used computer-generated speech in their Chinese learning. These data suggest that the majority of participants in this study have had rich experiences in using speech processing technologies in both their native languages and Chinese.

2.2 Materials, research design, and data collection

2.2.1 Materials

In this study, 10 audio clips were used as audio prompts to examine whether the participants could identify audio recordings made by humans and those generated by computers. Among them, 5 audio clips were recorded by humans and the other 5 were generated using Tencent's Text-to-Speech (TTS) technology². The 5 audio clips recorded by real people were downloaded from *China Plus*³, the official English news website of China Radio International, and *Chinese Take-In*⁴, online learning materials for first-year Chinese learners developed by the University of Texas at Austin.

In order to minimize the effect of participants' familiarity with the materials on the identification task, 4 unfamiliar sentences beyond the participants' current language levels (as judged by the authors) were mixed together with the other 6 sentences that were deemed to be comprehensible to all participants. The transcripts of the 10 audio clips and their attributes are presented in Table 1 below.

Table 1 Transcripts of the ten audio clips used in the study

Transcripts of the audio clips	Attributes
Q6: 你是老师吗?	CG
Q7: 我不是中国人。	RP
Q8: 明天起冷空气东移南下驱散北方雾霾。	RP
Q9: 法德领导人就应对欧元区债务危机采取全面有力的解决方案达成一致。	CG
Q10: 我是中国人。	CG
Q11: 我是老师。	CG
Q12: 我也没有哥哥。我有一个弟弟。	RP
Q13: 明天起冷空气东移南下驱散北方雾霾。	CG
Q14: 法德领导人就应对欧元区债务危机采取全面有力的解决方案达成一致。	RP
Q15: 我是美国人。	RP

² Tencent's Text-to-Speech technology: [https://cloud.tencent.com/product/tts_\(in_Chinese\)](https://cloud.tencent.com/product/tts_(in_Chinese)) or <https://www.tencentcloud.com/products/tts> (in English).

³ China Plus: <https://chinaplus.cri.cn/>

⁴ Chinese Take-In: https://www.laits.utexas.edu/chinese_take_in/about.php

Note: 1) CG stands for computer-generated, and RP real person voice; 2) Q6, Q7, ... represents the specific question number as they appeared the online survey (to be discussed below).

As can be seen in Table 1, both Q8 (read by real person) and Q13 (generated by computer) had the same content that were beyond the participants' current language proficiency levels, as were Q9 and Q14. All the other sentences would be comprehensible to all the participants since they were all covered in the beginning level Chinese textbooks used at the three American universities.

2.2.2 Experiment design and procedure

An online survey was used to answer the research questions regarding the feasibility of using synthesized speech in teaching Chinese as a foreign language, especially at the beginning and intermediate levels. The survey consisted of four parts. The first part collected participants' language background and CSL learning information, such as their current Chinese levels, textbooks they were using, and Chinese language courses they were taking, etc. The second part contained questions that asked participants to identify audio recordings made by a real person and computer (c.f., Figure 1) and self-report their comprehension. The third part asked participants to read aloud 12 lines of text and used Speech-to-Text technology to recognize their speech⁵. The fourth part investigated participants' experiences (with Yes/No questions) and opinions (using 5-point Likert scales) towards using speech processing technologies in both their native languages and Chinese (c.f., Table 2).

Part 2/4 Listening comprehension

Listen to the following audio recordings and select the best option. You can replay the audio recordings if needed.

Q6: ▶ 0:00 / 0:01 🔊 ⋮

The audio is recorded by

A real person Computer Cannot tell Skip

Do you understand the audio clip?

Yes No Skip

Figure 1 Part 2 of the online survey

The survey was developed and made available on a secured server at Middle Tennessee State University. Following the institutions' IRB policies, the participants from the three universities completed the survey anonymously either at home or in language labs based on their personal schedules and preferences. Before the study, all participants read and signed the informed consent form online. No personally identifiable information was collected throughout the process.

⁵ The third part is not related directly to the research questions at hand and hence the results is not reported in this paper.

Table 2 Questions about participants' previous experiences and attitudes

Experience in native languages	Q31. Are you aware that some video clips on YouTube are dubbed with computer-generated speech in your native language?
	Q32. Have you watched video clips such as on YouTube or heard audio clips that are dubbed with computer-generated speech in your native language?
Experience in Chinese	Q33. Have you watched video clips such as on YouTube or heard audio recordings dubbed with computer-generated speech in Chinese?
	Q34. Have you ever used computer-generated speech in your Chinese learning?
Attitude	Q35. Do you agree that computer-generated speech can help improve your Chinese listening skills?
	Q36. Would you object if your Chinese teacher used computer-generated listening materials in your Chinese class?

2.2.3 Variables and data analysis

Seven (7) variables were used for data analysis, including 1) the language proficiency levels of participants (labeled as “LEV” with 2 levels, beginning vs. intermediate), 2) the language difficulty of the audio clips (labeled as “DFT” with 2 levels, comprehensible at or beyond their current proficiency levels), 3) the frequency of participants' correct identification of the audio clips (labeled as “JDG”, i.e., if they can tell if a particular audio clip was made by a human or computer), 4) participants' self-reported comprehension of the 10 audio clips (labeled as “UDS”), 5) participants' self-reported experiences of using synthesized speech in their native languages (labeled as “EPN”), 6) participants' self-reported experiences of using synthesized speech in Chinese (labeled as “EPC), and 7) participants' attitudes towards the use of synthesized speech (labeled as “ATT”) for Chinese language learning.

Regarding the language proficiency levels (LEV), beginning level was coded as “1” and intermediate level as “2”. As for the language difficulty (DFT), the 4 sentences which were deemed to be beyond participants' comprehension were coded as “2” and the other 6 were coded as “1”. The numerical variables, identification (JDG), and comprehension (UDS) were collected from participants' answers to questions in Part 2. If a correct identification of computer speech was made, 1 point was given. All correct points were added as the value of JDG. The self-reported understanding of the audio clips was coded as “1” and no-comprehension was coded as 0. The sum of all audio comprehension was the value of UDS. As long as a student reported he/she had experience in synthesized speech in his/her native languages (EPN), it was scored “1”. Thus the value of EPN (experiences) was the sum of the two questions for EPN (Q31 and Q32, c.f., Table 2), with 1 for each Yes answer. The same coding method was also applied to the value of the numerical variable EPC (Q33 and Q34). As to the 5-point Likert scale variable ATT, the combined mean of the two questions was calculated. All skipped answers were coded as missing data.

Three hypotheses were created for data analysis:

- (1) Students can distinguish between audios recorded by a computer and a real person, and their judgement is not influenced by their Chinese proficiency levels, comprehension of the audio recordings, previous experiences on synthesized speech either in their native languages or Chinese, and their attitudes;
- (2) language difficulty, whether within or beyond the participants' current language levels, has no effect on participants' correct identification of computer-generated speech; and
- (3) under the circumstance that participants can correctly identify audio recordings made by a computer or a real person, most students will still show positive attitude towards the use of synthesized speech in Chinese language learning and teaching.

A Pearson correlation coefficient r was calculated to test hypothesis (1), i.e., the relationships of JDG with LEV, UDS, EPN, EPC, and ATT. An independent sample t -test was performed to test hypothesis (2). The percentage of the students' attitudes was calculated to measure hypothesis (3).

2.3 Results

The Pearson correlation coefficients were computed to assess the relationship among participants' language proficiency levels (LEV), their correct identification of the audio clips (JDG), their understanding (UDS) of the audio prompts, their previous experience in native languages (EPN), their previous experience in Chinese (EPC), and their attitudes towards synthesized speech. The results are shown in Table 3 below.

Table 3 Pearson correlation among JDG, UDS, STN, STC, and ATT

	JDG	LEV	UDS	EPN	EPC
LEV	-.12				
UDS	.18	.29			
EPN	.06	.37*	.05		
EPC	-.09	-.17	-.05	.06	
ATT	-.31	.21	-.13	.18	.01

* $p < 0.05$

There was a positive correlation between the students' language levels and their previous experiences in their native languages, $r = 0.7$, $n = 37$, $p < 0.05$. i.e., participants with higher Chinese language proficiency levels also had more experience with synthesized speech in their native languages. No other positive or negative correlations were found. That is, participants' language proficiency levels did not influence their judgement of the audio clips, whether the audios were recorded by human or computer. Their judgement was neither affected by their' understanding of the audio clips nor their previous experiences with synthesized speech in their native languages or in Chinese. Further, participants' attitudes towards using synthesized speech in teaching and learning Chinese did not influence their judgement of the audio clips.

Table 4 presents the rate of correct identification and participants' self-reported understanding of the audio clips. As can be seen from the table, the participants' identification of computer speech is not 100%. While participants' correct identification of all audio clips reached 64.6% (or 2 out of 3 clips), their successful identification of the four sentences that were deemed to be beyond their language levels was 56.4%, and 70.0% of the six sentences within their current language level. Further, only one out of five (or 21.1%) of the participants could understand the four sentences beyond their level, whereas 95.3% of the participants could understand the sentences within their language proficiency levels.

Table 4 Correct identification and understanding

Questions	Type	Level	Correctness %	Understanding %
Q6: 你是老师吗?	computer	within	76.9	97.4
Q7: 我不是中国人。	person	within	74.4	97.4
Q8: 明天起冷空气东移南下驱散北方雾霾。	person	beyond	51.3	33.3
Q9: 法德领导人就应对欧元区债务危机采取全面有力的解决方案达成一致。	computer	beyond	69.2	12.8
Q10: 我是中国人。	computer	within	53.8	92.3
Q11: 我是老师。	computer	within	33.3	92.3
Q12: 我也没有哥哥。我有一个弟弟。	person	within	92.3	97.4
Q13: 明天起冷空气东移南下驱散北方雾霾。	computer	beyond	79.5	30.8
Q14: 法德领导人就应对欧元区债务危机采取全面有力的解决方案达成一致。	person	beyond	25.6	7.7
Q15: 我是美国人。	person	within	89.7	94.9
Average			64.6	65.6

An independent sample *t*-test was conducted to evaluate the hypothesis that no matter how difficult the sentences were, i.e., either within or beyond their current language proficiency levels, the frequency of participants' correct identification of the audio clips (made by human or computer) would be the same. The test was non-significant, $t(8) = 0.92, p = 0.38$. The result met the assumption that the rate of correct identification does not differ by the two levels of sentence difficulty, i.e., within or beyond their language proficiency levels. The rate of correct identification on the within-level sentences ($M = 70.07, SD = 22.64$) was the same as that on the beyond-level sentences ($M = 56.40, SD = 23.61$).

Another independent sample *t*-test was conducted to evaluate whether participants' self-reported understanding of the sentences matched well with the difficulty of the sentences. The test was significant, $t(8) = 14.21$, $p = 0.00$. The result showed that participants' understanding of the within-level sentences ($M = 95.28$, $SD = 2.51$) was significantly higher than that of the beyond-level level sentences ($M = 21.15$, $SD = 12.80$).

Table 5 Results of the sample *t*-tests on the variables of DFC, UDS, and JDG

Logistic parameter	Within level		Beyond level		<i>t</i> (8)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
JDG	70.07	22.63	56.40	23.61	0.92	.38	12.00
UDS	95.28	2.51	21.15	12.80	14.21	.00*	8.08

* $p < 0.05$

Two 5-point Likert scale questions were asked to assess the participants' attitudes towards using synthesized speech in Chinese language teaching and learning. The majority (79.5%) agreed (to various degrees) on the helpfulness of computer-generated speech for Chinese language teaching and learning ($M = 3.36$, $SD = 1.09$, $n = 39$, c.f. Figure 2). When asked if their Chinese teachers could use synthesized speech as listening materials in Chinese classes, 74.3% of the participants did not object to the idea ($M = 4.0$, $SD = 1.1$, $n = 39$, c.f., Figure 3). These results indicate that the participants hold a positive view on the use of computer-generated speech in the Chinese classroom.

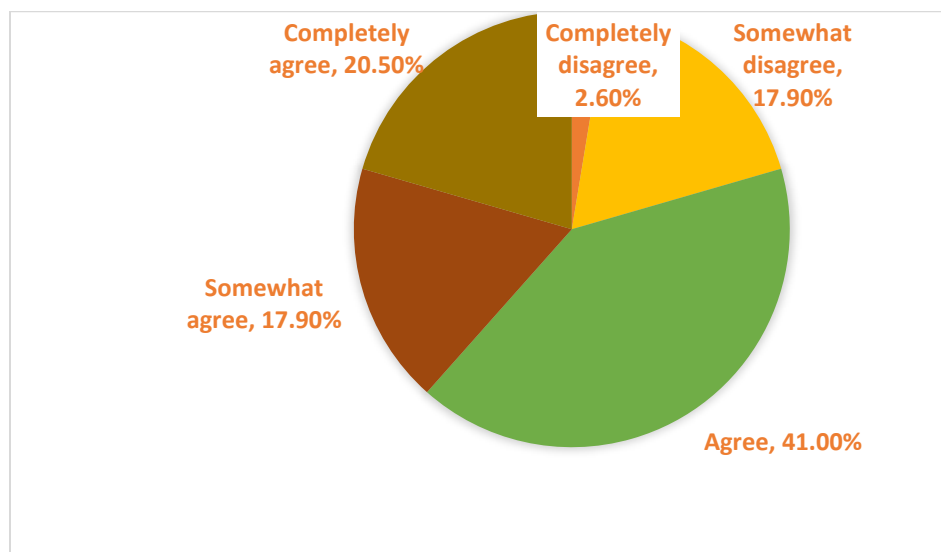


Figure 2 Responses to Q35: Do you agree that computer-generated speech can help improve your Chinese listening skills?

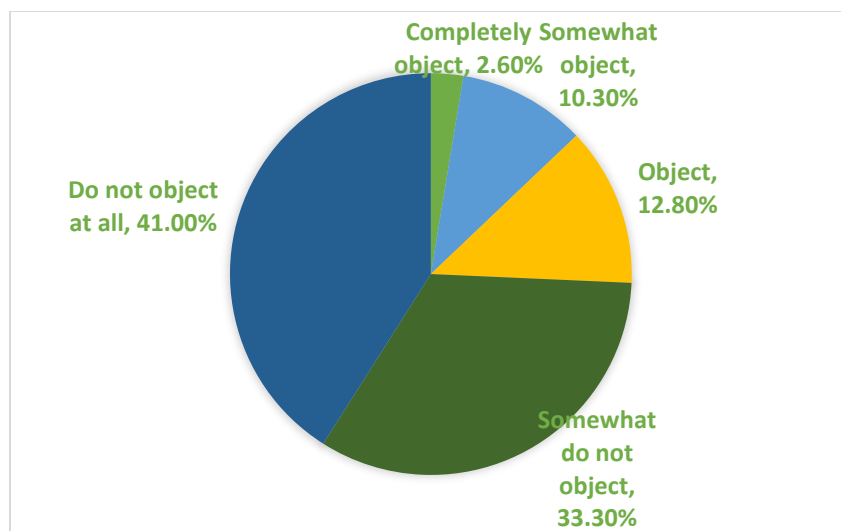


Figure 3 Responses to Q36: Would you object if your Chinese teacher used computer-generated listening materials in your Chinese class?

2.4 Discussions

It is not surprising that participants were able to correctly identify computer-generated speech most of the time, even though they were not 100% successful. Participants' failure to correctly identify certain sentences suggests that those synthesized audios are similar enough to human speech that they have heard before. Due to limited time and resources, this study did not ask participants to reflect on what criteria the participants used to make their judgement. Based on the authors' personal experiences, prosodic features (such as intonation, tempo of speech, and even pauses) that make speech natural are most likely the traits that participants used when making their judgement, whereas the pronunciation of individual sounds or syllables is less likely to betray the speaker of the audio recordings.

The fact that participants did not hold a negative view on the use of synthesized speech in their CSL learning is no surprise as well. Their experiences with the real-world use of TTS technology in their native languages may have paved the way for their acceptance of using the same technology for Chinese language learning. Even though this study did not ask in what ways synthesized speech could be helpful for their CSL learning, it is conceivable that the potential of TTS technology in providing additional materials to meet their learning needs is appealing enough.

3. Implications for SLA and CSL instruction

This study has found that beginning and intermediate level CSL learners can differentiate between audio recordings made by humans and computers. They can also comprehend synthesized Chinese speech that are within their current language proficiency

levels. Further, most of the participants have experiences with speech processing technologies in both their native languages and Chinese, and welcome the use of TTS technology for their Chinese language learning. Findings from this study have several implications for SLA research and CSL classroom pedagogy.

To begin, given the accepting attitude of CSL learners, instructors can be assured to experiment with Text-to-Speech technology to produce listening materials to meet the needs of CSL learners. These listening materials could, for example, serve as additional or supplemental materials for CSL learners.

If an instructor decides to introduce synthesized speech into the classroom, he/she should be aware that there is not enough research on the best phase in time for synthesized speech. For example, is it better to use it as supplemental materials at higher levels of instruction rather than the beginning level?

In addition, given the fact that Text-to-Speech technology has been increasingly used for real world communication by native speakers, instructors should begin to consider the necessity and possibility of including comprehension of computer-generated speech as part of the learning outcomes, just like how standard pronunciation and dialects are treated in the language curriculum design.

Moreover, this study only used Tencent's speech technology to generate the audio prompts. While the authors decided that the speech quality is natural enough for both instruction and this study, instructors are encouraged to experiment with similar technologies from other vendors such as iFlyTEK, Baidu or Microsoft, etc. While the authors have found that the speech quality from those different vendors have reached more or less the same maturity level, these technologies may not share the same accessibility. Further, due to hardware and software availability, it is likely that instructors may be confined to one technology vendor even though in theory there are many options available.

Finally, instructors should be aware that even though Text-to-Speech technologies are available in many languages, and learners are likely to have encountered them in their native languages, there are still a series of second language acquisition questions that need to be studied thoroughly before full confidence can be given to the use of the technology in second language learning and instruction. For example, can synthesized speech be considered authentic? Can second language learners develop or improve their listening skills equally as well with the help of synthesized speech? Will robotic speech have a negative impact on learners' pronunciation and accent? What are the side effects of errors introduced in synthesized speech or deviations (such as intonation or pronunciation, etc.) from real human speech on learners' language development? And more generally, what are the possible positive or negative effects on learning outcomes when Text-to-Speech technology is fully integrated as part of the technical assistance for second language learning and instruction?

It will be through experimenting with the technology in second language classrooms that these questions and issues can be understood and addressed.

4. Conclusions

This study examined CSL learners' ability to differentiate between human speech and computer-generated speech, and their attitudes towards the use of synthesized speech for CSL learning and instruction. The data from this study suggests that while CSL learners, even at the beginning or intermediate levels, do have the ability to tell the difference between human and computer speech, they welcome the use of Text-to-Speech technology for their CSL learning. Future research is needed to overcome some limitations in this study and further explore the issue of applying Text-to-Speech technology for its use in second language education.

First, only TenCent technology was used to generate the audio materials. As discussed in Section 3, even though both the quality and naturalness of speech synthesized by other vendors such as Microsoft or Google are judged by the researchers of this study as comparable, it is still desirable to experiment with synthesized speech using other vendors' technology to see if CSL learners also find them equally intelligible, and whether the varied qualities of synthesized speech would affect their attitudes towards the use of the technology for their Chinese language learning.

Secondly, this study involved beginning and intermediate level CSL learners but not learners at more advanced levels. It is necessary to examine the latter group of learners to fully understand and determine if language proficiency would affect learners' perception of intelligibility and their attitudes towards Text-to-Speech technology.

Thirdly, participants in this study involved CSL learners only. The case with native speakers was not studied. It would be interesting to experiment with native speakers so that findings concerning the latter can serve as a reference point for fully understanding the issues in the application of TTS technology.

Finally, due to limited time and resources allowed in conducting the survey, this study only used a small number of audio clips (5 by human and computer, respectively). Hence any statistical claims made based on the small set of data should best be interpreted as representing a trend rather than a definite claim about the reality.

Despite these limitations, findings from this study confirm that it is viable to experiment with Text-to-Speech technology for Chinese language learning and instruction. Future research is needed to better understand the issues and circumstances involved in using speech technologies for second language education.

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The Design of a Web-based Placement Test for College-Level Chinese Language Programs (论大学中文项目网上分班考试的设计)

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Abstract: This study reported on the design of a web-based Chinese placement test at the college level that was capable of automatically grading and making placement decisions. It can be used by the majority of Chinese programs at U.S. universities and consists of 60 multiple-choice questions covering grammar, vocabulary, and reading comprehension. To ensure validity and discriminability, the placement test was tested with 102 Chinese learners at three proficiency levels at a large state university. The results were compared to multiple established measures of L2 proficiency, including a cloze test. The correlation analyses revealed that the placement test scores significantly correlated with the cloze test scores, the final exam scores, and self-assessment, indicating that the placement test was accurate in assessing L2 proficiency and effective at discriminating between adjacent levels of instruction. We recommend that college-level Chinese programs use this placement test or use it as a model in their design of Chinese placement tests.

摘要: 本文旨在介绍一种北美大学中文项目的分班考试的设计方法,并且通过一系列的测试来证明用这种方法设计的分班考试具有较高的准确性和区分度。基于网络的分班考试能够让学生远程参加考试,远程提交,提交后自动批改和显示分班结果,其高效性和便捷性有利于学生尽快完成注册,同时又能降低教师的工作量。分班考试的内容为六十个多项选择题,涵盖语法、词汇和阅读理解。为了测试该分班考试的有效性和区分度,初级、中级和高级中文班的共102位学生参加了分班考试和其它一系列在二语习得研究中被证明为有效的测试。研究结果表明,按照这种方法设计出的分班考试与完型填空成绩、期末考试成绩和学生的语言水平自我评估都呈现高度正相关,说明分班考试的准确性高、区分度强。用这种方法设计分班考试简单高效,可供大学中文项目参考。

Keywords: Chinese placement test, computerized test, language assessment, proficiency test

关键词: 中文分班考试、电脑辅助语言测试、语言水平测试

1. Introduction

Placement tests are a type of language assessment that aims to place students with prior knowledge of a foreign language into appropriate levels of courses so that language classes consist of relatively homogenous learners to achieve instructional effectiveness (Brown, 1989). Despite the wide use of placement testing in language institutions and programs, relatively little research has been conducted on the validity and reliability of Chinese placement tests. The present study introduces the construction of an online and computerized Chinese placement test at a large state university to shed some light on how to use modern technology to maximize efficiency, efficacy, automaticity, and practicality in placement testing.

The importance of placement testing cannot be overstated. It differs from other types of language assessment, such as proficiency and achievement tests, in multiple ways. First, the objective of a placement test is to place students into the proper course for their current level of proficiency, and the stakes are relatively low (Read, 2000). Initial placement recommendations can be altered later. In Chinese programs, for instance, students sometimes need to be adjusted to a lower level class due to their lack of training in Chinese characters. Second, unlike other assessment tests, the priorities of placement tests include their ability to be accessed online from anywhere and at any time. For example, at the author's institution, prompt notification of placement decisions before the beginning of a semester is important because the university needs to make decisions on class cancellation based on enrollment figures. Third, placement testing has a major impact on student satisfaction (Brown, 2005).

Existing research shows that a wide range of measures have been used for placement purposes (Bachman & Palmer, 1996; Bernhardt, Rivera, & Kamil, 2004; Chapelle, 2001; Dunkel, 1991; Heilenman, 1991; Lange, Prior, & Sims, 1992; Schwartz, 1985). At the college level, placement tests vary significantly and use a variety of testing methods, such as paper-and-pencil tests, online tests, and oral proficiency interviews. A number of factors other than placement test scores are considered in the placement process, including years of prior language study, length of residence in countries using the target language, and scores on standardized tests, such as the Advanced Placement (AP) Test of the College Board (Wheritt & Clearly, 1990).

The number of studies on placement tests is scarce compared to other types of foreign language assessment tests, and even fewer have been conducted on East Asian languages. A search for Chinese and Japanese placement tests yielded two studies on Chinese placement tests (Li, 2008; Spring, 2008) and one on Japanese placement tests (Eda et al., 2008). Eda et al. (2008) validated the reliability of the items on the Japanese Skills Test (JSKIT) by comparing the JSKIT scores to those on an in-house placement test and the Oral Proficiency Interview (OPI) using data from students who enrolled in two summer intensive Japanese programs. The author recommended the use of JSKIT for

evaluating the proficiency of students transferring between language programs. Spring (2008) introduced how to use the existing and externally developed STAMP test to achieve placement purposes. Li (2008) outlined a future plan for making Chinese placement decisions based on students' answers to a language experience questionnaire. Eda (2008) and Spring (2008) offered detailed explanations of the validation procedures of using existing exams as placement tools, but little is known about how to construct an in-house placement test that is tailored to the needs of the students in that program. The present study aims to close this gap by providing an example of creating an online placement test and validating it using a battery of proficiency measures.

There is a contradiction between efficiency and accuracy in placement testing (Wesche et al., 1996). Because most foreign language programs at the college level are scarce in resources in terms of instructors, classrooms, and time, efficiency is a more important factor to take into consideration than accuracy (Bernhardt et al., 2004). A good placement test should be "good enough" rather than accurate in placing students in the right class while using the resources that the institution can afford (Wesche et al., 1996). The present study created a Chinese placement test by striking a balance between efficiency and accuracy.

It has been well-established that computerized placement testing is resource-efficient (Chalhoub-Deville, 2001). The coronavirus pandemic, in particular, underscored the importance of web-based testing to prevent in-person contact. The advantages of web-based placement testing, when compared to in-person tests, include the savings of resources associated with scheduling, proctoring, interviewing, and grading. Validated computerized tests have been shown to be more practical and flexible than the traditional method (Brantmeier, 2006), and they are not constrained by the time and space of group testing (Bernhardt et al., 2004; Brown, 1997). For instance, Bernhardt et al. (2004) conducted an empirical study on incoming and transferring students to Stanford University and reported that web-delivery placement testing provided them with more time to consider students' performance and language learning history, based on which they were able to make better placement decisions.

In terms of content, web-based language tests can increase validity and reliability (Chapelle & Douglas, 2006). True-or-false questions and multiple-choice questions can be graded automatically and instantly by the computer with total accuracy, and even open-ended questions with lengthy responses can be scored consistently based on rubrics (Bernstein et al., 2010; Carr & Xi, 2010; Williamson et al., 2004). It is also possible to make a wide variety of questions, including interactive types, to increase the authenticity of testing materials (Chapelle & Douglas, 2006; Huff & Sireci, 2001). These advantages have made web-based tests increasingly popular in making not only low-stakes placement tests but also high-stakes assessment tests, such as TOEFL (Bardovi-Harlig & Shin, 2014; Elder & Randow, 2008). The present study designed an online Chinese placement test to achieve fast delivery, accurate grading, and reduced utilization of time, space, and faculty resources.

Placement tests should be practical, valid, reliable, tailored specifically to the curriculum of individual language programs (Heilenman, 1983), and reflect the purpose

of placement testing (Shohamy, 1998). Ideally, a placement test should reflect students' current level of proficiency and the expected proficiency of the level they are placed in to ensure their success at that level, should be consistent in measuring proficiency, and should not take too much time and resources from the instructors and test-takers (Heilenman, 1983).

Many Chinese language programs at American universities are still using paper-and-pencil placement tests that require students to go to the testing site at a specified time, usually one week before the start of classes. The disadvantages of this conventional approach include: students must arrive on campus earlier than otherwise necessary; they must wait for placement results before registering for courses; instructors must complete a large quantity of grading within a short period of time. Some placement tests include character-writing sections and one-on-one interviews, which are particularly demanding on faculty time. Some institutions rely on comprehensive tests, such as the HSK test, and institutional status (i.e., the course levels a student has completed) to make placement decisions. However, comprehensive tests tend to be cumbersome, and institutional status may be unreliable. As a result, an online Chinese placement test that demands the least amount of faculty time is much needed.

In addition to being valid, reliable, and practical, the placement test introduced in this study is highly accessible and comprehensive. It can be accessed online at any time and any place and covers vocabulary, grammar, and reading comprehension at all instructional levels. It is resource-efficient by not including oral interviews and character-writing sections. Its online implementation allows for automated grading and instant receipt of placement decisions.

The validity of this Chinese placement test was checked against a cloze test, which was a fill-in-the-blanks test that had been found to be reliable in measuring general language proficiency (Eckes & Grotjahn, 2006; Tremblay, 2011) across various languages, including English (Heilenman, 1983), German (Mozgalina & Ryshina-Pankova, 2015), French (Tremblay, 2011), Spanish (Ozete, 1977), Japanese and Russian (Brière et al., 1978). Cloze tests are short, usually taking approximately 20 minutes to complete, easy to create, and easy to administer to participants, and thus have been popular as a measure of L2 proficiency in the fields of second language acquisition and psycholinguistics. Some foreign language programs use cloze tests as placement instruments because of their validity and reliability. For instance, the German program in Mozgalina and Ryshina-Pankova (2015) reported that their C-test, a type of cloze test, yielded more consistent and accurate results than the listening comprehension test, the reading comprehension test, and the language proficiency survey in their placement test, became the primary factor in making placement decisions and was adopted as the placement test. Cloze tests have strong correlations with some comprehensive tests, such as the Modern Language Association Cooperative Foreign Language Tests (MLA, $r=.90$ in Caulfield & Smith, 1981). The cloze test used in this study was created by using the rational deletion method and the exact scoring method. In the rational deletion method, the blanks are created by the test makers depending on certain criteria. In the exact scoring method, a point is given to each blank only when the answer is completely

correct. In addition, because Chinese uses a logographic writing system that is challenging for L2 learners, 0.5 point was given to each correct answer written in Pinyin.

Besides the cloze test, the validity of the Chinese placement test was verified using self-assessed proficiency in listening, speaking, reading, and writing. Self-assessment has been found to be capable of indicating second language abilities in general (AlFallay, 2004; Birckbichler et al., 1993; Falchikov & Boud, 1989; Hargan, 1994; Oscarson, 1997) and has been recommended to be used in place of traditional placement tests (Hargan, 1994; Heilenman, 1991; Schwartz, 1985). In a meta-analysis of 60 empirical studies involving self-assessments, Ross (1998) observed considerably stronger and more stable correlations between students' self-assessed reading skills and their actual reading capability than for other skills between self-assessment and test scores. Self-assessment accuracy was highest for reading skills, followed by listening, and then speaking skills, leading the author to conclude that students were better able to evaluate their receptive skills, such as reading and listening, than their productive skills, such as listening and writing. After reviewing multiple studies on computer-adaptive language testing, Deville and Deville (1999) recommended that educators use self-assessment to determine the starting point for computer-adaptive placement tests. So far, only a few studies have investigated the reliability of self-assessment across all four domains of language skills—listening, speaking, reading, and writing. This study will shed some light on the reliability of self-assessment in addition to using it as a validation tool for the placement test.

The current study aims to introduce a college-level online Chinese placement test and the validation procedures to ensure its validity and practicality. Advice specific to the Chinese language, such as how to deal with the two versions of the Chinese writing system, will be provided. It attempts to strike a balance between comprehensiveness and practicality, seeking to minimize the use of university and faculty resources. The placement test is fast, taking approximately 20 minutes for elementary students, 40 minutes for intermediate students, and 60 minutes for advanced students to complete. Such efficiency is especially beneficial to large institutions, where hundreds of incoming students need to be placed and conventional paper-and-pencil placement testing is overwhelming to instructors. The validation process involves a set of correlational analyses with other measures of L2 proficiency. In short, the goal of this research is to introduce a way to design and validate online Chinese placement tests.

2. Methods

2.1 Participants

Participants were 102 second language learners of Chinese (52 males; mean age: 20.5; range: 16–44) enrolled in the second, fourth, and sixth semesters of Chinese language courses at the University of Colorado Boulder. They have completed one, three, or five semesters of classroom instruction, respectively, or at equivalent proficiency levels. The first, third, and fifth semesters of Chinese language courses were not offered at the time of data collection. The data was collected in the first class of the semester.

There were 37 participants in the second-semester class, 42 in the fourth-semester class, and 23 in the sixth-semester class. Additional demographic information is provided in Table 1. One participant did not complete the cloze test, and 14 did not have final exam scores from the previous semester because they did not take any Chinese courses that semester. Nine participants began learning Chinese before age 10 (4, 4, and 1 in the 2nd-, 4th-, and 6th-semester courses, respectively). Their proficiency levels were comparable to those of their peers in the same classes, and they were included in the data analysis.

2.2 Materials and Design

The Placement Test. The placement test was constructed based on the three years of Chinese language classes at the University of Colorado Boulder. The placement test was designed to place students into six levels of Chinese language classes. It consisted of 60 multiple-choice questions in total, and the design was such that there were 10 multiple choice questions targeting each of the six levels—Introductory Chinese 1 and 2, Intermediate Chinese 1 and 2, and Advanced Chinese 1 and 2. The first five semesters used the textbook *Integrated Chinese* (Liu & Yao, 2009), covering eight chapters per semester and completing the four volumes of *Integrated Chinese* in five semesters. The textbook for the 6th semester was *Chinese Odyssey (Volume 5)* (Wang, 2008). These six local levels of proficiency were roughly equivalent to the novice-mid, novice-high, intermediate-low, intermediate-mid, intermediate-high, and advanced-low levels of proficiency on the ACTFL scale. In other Chinese language programs, the test questions should be based on the materials used to teach each level of Chinese at that institution.

Simplified Chinese characters are used in mainland China and Singapore and traditional Chinese characters in other places such as Taiwan and Hong Kong. Chinese placement tests should be able to place students who have learned a writing system different from the one currently taught in the program. The approach implemented by this placement test was to place students who had learned a different writing system one level lower than their proficiency level to give them one semester to catch up on the writing system.

Eight of the ten questions at each course level tested vocabulary and grammar, while the other two questions addressed reading comprehension. All questions were short, with grammar and vocabulary questions ranging from 10 to 41 characters and reading comprehension questions ranging from two to five lines. All questions were multiple-choice with four selections, allowing for automated grading and rapid score calculation once implemented into the course management system. The questions got progressively harder, and participants were instructed to answer all questions. There were 60 questions in total, and the highest possible score was 60. No participant has seen the test items before. Two versions of the placement test, with simplified characters and traditional characters, were developed, and participants were free to choose one of the two versions. Examples (1), (2), and (3) below illustrate test items targeting grammar, vocabulary, and reading comprehension, respectively. English translations are provided here but not on the actual test.

- (1) 你想喝茶还是喝咖啡_____?
 A. 吗 B. 吧 C. 呢 D. X
 Would you like to have tea or coffee _____?
 A. Question particle “ma”
 B. Suggestion particle “ba”
 C. “Ne” particle for softening the tone
 D. No words are needed
- (2) 父母_____我每天晚上十一点以前一定要回家。
 A. 规定 B. 制定 C. 实行 D. 实施
 My parents _____ I before eleven pm every night must go home.
 A. set a rule B. make (plans) C. implement D. carry out
- (3) 明明长得高高的，眼睛又大又圆，是个很帅的男孩子。他喜欢跟朋友一起聊天、看电视、打球。他不喜欢做功课，也不喜欢学习。下面哪个是对的?
 A. 明明是个好学生。
 B. 明明的眼睛不大。
 C. 明明常常在家看书。
 D. 明明爱跟朋友一起聊天。

Mingming is tall. He has big, round eyes and is very handsome. He likes chatting, watching TV, and playing balls with his friends. He does not like homework. He does not like studying, either. Which of the following is true?

- A. Mingming is a good student.
 B. Mingming does not have big eyes.
 C. Mingming often stays at home and reads books.
 D. Mingming likes chatting with his friends.

The Language Background Information Form. Prior to the placement test and the cloze test, all participants completed a language background information form, in which they provided information about their age, gender, native language, age of acquisition, length of classroom instruction, length of time spent in Chinese-speaking countries, daily percentage use of Chinese and the native language, and self-rated proficiency in listening, speaking, reading, and writing. The demographic information was used to determine which factors contributed to L2 proficiency but was not considered for the decision-making process in the placement test. Self-assessment questions asked participants to rate their abilities on a scale of 1 (very bad) to 7 (very good). Participants completed the questionnaire in approximately five minutes.

The Cloze Test. The cloze test was a fill-in-the-blanks test, in which participants filled in 40 blanks in a 425-character passage. The passage was adapted from a story in the textbook *Encounters: A Cognitive Approach to Advanced Chinese* (Liu & Li, 2010). Participants could write characters for full points or Pinyin for half points. The cloze test was available in two versions: traditional characters and simplified characters.

Participants could select the version in which they were more proficient at reading. Prior to its usage by second language learners, the cloze test was administered to five native speakers. All native speakers finished it within 5 to 10 minutes and with complete accuracy. An answer bank was developed, and all participants' answers were compared to the answer bank in the grading process. In addition to the Language Background Information and the Cloze Test, participants' final exam scores from the previous semester were also used to check the validity of the placement test.

Table 1 Demographic Information and Test Scores

	All participants	First-year class	Second-year class	Third-year class
Number of participants	102	37	42	23
Age	20.5	20.5	20.1	21.3
Age of acquisition	15.7	17.3	14.1	16.1
Length of classroom instruction (months)	35.6	16.8	44.8	49.0
Length of living in Chinese-speaking countries (months)	8.9	3.1	11.1	14.5
Daily percentage use of Chinese (%)	8.1	6.8	6.6	12.9
Daily percentage use of native languages (%)	91.3	93.2	93.4	84.5
Self-reported proficiency in listening (<=7)	4.4	4.3	4.4	4.5
Self-reported proficiency in speaking (<=7)	4.2	3.9	4.4	4.2
Self-reported proficiency in reading (<=7)	4.3	4.1	4.2	4.7
Self-reported proficiency in writing (<=7)	3.7	3.6	3.6	3.9
Placement test (<=60)	24.6 (8-58)	17.2 (8-29)	23.7 (12-43)	38.2 (19-58)
Cloze test (<=40)	5.8 (0-35)	1.6 (0-7)	5.1 (0-27)	13.9 (2-35)
Final exam of the previous semester (<=100)	81.3	75.2	85.5	83.1

*Ranges are shown in parentheses.

2.3 Procedure

All students (n=102) enrolled in the Chinese language program took the placement test in paper-and-pencil format on the first day of class. They first filled out the Language Background Information Form and then complete the placement test and the cloze test. On average, it took first-year students 20 minutes, second-year students 40 minutes, and third-year students 60 minutes for the placement test. It took all participants approximately 20 minutes for the cloze test and 5 minutes for the Language Background Information Form.

3. Results

Demographic information and scores of the placement test, the cloze test, and the final exam of the previous semester are summarized in Table 1.

To verify the validity and reliability of the placement test, ANOVAs and correlational analyses were conducted on the placement test scores and a battery of other measures of proficiency. As seen in Figure 1, the one-way ANOVA on the placement test scores yielded a significant main effect of class levels ($F(2,99)=47.55, p<.0001$; first-year mean=17.2; second-year mean=23.7; third-year mean=38.2). Subsequent ad-hoc tests revealed that all three levels of classes were significantly different from one another after adjusting the p -value for the number of statistical tests conducted. Second-year participants scored significantly higher than first-year participants ($F(1,77)=18.52, p<.00001$) and third-year participants scored significantly higher than second-year participants ($F(1,63)=33.22, p<.00001$), indicating that the placement test was effective in discriminating between adjacent levels of proficiency, which was precisely the purpose of placement testing.

Correlation analyses between the placement test scores and the final exam scores of the immediate previous semesters (first semester, third semester, and fifth semester) showed strong correlations across all three levels of classes (first-year: $r=.62, p<.001$; second-year: $r=.56, p<.001$; third-year: $r=.51, p<.05$).

Further analysis of the placement test scores and the cloze test scores revealed a strong and statistically significant correlation between them ($r=.88, p<.0001$), as shown in Figure 2. Given that it has been well-established that cloze tests are accurate and reliable in measuring native and non-native language proficiency across a number of languages (see Tremblay, 2011, for an overview), this result indicated that the placement test was also effective in measuring language proficiency. At each class level, the placement test scores were significantly and strongly correlated with the cloze test scores at the second-year ($r=.68, p<.00001$) and third-year ($r=.94, p<.00001$) levels, and moderately but significantly correlated with the cloze test scores at the first-year level ($r=.39, p<.05$). Correlation coefficients were highest for third-year students ($r=.94$), followed by second-year students ($r=.68$) and first-year students ($r=.39$). The final exams for the three instructional levels targeted the knowledge learned in one semester, while the cloze test targeted cumulative knowledge. Thus, for first-year students, the final exam was a better indicator of proficiency than the cloze test, and for second- and third-year students, the cloze test was a better measure than the cloze test. As shown in Figure 3, the correlations between the placement test and the better indicator of proficiency at each of the three instructional levels were .62, .68, and .94, respectively, indicating medium effect sizes at the first- and second-year levels and a big effect size at the third-year level. Taken together, these results attested to the validity of the placement test at all three levels, particularly at the advanced level.

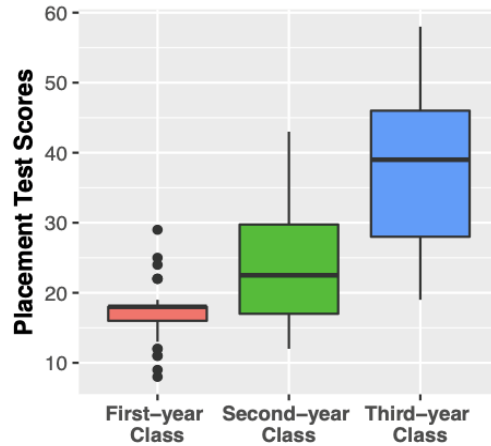


Figure 1 The placement test scores for the first-year, second-year, and third-year Chinese classes

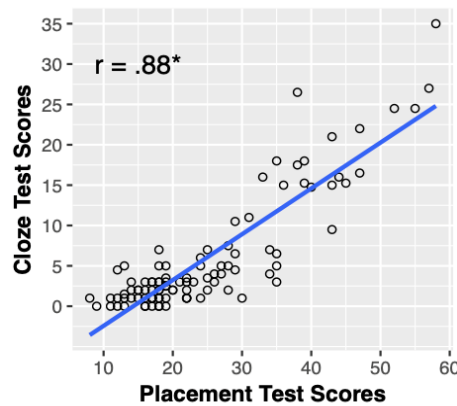


Figure 2 Correlation between placement test scores and cloze test scores for all participants

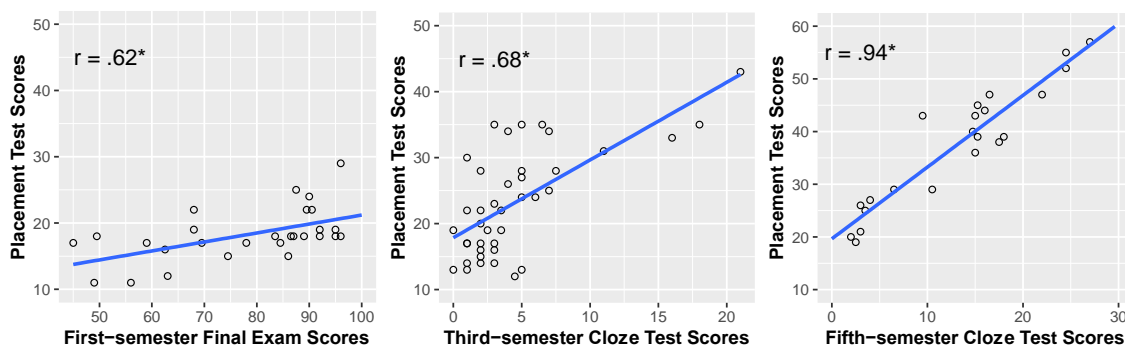


Figure 3 Correlations between the placement test and the final exam for the first-year students and between the placement test and the cloze test for the second- and third-year students

Further correlation analyses performed on all participants' data and between the placement test and other measures of proficiency revealed statistically significant correlations between the placement test and self-reported proficiency in listening ($r=.21$, $p<.05$), speaking ($r=.20$, $p<.05$), reading ($r=.20$, $p<.05$), and the composite self-reported proficiency scores computed by adding self-reported listening, speaking, reading, and writing scores ($r=.21$, $p<.05$). When correlation analyses were conducted at the class levels, the correlation effects were most pronounced at the second-year level, where placement test scores were significantly correlated with the composite self-reported proficiency ($r=.37$, $p<.05$), self-reported reading proficiency ($r=.33$, $p<.05$), and marginally significantly correlated with self-reported writing proficiency ($r=.26$, $p=.10$). Placement test scores were correlated with self-reported proficiency in listening ($r=.49$, $p<.05$) at the third-year level. At the first-year level, self-reported proficiency did not significantly correlate with placement test scores, probably because students with just one semester of Chinese language instruction were not yet good at estimating their proficiency. These results showed that L2 learners were able to evaluate their proficiency to some extent, but self-assessments were less accurate than objective measures, such as the placement test and the cloze test.

Additional correlation analyses revealed that the placement test was significantly and negatively correlated with age of acquisition ($r=-.19$, $p=.05$), indicating that an earlier start to learning Chinese was associated with higher proficiency. The placement test was positively correlated with the length of classroom instruction ($r=.43$, $p<.00001$) and the length of residence in Chinese-speaking countries ($r=.26$, $p<.01$), suggesting that more classroom instruction and more time in places where the target language was spoken resulted in increased proficiency. Finally, the placement test showed a positive correlation with the daily percentage use of Chinese ($r=.28$, $p<.01$) and a negative correlation with the daily percentage use of the participants' native languages ($r=-.36$, $p<.001$). To summarize, the placement test successfully distinguished between participants with varying levels of proficiency and was correlated with other measures of proficiency, including the age of acquisition, length of classroom instruction, cloze test, final exam scores, and self-reported proficiency in listening, speaking, and reading, thereby attesting to the discriminatory ability, validity, and reliability of the placement test.

4. Cut-off Points and Online Implementation of the Placement Test

The statistical analysis demonstrated that the placement test was valid and capable of discriminating between various levels of proficiency. The next step was to establish the cut-off points for the six levels. Tables 2 and 3 show the 25%, 50%, 75%, and 80% percentile scores for the three classes, as well as the placement decisions for the six levels. The cut-off lines were established based on the performance of the current students to ensure that incoming students would have equivalent proficiency to those in the classes into which they would be placed. To this end, the cut-off line was set at 80% quantile. This approach of deciding cut-off points based on the performance of current students has been employed in previous studies, such as Long et al. (2018), when prior test scores or students' proficiency levels were available for reference. A relatively high quantile point

(80%) was selected for two considerations: 1) students participating in this placement test did not have exposure to Chinese over the winter break that was immediately before the placement test; and 2) incoming students would not feel overwhelmed in the new class. As seen in Table 2, students who have completed three semesters scored 14 points higher than those who have completed one semester, and students who have completed five semesters were also 14 points better than those who have completed three semesters. As a result, the cut-off point for each level was precisely 7 points higher than the preceding level, as shown in Table 3. Additionally, Table 3 illustrates that if a student's placement test version (simplified vs. traditional characters) differed from the characters taught in the Chinese program, the student would be placed one level lower to allow for additional time to catch up on the writing system. Very few previous studies on placement testing have reported the algorithms and rationales for determining cut-off points. The present study developed the algorithm by taking into account the proficiency levels of current students.

Table 2 Percentage Quantiles of the Placement Test Scores for the Three Levels

Class Level	25% quantile	50% quantile	75% quantile	80% quantile
Students who have completed one semester of Chinese instruction	16	18	18	19
Students who have completed three semesters of Chinese instruction	17	23	30	33
Students who have completed five semesters of Chinese instruction	28	39	46	47

Table 3 Cut-off Points for the Six Levels of Chinese Classes

Placement Decisions	Range
First semester	0-18
Second semester	19-25
Third semester	26-32
Fourth semester	33-39
Fifth semester	40-46
Sixth semester	47-53

After the discriminatory ability of the placement test was confirmed, it was entered into the Canvas course management system, allowing students to access it remotely at any time, from any place, get automatic grading, and receive an immediate notification of their placement results. Two versions of the placement test, with traditional characters and with simplified characters, are available on Canvas. For instance, since traditional characters were taught in all levels of Chinese classes at the University of Colorado Boulder, the placement test instruction screen clearly states, "For this exam, you will need to decide to take the exam in Traditional Chinese or Simplified Chinese. If you take the exam in Simplified Chinese, you will automatically be placed one level lower. " Students are prompted to choose one of the two versions following this instruction.

When implemented into Canvas, the instruction screen also includes the following information: 1) a description of the placement test, in which students are informed that there are 60 questions and they have one chance but unlimited time to take the exam; 2) a warning that the use of external resources is discouraged because it will result in incorrect placement decisions; and 3) the placement decision table (Table 3). Students are allowed unlimited time so that in the event of internet disruption, they can log in again to continue the exam. However, they have only one attempt, which means after clicking the submission button, they cannot take the placement test again. Before submission, students are allowed to change their answers to previous questions. Such a design is consistent across all foreign language placement tests. The placement decision table details the ranges of scores and their corresponding classes. For instance, students scoring 0–18 are placed in Elementary Chinese I (first-semester), 19–25 into Elementary Chinese II (second-semester), etc. Students scoring 54 and above are told to see the Chinese Program Coordinator for advice because their proficiency is beyond all the language courses offered at the institution. Students receive their placement test scores and placement decisions shortly after their submission and are automatically given permission to register for the course that they are placed in. This online placement test is also linked to the school system, from which university undergraduate advisors are able to see the placement test results and advise students accordingly. This online and automatic placement system has proved to be successful because of its efficiency, efficacy, convenience, and practicality.

4. Discussion and Conclusion

This study introduced a way to design a computerized and web-based Chinese placement test and tested it for validity, reliability, and discriminability. We intended to contribute to the field of Chinese language instruction by introducing the procedures for constructing test items and evaluating the validity of the placement test.

The placement test was in a simple format of 60 multiple-choice questions, allowing for automated grading and instant calculation of placement decisions. There were no open-ended questions, such as translation, composition, or interview. It took elementary learners approximately 20 minutes, intermediate learners 40 minutes, and advanced learners 60 minutes to complete. The validity of the placement test was tested with 102 Chinese-learning students enrolled in three levels of Chinese courses (elementary, intermediate, and advanced) prior to its online implementation. Validation was conducted using correlation analyses with other measures of proficiency that were commonly used in the field of second language acquisition. Results showed that scores of the placement test were significantly correlated with those of the cloze test, the final exam of the previous semester, age of acquisition, length of classroom instruction, daily use of Chinese, daily use of native languages (negative correlation), and self-reported proficiency in listening, speaking, and reading, indicating that the placement test was valid and accurate in assessing L2 Chinese proficiency. More importantly, the placement test successfully distinguished participants with adjacent levels of proficiency, which was precisely the purpose of placement testing.

To strike a balance between efficiency and comprehensiveness, this placement test assessed students' ability to recognize characters but not their ability to write them. The Chinese writing system is logographic, with 2000–3000 commonly used characters. Acquiring the ability to write characters involves a great deal of practice and route memory. Character-writing is an integral part of the Chinese language learning process. However, it was determined that assessment of the character-writing skill should be excluded to allow for automated grading by the course management system, as the grading of character-writing would necessarily require faculty work, rendering instant and automated grading impossible. Students would be unable to receive placement decisions quickly enough to register for courses, making it difficult for the Chinese program and the university to evaluate class enrollments and make administrative decisions accordingly.

Any discussion of Chinese placement tests must include a discussion of how to test students' ability to read and write Chinese characters. Chinese characters are notoriously challenging for second language learners. There is a growing trend among Chinese programs at American colleges to transition away from requiring students to write characters and toward character recognition or e-writing in order to alleviate their onerous workloads, such as the Chinese programs at University of Rhode Island (He, 2022), University of California Davis (personal communication), University of Colorado Boulder (Qian & Li, in press), Florida State University (Qian, 2022), University of British Columbia (personal communication), and George Washington University (Zhang, 2021). This placement test was designed to meet this new trend by excluding the assessment of character-writing ability. Other institutions that require the ability to write characters are recommended to test students' writing abilities early in the semester and change placement decisions if necessary.

This placement test had high content validity since all test items addressed the linguistic information that students were expected to acquire at each instructional level. Placement tests constructed in this manner accurately represent course objectives and program curricula. They can serve not only the purpose of placement testing but also as indicators for teachers when making instructional decisions (Green & Weir, 2004).

There is certainly room for improvement. The use of a computer-adaptive approach that allows test-takers to stop answering questions once they reach a difficulty level beyond their current capability will be more efficient and less frustrating, especially for lower-level test-takers. Language background information, including the instructional levels a test-taker has completed, can be used to estimate the starting point of the computer-adaptive test. With the advancement of modern technology, we recommend that language program directors and instructors combine this design with an algorithm to create computer-adaptive placement tests.

To conclude, the present study introduced a way to construct computerized and web-based Chinese placement tests at the college level and verified its validity and reliability using other measures of proficiency, with the goal of providing an example to Chinese language programs on how to design, construct, and validate placement tests and determine cut-off points for each instructional level. Language instructors and program

directors constantly face the challenge of placing a large number of incoming students into the appropriate classes within a short period of time. This study outlined the procedures required to develop a computerized and online placement test that is simple, flexible, and practical, as well as allows for automated grading and immediate notification of placement decisions.

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Appendix

中文分班考试 (Chinese Placement Test)

1. 我是中国人, 她_____是中国人。
A. 都 B. 也 C. 很 D. 还
2. 你想喝茶还是喝咖啡_____?
A. 吗 B. 吧 C. 了 D. ×
3. 我今天不_____去你家, 因为我要开会。
A. 会 B. 是 C. 能 D. 很
4. _____你明天有空, 我就去看你。
A. 要是 B. 就是 C. 但是 D. 不是
5. 你平常很早来, 今天_____这么晚才来?
A. 那么 B. 多么 C. 怎么 D. 什么
6. 中文书我上星期_____买了。
A. 因为 B. 已经 C. 所以 D. 以后
7. 除了电脑课_____, 我还上英文课。
A. 以外 B. 以上 C. 以前 D. 以往
8. 我去他家的时候, 他_____吃晚饭。
A. 要在 B. 现在 C. 正在 D. 有在
9. 你先坐公车, _____坐地铁。
A. 可是 B. 虽然 C. 也是 D. 然后
10. 他的中文跟我的_____好。
A. 非常 B. 这么 C. 一样 D. 大家
11. 这个唱歌很难听_____男孩子是我男朋友。
A. 的 B. 得 C. 地 D. 德
12. 她太可爱了, _____哭的时候都很可爱。
A. 就 B. 和 C. 要 D. 连
13. 机场_____我家很近, 开车只要三分钟。
A. 在 B. 离 C. 是 D. 对
14. 请_____我的书拿上来好吗?
A. 被 B. 用 C. 把 D. 得
15. 我前天喝鱼汤, 昨天_____喝鱼汤。
A. 在 B. 又 C. 再 D. 却
16. 这些礼物, 我一个_____不想收。
A. 多 B. 都 C. 是 D. 却
17. 因为今天要考试, 所以我早上六点半就起床了。起床以后我一边复习中文一边吃早饭。我复习了生词、语法、发音和课文。下面那个是对的?
A. 我明天要考试。 B. 我没时间吃早饭。
C. 我很早就起床了。 D. 我练习了写作。

18. 我请我的同学王小英跟我一起练习中文。她的中文说得太好了，汉字也写得不错。我十点开始考试，考完试后，我给姐姐打电话，可是她不在。下面哪个是对的？
- A. 我的中文比王小英好。 B. 王小英汉字写得不错。
C. 我十点给姐姐打电话。 D. 姐姐帮我复习中文。
19. 小雪家离学校很远。每天她要先开车到公共汽车站，再坐公共汽车到学校。每天都要花四十分钟左右。下个学期，小雪要搬到别的地方住。下面哪个是对的？
- A. 小雪每天要坐地铁。 B. 小雪不会开车。
C. 下个学期小雪要搬家。 D. 小雪家离学校不太远。
20. 明明长得高高的，眼睛又大又圆，是个很帅的男孩子。他喜欢跟朋友一起聊天、看电视、打球。他不喜欢做功课，也不喜欢学习。下面哪个是对的？
- A. 明明是个好学生。 B. 明明的眼睛不大。
C. 明明常常在家看书。 D. 明明爱跟朋友一起聊天。
21. 王朋找房子_____一个多月了，可是还没有找到合适的。
- A. 找 B. 还有 C. 找了 D. 了
22. 他的宿舍房间太小，连电脑都_____。
- A. 放下 B. 不放下 C. 放不 D. 放不下
23. 养宠物太麻烦了，我_____宠物都不养。
- A. 无论 B. 什么 C. 很多 D. 多的
24. _____的机票便宜，就买哪家的。
- A. 他家 B. 这家 C. 那家 D. 哪家
25. 北京的好饭馆多得_____。
- A. 不得了 B. 极了 C. 非常 D. 十分
26. 张天明_____美国出生长大_____。
- A. 是…X B. 是…的 C. X…的 D. 在…X
27. 服务员，菜要清淡一点，别太咸，_____油，别放味精。
- A. 放 B. 多放 C. 少放 D. 放少
28. 天明从家里带来的衣服_____样子还是颜色都不太好。
- A. 虽然 B. 不是 C. 无论 D. 可是
29. 有的中国菜好吃_____，可是太油了。
- A. 好吃 B. 是好吃 C. 不好吃 D. 吗
30. 下个学期我肯定要选中文课，_____另外两门课选什么，我还没想好。
- A. 像 B. 要么 C. 要是 D. 至于
31. 他想搬到姐姐家住，这样可以把房租跟饭钱_____。
- A. 省出来 B. 省下来 C. 省回来 D. 省过来
32. 在兴趣_____，丽莎跟天明不太一样。
- A. 里 B. 上 C. 外 D. 下
33. 柯林只要一玩电脑，就_____功课的事忘得一干二净。
- A. 做 B. 被 C. 把 D. 吧

34. 很多中国孩子一生_____, 父母就开始给他们存教育费。
A. 起来 B. 下来 C. 下去 D. 过来
35. 中国西边是高原, _____东边是平原和大海。
A. 而 B. 而是 C. 还 D. 还是
36. 南京一边是_____高楼, 一边是传统的建筑。
A. 一栋 B. 一座 C. 一栋栋 D. 一种种
37. 北京是中国的首都, 也是中国的政治和文化中心。那里有很多名胜古迹。六月去北京的人很多, 不过那时的机票有点贵。下面哪个是对的?
A. 北京是中国的经济中心。
B. 北京的名胜古迹吸引了很多游客。
C. 每年五月去北京的人最多。
D. 去北京的机票什么时候都很贵。
38. 买衣服只考虑便宜当然不好, 但是也不必非买名牌的衣服不可。很多名牌的衣服虽然贵, 但是质量和款式并不好。再说穿衣服不是给别人看的, 所以舒服最重要。下面哪个是对的?
A. 买衣服价钱最重要。 B. 买衣服牌子最重要。
C. 名牌衣服质量一定好。 D. 衣服舒服不舒服最重要。
39. 有的人觉得金融专业又轻松, 以后赚钱又多。可是金融专业整天跟钱和数字打交道, 真没意思。文学专业虽然又轻松又有意思, 可是以后赚钱不多。所以越来越多的人选工程和电脑, 又有意思又好找工作。下面哪个是对的?
A. 文学专业又没意思, 又不好找工作。 B. 工程专业又有意思又好找工作。
C. 电脑专业很轻松。 D. 金融专业很有意思。
40. 找男朋友女朋友的标准很多, 有的人觉得人好不好, 还有性格开朗不开朗最重要。有的人觉得男女朋友在兴趣爱好上一样最重要。其实唯一的标准就是要找到对的那个人。下面哪个是对的?
A. 找女朋友性格最重要。 B. 找女朋友为人最重要。
C. 找女朋友兴趣一致最重要。 D. 找到对的那个人才是最重要的。
41. 丽江美丽的风景_____我留下了深刻的印象。
A. 跟 B. 给 C. 为 D. 对
42. 中国人说早餐要吃好, 午餐要吃饱, 晚饭要吃少。美国医生也这么说。_____这个说法是有道理的。
A. 可见 B. 听出来 C. 听到 D. 看出来
43. 职业球员的薪水是_____市场决定的。
A. 被 B. 由 C. 用 D. 为
44. 环境保护应该从小地方做_____。
A. 上 B. 下 C. 起 D. 来

45. 孔子是中国历史上最有名的教育家。他到现在_____中国教育还有很大的影响。
A. 跟 B. 给 C. 为 D. 对
46. 在秦朝的基础上, 统一的汉朝在政治、经济各个_____都有很大的发展。
A. 地方 B. 基础 C. 方面 D. 朝代
47. 小王, 这个推销热水器的工作不过是个实习的工作_____, 不用太紧张。
A. 起来 B. 多了 C. 过来 D. 而已
48. 要是你去北京_____, 一定要去_____故宫博物院。
A. 游览...游览 B. 参观...参观 C. 游览...参观 D. 参观...游览
49. 到了美国就该入乡随俗, _____美国人的饮食习惯吃饭。
A. 按照 B. 随着 C. 跟着 D. 用着
50. 中国教育系统评量学生的方式以考试为_____。
A. 重要 B. 起 C. 主 D. 开始
51. 农历五月初五是端午节。据说人们那天吃粽子_____纪念楚国诗人屈原。
A. 对 B. 为了 C. 给 D. 是为了
52. 四月五号那天正值春天, 百花的清香与绿草的明亮给人清凉明快的感觉, 因此人们把那天_____清明节。
A. 是 B. 成为 C. 当作 D. 称为
53. 中国人喜欢静态的休闲活动, 而从事动态活动的人_____比较少。
A. 并 B. 却 C. 可是 D. 不过
54. 孩子学东西, 一定要有兴趣, 这样他们才会_____。你千万不要_____。
A. 杯弓蛇影...怀才不遇 B. 乐在其中...赶鸭子上架
C. 画饼充饥...望梅止渴 D. 乐此不疲...专心致志
55. 父母_____我每天晚上十一点以前一定要回家。
A. 规定 B. 制定 C. 实行 D. 实施
56. _____西医看不到, 不妨试试中医。
A. 虽然 B. 固然 C. 果然 D. 既然
57. 过去, 中国人重男轻女。1950 年以后, 中国政府非常重视提高妇女的社会地位。从那时起, 中国人人有工作, 男女收入也差不多, 妇女的地位大大提高了, 无论在工作单位还是在家里, 中国可以算是男女平等了。下面哪个是对的?
A. 1950 年以后, 中国开始重男轻女。 B. 1950 年以后中国基本实现男女平等。
C. 1950 年以后, 女性的地位比男性高。 D. 政府不想改善男女不平等的问题。
58. 可是改革开放以后男性和女性的社会地位又有了改变。企业的薪水是由市场决定的, 因为企业毕竟是要挣钱的, 谁能帮企业多挣钱, 谁的薪水就高。由于女人要生孩子要照顾家庭, 在工作上有很多限制, 因此即使女性在学校里的成绩好, 企业也喜欢用男性。下面哪个是对的?
A. 改革开放以后, 人们的薪水是由政府决定的。
B. 改革开放对男性和女性的地位没有影响。
C. 改革开放有益于提高女性的地位。
D. 女性地位的高低跟收入有关系。

59. 小美是欧洲人，她快要去北京实习了。听说北京空气污染很严重，中国又没有言论自由，什么都要审查，我不懂她为什么选择去北京。后来一谈才知道，说白了都是为了钱。现在欧洲经济发展停滞了，失业率上升。要是去美国工作，她跟美国人相比并没什么特别，可是到了中国，她的工作机会就会比一般的中国人多得多。据调查，64%的外国人到了中国后存款增加了。下面哪个是对的？
- A. 小美支持中国的言论审查制度。 B. 外国人在中国工作利大于弊。
C. 中国人近年来存款有了大幅增长。 D. 很多外国人在中国工作是出于好奇。
60. Jimmy Choo 就是周仰杰。他家境贫穷，从小就跟着父亲做鞋子。那个时代鞋匠是社会地位很低的行业。然而他不自暴自弃。后来，伦敦时装学院因为他的一张鞋子的设计稿录取了他。为了交学费，他一边上学一边在餐馆打工，直到三十五岁才毕业。经过长时间的刻苦努力，他的鞋终于被媒体发现，来找他做鞋子的名人也越来越多，其中包括戴安娜王妃。周仰杰今年六十四岁了，他每天早上七点起床，一直工作到半夜。他说他爱做鞋，一点也不觉得疲惫。下面哪一个词语不能用来形容周仰杰？
- A. 出身低微 B. 乐此不疲 C. 怀才不遇 D. 行行出状元

Optimizing Remote Synchronous Learning in A Chinese Language Class: Theory and Practice (优化中文语言课堂的远程同步学习：理论及实践)

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Abstract: During the COVID-19 pandemic, remote synchronous teaching became the mainstream form of online instruction. However, reducing transactional distance – the psychological and communicational distance between instructors and students is one of the main challenges. Drawing from the Theory of Transactional Distance (TTD), this study describes the design and implementation of a remote synchronous class with high structure, high dialogue, and high autonomy for a second-year Chinese course at the post-secondary level. High structure is reflected in the organization of teaching content as well as the content delivery methods. High dialogue denotes a high degree of learner-content, learner-instructor, and learner-learner interaction within the course. Additionally, learner autonomy is increased through the presence of reflection tasks. Findings from surveys show students' high level of satisfaction with this design. However, due to the nature of language courses and the alienation caused by distance learning, most students still prefer face-to-face or hybrid courses. We hope this case study can shed light on how to integrate the strengths of synchronous and asynchronous teaching in future course design.

摘要：疫情期间，远程同步教学成为了网上教学的主流形式。网上教学的一大难题就是如何减少交互距离，即师生交流时在心理及沟通上的距离。本文借鉴交互影响距离理论，以大学中文二年级课程为对象，设计了一门高结构性、互动性及自主性的远程同步课。具体来说，高结构性主要表现在教学内容组织、内容传递方式等方面。高互动性则包括学生与内容的互动、学生与老师的互动、以及学生与学生的互动。同时通过反思任务加强学习自主性。从学生的问卷调查及反馈来看，学生对于课程的设置高度满意。尽管如此，由于语言课程的性质、网课对学生自主性的要求、加上疏离感等原因，多数学生也表示更倾向于面对面授课或者混合授课方式。本文希望通过对交互影响距离理论的实践，可以启发老师设计出融合同步与异步教学优势的课程。

Keywords: Transactional distance, structure; dialogue, learner autonomy, synchronous, asynchronous

关键词: 交互距离、结构、对话、学习自主性、同步、异步

1. Introduction

As the COVID-19 pandemic spread worldwide in early 2020, many courses were forced to shift from face-to-face (FTF) instruction to online instruction. Hodges et al. (2020) referred to this type of teaching as “emergency remote teaching” (ERT). During this period, instructors had to adjust their expectations in response to challenges such as learning new technologies, accommodating accessibility requirements, and implementing measures for testing security. However, with these experiences of ERT, we have gained insights into the affordances of online teaching. As the effects of the pandemic are still ongoing, programs have started to make more conscious decisions in planning and implementing courses in online formats.

The primary modes of online teaching are synchronous, asynchronous, and hybrid. Synchronous teaching involves regularly scheduled live Zoom sessions that students are required to attend to receive instruction. In contrast, asynchronous teaching refers to an online context where all interactions take place asynchronously, whether that be through discussion forums, recorded videos, or chats. Hybrid teaching may fall anywhere between the two previously mentioned modes. For example, instructors and students may meet regularly through live Zoom sessions, with additional instruction completed asynchronously outside of class time. Though these modes of online instruction may differ significantly, in all cases, instructors and students are physically separated. Distance thus becomes a salient issue in remote online teaching. Moore’s (1993) Theory of Transactional Distance (TTD) offers a useful way to conceptualize and comprehend distance education in general (Jung, 2001). In this paper, we apply this theory in evaluating an online course with low transactional distance and explore how its design affects learners’ sense of autonomy and overall satisfaction with the course.

2. Theory of Transactional Distance (TTD)

Moore (1993) posits that there is a substantial physical and temporal distance between instructor and student in remote learning, which may lead to significant communication gaps. Distinct from physical and temporal distance, transactional distance (TD) refers to the psychological or communicative space that separates instructor from learner in the transactions between them. In a traditional classroom setting, the instructor typically has a high degree of control over the learning process and is able to provide immediate feedback and support to learners. In a distance learning environment, however, the instructor may not be able to provide immediate feedback or support when learners need it. This can create a sense of psychological and emotional distance between the learner and instructor, which can impact the effectiveness of the learning experience. Moore identifies three major factors that influence the extent of transactional distance: structure, dialogue, and learner autonomy.

2.1 Factors of Structure, Dialogue, and Learner Autonomy

Structure describes “the rigidity or flexibility of the course's educational objectives, teaching strategies, and evaluation methods” (Moore, 1993, p. 26). It describes the degree to which a course can adapt to accommodate each learners' distinct needs. In a more structured course, students need to follow the same sequence of activities and assessments. By comparison, in a course with loose structure, students can follow different pathways through the content or request accommodations from instructors.

Dialogue refers to two-way communication and interaction. In Moore's original theory, dialogue is confined to the interaction between an instructor and learner. However, as this theory has developed, the definition of dialogue has expanded to include learner-instructor, learner-learner, and learner-content interactions (Haythornthwaite, 2002; Zhang, 2003). Many studies have shown that learner-instructor interaction and learner-learner interaction are the main factors contributing to perceived learning effectiveness and student satisfaction (Dennen et al., 2007; Zhang, 2003).

The third factor, learner autonomy, refers to the individual learner's self-directedness – or sense of personal responsibility – in terms of what one learns, how one learns it, and how one evaluates their learning. It is contingent on factors like structure and dialogue. Autonomous learners are comfortable with classes with greater transactional distance, that is, less dialogue and more structure. In other words, if targeted learners show characteristics of high autonomy, it is possible to design a course with high structure and minimum dialogue to best meet their needs.

2.2 Relationship among the Three Factors

Regarding the relationship between these three factors and TD, it is generally agreed upon that an inverse relationship exists between dialogue and TD (Benson & Samarawickrema, 2009; Moore, 1993). However, there is no consensus on the relationship between structure and TD. It is hypothesized that a high level of structure limits dialogue, thus increasing TD (Moore, 1993; Saba & Shearer, 1994). However, it is noteworthy that earlier work on the subject mainly involves the use of asynchronous communication systems for course delivery and communication (e.g., Moodle, Blackboard). With the development of new technologies, interactions can now be enhanced through the use of synchronous systems. Previous research has shown that synchronous communication diminishes feelings of isolation, facilitates interaction and engagement, and contributes to group identity and community formation (Chou, 2002; Collis, 1996; Falloon, 2011; Haythornthwaite & Kazmer, 2002; McBrien, Jones, & Cheng, 2009; Pan, & Sullivan, 2005; Schullo, Hilberlink, Venable, & Barron, 2007; Yang & Liu, 2007). These studies suggest that course structure may not necessarily limit dialogue. Instead, dialogue may even be enhanced through an increase in course structure when combined with well-designed learning objectives and careful planning (Kearsley & Lynch, 1996; Wikeley & Muschamp, 2004).

Depending on the presence or absence of structure (S) and dialogue (D), there exist various ways of managing transactional distance, including $-S-D$, $-S+D$, $+S-D$, $+S+D$. Learner autonomy (A) can vary widely from full autonomy to no autonomy. Several studies focusing on aspects of structure and dialogue suggest that high structure and high dialogue reduce transactional distance (Huang, et al., 2016; Stein et al., 2005; Wikeley & Muschamp, 2004). This is aligned with findings that in contexts where transactional distance is high (e.g., off-campus or transnational context), high support in both venues of structure and dialogue must be built into the e-learning design (Benson & Samarawickrema, 2009).

In the field of Chinese teaching, synchronous remote classes were widely adopted by instructors during the pandemic (Wang, 2020). While synchronous teaching is still quite common in practice, there is little discussion on how different programs implemented this and how effective their strategies were. In this paper, we address a course design that features high structure and high dialogue (+S+D) in a second-year online synchronous Chinese class at the post-secondary level. We further discuss the impact of such a course design on learner autonomy and overall satisfaction based on student surveys and open-ended questions.

We choose this case because high structure and high dialogue formats are typical of many language courses. By elaborating upon what we define as high structure and high dialogue, coupled with concrete examples from our remote teaching practices, we show how this design is effective in reducing transactional distance and achieving student satisfaction. This study is significant as research is still scant on synchronous distance education, particularly in language education. Though this study is limited in scope and empirical evidence, we hope our findings will show instructors new areas of inquiry and new possibilities for future courses.

3. Design of Remote Synchronous Instruction: A Chinese Language Class

This study is situated within a Chinese language program at Indiana University Bloomington. With federal funding, this program hosts a Chinese Flagship Program, which is a national initiative in the United States that aims to improve students' language proficiency and cultural competencies needed to succeed in a globalized world. Proficiency-oriented language instruction is thus provided across all levels. Flagship students take courses with non-Flagship students but receive additional tutoring outside of class. Following ACTFL guidelines, we aim to achieve the benchmark as shown below (Table 1).

Table 1 Benchmarks of language proficiency for each level

	Non-Flagship/Flagship
First-year	Novice High/ Intermediate Low
Second-year	Intermediate Low/ Intermediate Mid
Third-year	Intermediate Mid/ Intermediate High
Fourth-year	Intermediate High/ Advanced Low
Fifth-year	Advanced Low~ Advanced Mid

In the first- to third-year levels, we adopt the lecture-drill mode of teaching, introducing the main content of the lesson and key language usages in lecture, while providing more targeted practice and individualized feedback in drill. Throughout each week, our teaching transitions from a more controlled manner to a less controlled one, with increased interaction among students. Student-instructor ratios are roughly 25 to 1 for lectures and 15 to 1 for drills. These courses rely on team teaching, where lectures are taught by full-time faculty and drills by graduate students. In this paper, we focus on a second-year Chinese course taught by the first author in the Fall 2020 semester. The total enrollment was 58, similar to previous years. In the following sections, we will describe our course design in terms of its structure, dialogue, and learner autonomy.

3.1 High Structure

Drawing from Sandoe (2005), we analyze course structure with regards to 1) content organization (e.g., syllabus, sequence, schedule), 2) delivery organization (e.g., layout, consistency, flexibility), and 3) course interactions delivery (e.g., communication methods).

3.1.1 Content organization

In general, content organization remained similar to FTF classes after we moved online. We covered a total of nine lessons in *Integrated Chinese Textbook (vol. 3)*. In a typical week of this second-year class, a new lesson was covered in five 50-minute sessions, starting with Tuesday's lecture and ending on the following Monday's drill (Table 2). While we covered the same number of lessons (9 lessons in total), we slightly lowered the pace by incorporating additional review sessions and assessments. In terms of pedagogy, lectures provided a "bite-size" expository and practice environment, while drills had more opportunities for learner-learner interaction and collaboration.

Table 2 Weekly class routine

	Before class Asynchronous online components	In class Synchronous meetings on Zoom	After class Online assignments and assessments
Tuesday (lecture 1)	Do preview (textbook & lecture slides) Complete dictation	Go over key vocabulary and grammar and first part of text	Workbook + audio recording or video quiz (alternative) due by completion of the chapter
Wednesday (drill 1)		Further practice key vocabulary and grammar in first part of text	
Thursday (lecture 2)	Do preview (textbook & lecture slides) Complete dictation	Go over key vocabulary and grammar and the second part of text	
Friday (drill 2)		Further practice on key vocabulary and grammar in the second part of text	
Monday (drill 3)		Apply new language forms in comprehensive tasks and activities	

One major adjustment we made in this course was transitioning from synchronous to asynchronous assessments. In FTF classes, students typically took a dictation quiz at the beginning of each lecture. However, it was time-consuming to do so in an online setting due to unstable audio quality and complications with uploading handwritten files. Therefore, we decided to set up timed dictation quizzes in the learning management system (LMS) called Canvas, allowing students to take them before class in an asynchronous manner. Likewise, all the written tests were set up in a similar way, providing students with slightly more flexibility in when and where to complete them.

3.1.2 Delivery organization

In an online setting, Canvas plays a much more important role in the delivery of a course. In addition to storing course materials and recording grades, it also serves as a platform for establishing goals and expectations as well as organizing content. Taking this into account, we redesigned our course site by updating the homepage and structuring the course in modules accordingly.

The homepage is the default page for the course on Canvas and is where every student first learns about the course. Our redesigned homepage included the following components:

- Course expectations: Syllabus and modules
- Instructor information: video recording of instructors' self-introduction, contact information, office hours, and Zoom links
- Learning goals: expectations for students' performance by the end of course
- Language learning resources: useful websites, tools, or apps for language learning
- Guidelines for online coursework: rules of netiquette
- Tools: common tools used in the course (e.g., Zoom, Canvas, Kaltura, Google at IU, etc.)

The course content was divided into modules, as seen in Figure 1. In each module, an overview page described the learning objectives and to-do list in English. Students had a clear idea of what they should be able to accomplish with language after completing each chapter. The to-do section listed what students were expected to do before and after class to achieve these objectives. It showed a learning path that instructors found effective while providing students flexibility in completing tasks out of sequence and finding a learning path that worked for them. As shown here, the overview page served as a hub for students to find all the materials needed for completing that particular chapter. This structure made it easy for students to navigate through the material and provided consistency within the course.

Another benefit of using modules was the adaptive release function in Canvas (Figure 2), which allowed instructors to set requirements to be enforced by the website. Students would have to either complete some or all of the requirements before they could access content in the following modules. This helped both instructors and students track their learning progress.

L3 | Overview

Weekly Learning Objectives

1. Order food and drinks
2. Talk about what tastes you like and dislike
3. Describe your dietary restrictions and preferences
4. Name principal regional Chinese cuisines and tastes

To-Do

- PREVIEW
 - Read vocabulary and text
 - Listen to [audio recordings](#) on CELT website and repeat after it
 - Read grammar explanations
 - Watch the video titled 20FA C201 L3 在饭馆儿 - (no quiz) in Kaltura:Media Gallery.
- ASSIGNMENT
 - Review lecture slides ([Tuesday](#), [Thursday](#)) & drill slides ([Wednesday](#), [Friday](#), [Monday](#))
 - Check video recordings of class on Kaltura Media Gallery.
 - Contact Laoshi if you have questions (see [homepage](#) for Laoshi's email & office hours information or send message on Canvas)
 - Complete L3 assignment, including 1) assigned parts in workbook ,and 2) audio recording
 - Complete the video quiz titled 20FA C201 L3 在饭馆儿 - (quiz) by the end of last drill.

Figure 1 Lesson overview page

Week 1 Welcome

Lock until

Requirements

Students must complete all of these requirements

Students must move through requirements in sequential order

Student must complete one of these requirements

Cultural artifact submit the assignment

+ Add requirement

Figure 2 Module adaptive release function

3.1.3 Course interactions organization

In terms of communication, we use Zoom as the platform for holding synchronous teaching, office hours, and other extracurricular activities. Canvas was the main site for sharing course materials, setting up assignments, quizzes, and tests, providing feedback, and making announcements. Other ways of communication included email, Canvas messages, and social media apps (e.g., GroupMe, WeChat). Creating a class GroupMe was helpful for instructors to send quick reminders and clarifications. It also became a useful platform for timely communication in cases when Zoom or Canvas failed during class.

According to TTD, our course was highly structured and class-paced. In a class-paced course, the content was predetermined by the instructor and delivered in a certain sequence. Students were expected to progress through the material at a specific rate. Taking into consideration the affordances of Canvas, we provided sufficient guidance and direction to students in the learning process. The adjustments we made regarding dictations facilitated asynchronous learning, giving students more flexibility. In the following section, we will discuss how our course design helps learners to engage in dialogue with content, instructors, and peers.

3.2 High Dialogue

Communication medium has a direct bearing on the quantity and quality of dialogue. As synchronous communication technology (e.g., video conferencing and chat tools) progresses, it is easier than ever to achieve synchronous learning, greatly reducing the psychological and communicative space existing in traditional forms of online learning. In addition, as recent LMS (e.g., Canvas, Blackboard, Google classroom) can integrate various tools/APPs and provide more sophisticated functions, instructors can create and customize course design to suit their teaching needs, which contributes to effective asynchronous learning. Thus, the question is not how we can incorporate dialogue into distance learning, but rather how communication medium changes dialogue, and how we can make full use of technology to interact with one another in class. In the next section, we focus on three types of interaction in the learning process: learner-content interaction, learner-instructor interaction, and learner-learner interaction.

3.2.1 Learner-content interaction

Learner-content interaction refers to the process of accommodating new understanding into one's cognitive system and constructing knowledge. This is considered a crucial form of interaction because it is where learning takes place. Below are the practices we adopted to enhance this type of interaction.

Presenting content in multi-modalities

Previous research showed that multimodal teaching helps learners gain nuanced understanding of subject-matter content knowledge (Choi & Yi, 2016). In our context, the textbook and its accompanying audio recordings were the main sources for students to gain knowledge about language use. To help learners construct meaning in multiple modes, we also uploaded course slides and instructional videos to Canvas in advance. Besides, since Zoom can record synchronous classes, we shared the archived video recordings of each class with students afterward. As a result, students could review the content through various formats such as text, graphics, audio recordings, and videos.

Using various assessments to check students' mastery of content

In a traditional class, students usually have to wait multiple days to get instructor feedback on assignments and exams. While this type of feedback is still provided electronically in remote classes, technology can afford another source of feedback: automated feedback. This type of feedback is instant and consistent, allowing students to identify their mistakes without the presence of instructors.

For all the dictation quizzes, students were able to view the correct answers to objective questions after submitting the quiz (Figure 3). This helped students judge how well they were prepared for the class. In another example, the first author developed a series of close-to-life videos that were based on the themes in the second-year Chinese textbook. These videos were 5-7 minutes long and included narratives, conversations, and

interviews using key vocabulary and patterns from that chapter. The instructor created embedded quizzes about the videos on Kaltura, which were integrated into the Canvas site. By taking the quiz and receiving automated feedback, students could know how well they mastered the new content. The auto-generated statistics for each quiz also allowed instructors to identify areas in which students needed further practice.

In addition to the dictation quiz mentioned earlier as a form of asynchronous assessment, instructors also incorporated live activities using apps like Kahoot and Poll Everywhere in synchronous classes. Instructors created questions in advance and published them during class. Question formats were diverse, including, but not limited to, (a) word collocation, (b) filling-in-the-blank, (c) true or false, (d) matching images with descriptions. Instructors could view students' responses immediately and adjust their pace of teaching accordingly.

Score for this quiz: 100 out of 100
Submitted Oct 13, 2020 at 2:31am
This attempt took 18 minutes.

Question 1	5 / 5 pts
Which of the following is NOT true? 天明觉得这学期的课怎么样?	
<input type="radio"/> 中文课听和说很容易	
<input type="radio"/> 汉字有点儿难	
<input checked="" type="radio"/> 其他课不需要花很多时间	
<input type="radio"/> 其他课不太轻松	

Correct!

Figure 3 Canvas dictation quiz with auto-feedback

3.2.2 Learner-instructor interaction

Learner-instructor interaction is defined as assistance and support instructors provide to learners in helping them develop a new understanding of content. As experts in the subject matter, instructors help learners assess their understanding of new knowledge as they apply it. In language classes, instructors play a critical role in providing language input as well as giving feedback on students' language output. Below, we will discuss what we have done in these regards.

Using multi-modal input to scaffold learning

According to Krashen (1981), comprehensible input is a prerequisite to language acquisition. In an online setting, verbal input may be constrained due to unstable sound quality and audio cutoff. On the other hand, non-verbal input such as facial expression and body language is limited to a small window within Zoom. During classes, students sometimes complained that they had difficulty hearing the teacher's language modeling. Therefore, it is important to provide multi-modal input, that is, a combination of input in

text, image, audio, video, gestures, etc. (Figure 4). Drawing from Mayer's (2001) multimedia learning design principles, we presented words and images together rather than words alone to foster generative processing. We also used signaling (i.e., highlighting essential material by color-coding and annotation techniques such as underlining/drawing/circling) to help students notice, attend to, and process the input. The teacher's questions and modeling examples were also displayed on slides to maximize the total amount of input students could receive. Ultimately, the redundancy of course input in multiple formats served to enhance comprehension and learning.

中国的小学

- <https://www.youtube.com/watch?v=Eu39iopXKAo>
- 中国小学生在上学以前需要学什么？
- 他们一天的生活忙不忙？
- 跟你的小学生活有什么一样的和不一样的地方？
- 还有什么你觉得有意思的或者没想到的事情？

序号	时 间	内 容
1	7:30—8:00	学生到校
2	8:00—8:45	第一节
3	8:45—9:15	课间操
4	9:15—9:45	第二节
5	9:45—10:15	第三节
6	10:15—10:45	第四节
7	10:45—11:30	第五节
8	11:30—12:00	午 休
9	12:00—12:45	第六节
10	12:45—1:30	第七节
11	1:30—1:45	散 步
12	1:45—2:30	阳光体育活动
13	2:30—2:45	第八节
14	2:45—3:30	第九节
15	3:30—4:00	学生离校时间

在中国孩子从小开始做什么？到了三四岁呢？再长大一点呢？安排sb+V; ……，像A,B,C什么的；除了…以外，还…；A让B+VP; A给B很大的压力; ……，连…都…

在中国，孩子从很小的时候就开始认字，学英文。等他们到三四岁的时候，父母就安排他们上很多兴趣班，像画画、钢琴、跳舞什么的。等他们到六七岁的时候，除了上艺术课以外，还得花很多时间做课外作业。父母给孩子很大的压力，害得他们连周末都没有时间休息。

你觉得父母为什么让孩子做这些事？这样的教育有什么好处和坏处？

Figure 4 In-class slides with multimodal input

Utilizing tools to support language output

Output plays just as much a role as input does in language learning. According to Swain's (1985) Output Hypothesis, learners need to be pushed to produce language in order to notice gaps in their output and test tacit hypotheses about language rules. However, it usually takes more time to switch between speakers in an online setting. As a result, opportunities for each student to verbally apply language were not as frequent as in FTF classes. One way to compensate for the loss of speaking opportunities was to use GroupMe as a platform for students to video record their oral output, especially after the instructor's modeling or a group discussion. Using this method, everyone had a chance to speak, and instructors could quickly check students' output and provide feedback.

Adopting interactive tools to increase engagement

Many instructors have noticed students' lack of concentration in online settings. Whether at home or in a dorm, students seem to be more easily distracted by their surroundings and other electronic devices. To counter this phenomenon, we aimed to check in with students more frequently about their learning process during class. For example, we often used the "thumbs-up/thumbs-down" function in Zoom to conduct quick polls. Virtual whiteboard annotations and in-discussion chats were also useful tools for brainstorming, sharing thoughts, and providing responses to prompts.

Offering various forms of feedback

As learners may lack the ability to judge if they are applying new language forms correctly, instructors' feedback is critical in solidifying language acquisition. Similar to FTF classes, instructors provided feedback verbally and used traditional whiteboards during a synchronous online class. Furthermore, Zoom's in-meeting chat feature allowed instructors to record students' errors, supply language forms they needed, or recycle what was previously learned. With notes in the chatbox, students could work on appropriate ways of expressing language either individually or collaboratively. Many students indicated that these notes were useful learning resources and downloaded them to their own devices for future reference.

Regarding asynchronous feedback, in addition to setting up automated feedback for objective questions, we added clear and detailed grading rubrics for larger assignments, such as the final project and essays. Rubrics helped instructors communicate with students what they regarded as quality work, which in turn allowed students to assess their own work accordingly.

3.2.3 Learner-learner interaction

Learner-learner interaction refers to the interaction between one learner and other learners. It can take place in the form of one-on-one or group interactions. In this process, peers play an important role in helping one check their understanding of new knowledge. In this case, knowledge is not transmitted from instructor to student but instead constructed by the learners themselves. Instructors do not assume an authoritative role but rather acknowledge and encourage the development of expertise among students.

Designing interactive tasks by using annotation and chat

Techniques for designing interactive tasks are diverse, including think-pair-share, hot seat, jeopardy, role-play, debate, and more. The key principle is to create "gaps" in communicative activities (e.g., information gaps, reasoning gaps, or opinion gaps) to help speakers engage in the process of meaning negotiation. For example, when learning the chapter of Choose Classes in *Integrated Chinese 3*, students worked in pairs to share information on their course schedule and progress toward their degree, thus bridging an information gap. Other activities targeting reasoning gaps asked students to propose a solution to a problem or provide advice on a complicated situation. For example, students discussed in groups whether to live in a dorm or rent an apartment when planning for accommodations during study abroad.

While it took longer to assign groups and explain task instructions online, annotation and chat functions allowed for interaction in the written modality (Figure 5 & Figure 6) in addition to oral interaction. In the lesson covering the Education chapter, for example, we discussed whether or not parents should take an active role in arranging for their children's life. At first, students immediately agreed upon a single perspective. However, the instructor then guided students in asking follow-up questions about arguments for the opposing side, which aimed to facilitate further conversation and critical thinking. After oral discussion, students built upon each other's responses to develop a

more sophisticated argument in the chat box. Finally, instructors selected some students to share what they wrote. By following these steps, students engaged in all three modes of communication, and their language output progressed from discrete sentences to extended strings of sentences.

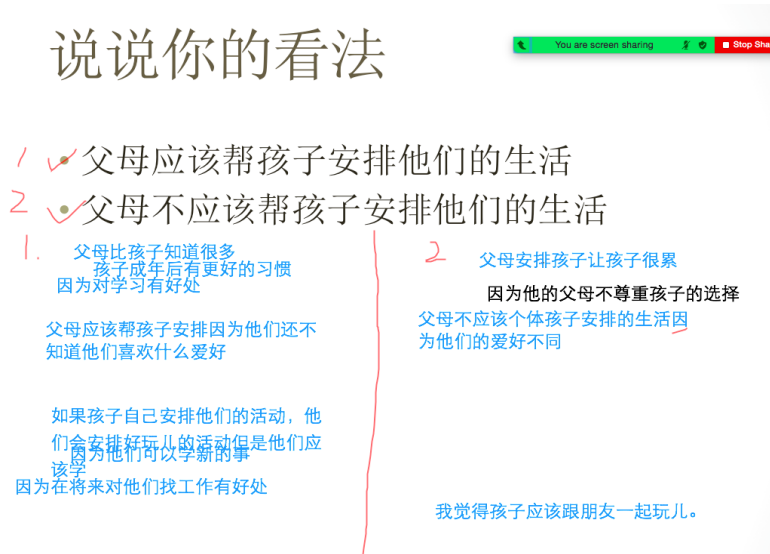


Figure 5 In-class discussion using Zoom annotation

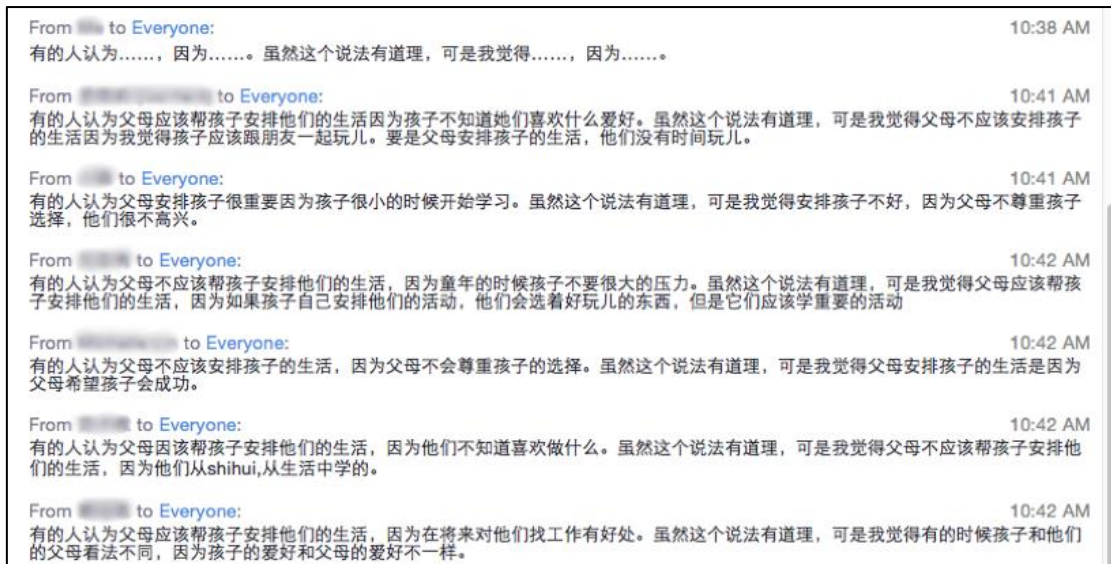


Figure 6 In-class discussion using Zoom in-meeting chat

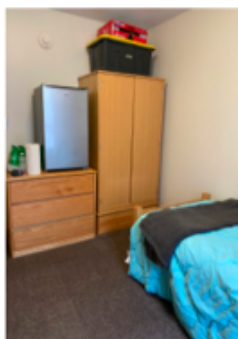
Using Zoom breakout rooms or discussion board for interaction

In an online setting, each breakout room can be conceptualized as an individual workstation with shared or different tasks. Students assigned in one room need to work collaboratively to complete the relevant task. However, interactions in breakout rooms may not be as effective as in an FTF class since instructors cannot simultaneously monitor all interactions. Therefore, we strived to include detailed instructions and all relevant

vocabulary/grammar on the slides or handouts. Furthermore, instructors sometimes set up Google documents for students to update during their discussions. This way, instructors could still provide timely feedback and enter rooms that seemed to be stuck.

In addition to synchronous interaction, we also used discussion boards on Padlet to facilitate asynchronous interaction (Figure 7). In the example below, students posted a picture of their living space and appended a written description. Classmates were instructed to make comments on their peers' posts.

我的房间里有一张床。床上有一套被子和一套毯子。除了一张床以外，还有一张书桌。书桌前面是一把椅子。房间里也有一个书架和一个衣柜。我也有一台冰箱，我的公寓离马路很近，所以我的房间吵得很。公寓附近有别的公寓，一些餐馆，和Eigenmann宿舍。公寓附近也有商店。太方便了！我很喜欢我的公寓。



↩ Reply



你的房间看起来很好！你有很多家具，很方便！

↩ Reply



你的衣柜上摆着一台冰箱，太可爱了！

Figure 7 Student post on Canvas discussion board

Promoting collaborative learning through student project

Previous studies have shown that learning in small groups can have significant positive effects on students' individual achievement (Lou, et al., 2001). Designing assignments or assessments that require interaction and collaboration is another useful way to increase learner-learner interaction. At the end of our semester-long course, we asked students to complete a final project in the form of a video or e-book. The project required collaboration throughout each step, including 1) writing an outline, draft, and revised script, 2) collecting images and audio/video clips or shooting video footage, 3) rehearsing and recording the script, 4) editing the e-book or video, and 5) presenting and conducting a Q&A. Since this was a significant assignment accounting for 10% of students' final grades, it was helpful to split labor and expertise among group members. To ensure student accountability, students were asked to rate their team members on their attitude, engagement, and contribution to the final product. Many students gave very positive

feedback on the final project and described it as simultaneously challenging yet creative and fun. They also enjoyed how this experience brought them closer to some of their classmates.

3.3 Learner Autonomy

As discussed in the above sections, our synchronous online Chinese classes were highly dialogic and had a high level of structure. According to the hypothesized relationship between learner autonomy and transactional distance, our course should theoretically be able to accommodate students with lower levels of learner autonomy.

Furthermore, we made efforts to cultivate learner autonomy by incorporating a series of student self-reflection assignments in our course. Throughout the semester, students wrote three reflection posts based on the detailed prompts and replied to at least two classmates' posts. In general, students reflected on their learning progress, set personal learning goals, and exchanged ideas on learning resources and learning strategies with peers. Highlights of each reflection assignment are summarized below (Table 3).

Table 3 Self-reflection post assignments

	Main tasks	Timeline
Reflection 1	<ol style="list-style-type: none"> 1. Check one's current proficiency level and identify areas that need improvements in three modes of communication 2. Find out reasons for difficulties you have encountered 3. Set up three micro goals following SMART rule 	beginning of semester
Reflection 2	<ol style="list-style-type: none"> 1. Check on your progress toward goals 2. Read learning tips shared by the instructor and choose some to incorporate into your learning routine 3. Use checklist prepared by the instructor to evaluate your readiness to move on 	mid-semester
Reflection 3	<ol style="list-style-type: none"> 1. Share learning strategies/habits/resources you plan to keep in future learning 2. Comment on pros & cons of different modes of learning (online vs. in-person, synchronous vs. asynchronous) 3. Evaluate the level of learner autonomy required of this course 	end of semester

Students could choose to answer in English or Chinese, and the assignments were graded on completion. In response to some heated online discussions, the instructor also summarized common problems and useful learning tips mentioned by students and provided further resources or suggestions during synchronous classes. Overall, it was a useful way to help students assess where they were, where they hoped to go, and how to get there. In the process, they gained a sense of learner responsibility and a sense of empowerment. More importantly, by exchanging ideas and providing emotional support, students developed a sense of connectedness and belonging in the classroom community.

4. Students' Feedback

4.1 Survey Results

In order to better understand students' views on the components of structure, dialogue, and learner autonomy in relation to their overall satisfaction with the course, we created a survey of student perception of synchronous online classes based on Zhang's survey (2003) (Appendix A). The questions included perceptions of the course structure, course content, instructors and students in the class, learner autonomy, and overall satisfaction. The survey was sent out to the whole class after the final grade for this course was posted. Among 58 students enrolled in the class, we received 16 responses.

Course structure. 93.75% of participants agreed on the statements that 1) the course was organized in a clear manner, 2) the course site was informative, and 3) the course site was easy to navigate. Most participants also agreed that course objectives and outcomes (87.5%), assignment requirements and schedules (81.25%), and grading policy (81.25%) were clearly stated.

Course content. All respondents agreed that the course content was of great interest to them. Most of them (93.75%) also felt that the course materials were at a level appropriate for them. 87.5% of respondents agreed that they knew the learning objectives. Likewise, 87.5% of participants responded agreed with the two statements that the coursework facilitated their learning and that the exams in this course challenged them to do their best.

Interaction. In terms of instructor-learner interaction, all participants agreed that the instructor paid attention to students. They all felt that they could turn to the instructor when they needed help in the course. 93.75% of participants agreed that the instructor answered students' questions and was helpful to them. When asked about feedback, 87.5% agreed that the instructor provided frequent feedback in class. All of them were in agreement with the statement that they received prompt feedback from the instructor on their academic performance. Overall, they felt the interaction between the instructor and the whole class was high (87.5%).

Most participants agreed that their classmates were supportive (93.75%) and that they felt respected by other class members (87.5%). However, there was a lower percentage of agreement on the effectiveness of learner-learner interaction. Half of the participants agreed that they learned a lot from interacting with other students. 43.75% of respondents agreed that their classmates challenged them to do their best work. However, only 37.5% felt a sense of kindred spirit with their fellow classmates.

Autonomy. Students indicated that the course could accommodate their learning goals (93.75%) and learning path (87.5%), as well as evaluate various types of learning (81.25%). Yet, they hoped to have more autonomy in identifying their learning goals and objectives (68.75%), determining the pace and sequence of learning (62.5%), and evaluating the usefulness and quality of learning (68.75%).

Overall satisfaction. When asked to rate their level of agreement with statements expressing overall satisfaction with the course, a high percentage of respondents indicated that they enjoyed learning in this class (93.75%) and felt they learned a great deal in this course (93.75%). Besides, 75% of respondents agreed that, overall, they were extremely satisfied with this course. Yet, there was a split on the effectiveness of online classes as opposed to face-to-face classes. 37.5% agreed that they learned as much in the online class as in face-to-face class, while over half (56.25%) showed disagreement. Overall, we believe that the high degree of student satisfaction can be attributed to our current course design. The preference for an alternative course design is further explored and discussed in the next section.

4.2 Open-Ended Questions

In addition to the survey, the first author also asked students to share their thoughts on the level of learner autonomy required during the course and their preferences for course design in the reflection post. Below we will report student opinions in these two regards.

4.2.1 Learner autonomy

Most students reported that the synchronous Chinese course required a high level of learner autonomy. They mentioned that they needed to complete previews, dictations, workbooks, reviews, and tests on their own. In fact, many of these requirements were the same as in an FTF class. As stated by one student,

You can't really fake your way through it (i.e., learning Chinese). You have to come to class/the test knowing the vocab and past grammar in order to build on it for the class that day. Even in-person, this course would require a much higher level of learner autonomy than most others.

In other words, this Chinese class required more learner responsibility regardless of the medium. Students needed to undertake a more active role in preparing for the class and reviewing regularly. One student put it this way, “If you fall behind, it can be really hard to keep up with assignments or to actively participate during class. I have to frequently review content in order to make the learning more concrete.”

Out of the areas of setting goals, learning experiences, and evaluation, students most strongly indicated that our course supported autonomy in learning experiences. As one student said, “I think this class has a high level of learner autonomy in terms of how to learn the material, but not in terms of what to learn.” In the case of writing characters, we did not restrict students to one way of practicing. They could either write characters over and over on a piece of paper or use apps like Skritter. Similarly, when learning vocabulary, they could either make paper or electronic flashcards, use mnemonics, or practice new words in context. Thus, while learning goals and evaluations were mainly determined by instructors, students could choose learning strategies or tools that worked best for them.

When compared with other non-language online courses – particularly asynchronous ones – our synchronous Chinese courses seemed to be manageable for students. As one pointed out,

The learner autonomy for this class isn't nearly as high as the classes I have that are mostly asynchronous. It's up to me to have the motivation to watch all the lecture videos on my own time rather than being scheduled and expected to show up to class for lectures. Chinese class still has autonomy in the fact that we have to preview, but that's still the same expectation as when we were in person.

Many students felt that daily meetings greatly helped them keep up with the class's pace and reduced excessive self-autonomy requirements. One student wrote,

I think this class does have a higher level of learner autonomy than many other ones, but since it's every day (sic) and synchronous, it requires less than other online classes I've taken. Seeing 老师 everyday holds us as students much more accountable than a fully asynchronous course, and that helps to keep me engaged. The current mix of autonomy and support seems reasonable.

In summary, while many students felt that our course did require a high level of autonomy, they also recognized that it was necessary and beneficial for language learning. As one student said,

At the end of the day, I think that people get out of this class what they put into it. It is pretty hard to learn nothing from this class, but people still have to put in work to really learn the material.

All the students showed great appreciation for the instructors' strong support throughout the semester. The mix of learner autonomy and teacher support seemed to be appropriate for this class.

4.2.2 Course design

Ultimately, the results showed that a majority of students preferred face-to-face classes. Many students felt that they did not learn as much online as in person. However, this seemed to be more of an issue due to the nature of language courses and the instructional modality than course design. In a language class, language is both the objective of learning and the medium through which we communicate. As stated by one student, "When it comes to learning languages, face to face is often better because you get to really interact with people. It's weirder to do it online." While synchronous communication is comparable to in-person communication in many regards, it is overall not as effective due to technical limitations such as audio quality or lagging issues. One student mentioned, "The lag is the worst part, because it often causes me to miss what Laoshi is saying or not being able to hear clearly, which are both very important for a language class." It also made chorus response after instructors' modeling undesirable.

Another major reason for students' preference for in-person teaching is related to the level of teacher support and engagement in pair and group work. While Zoom breakout rooms allowed for student interaction, it was not as easy as in an FTF class for instructors to monitor each group's progress and provide timely support when needed. Students commented that "getting assistance in the breakout rooms was much harder because the teacher could only be in one breakout room at a time, instead of overlooking the entire class like in an actual classroom". Additionally, as pointed out by another student, "I also think that the level of engagement in breakout rooms depends vastly on the mood of the day, the people you're partnered with, or other factors". While this issue also occurs in FTF classes, instructors are able to motivate students more easily or clarify any confusing points.

The third common issue with online learning was a sense of isolation. In FTF class, both frequency and quality of interaction were higher because learners were more likely to interact with each other outside the classroom. However, in online classes, most interactions were constrained to Zoom meetings. As one student mentioned, "There is no talking with classmates before/after class." In general, the liveliness and feeling of community were weaker in online classes. As another student said, "I miss laughing together during class." As a result, many students felt that they could not have the same bond with classmates as they could have in person.

Nonetheless, hybrid classes (i.e., combination of face-to-face and online class) seemed to be a possible option for many students. A course design option supported by students was differentiating teaching modality for lecture and drill. As explained by one student,

I would prefer hybrid classes where lecture classes are online and drill is in person. Since lectures are more focused around sentence structures, it would be nice to go back to the recording and watch them again in case I forget how to use them.

The student did not specify whether they preferred the online lecture to be synchronous or asynchronous, but several students echoed their stance on the usefulness of video lecture recordings. In another post, one student stated,

I believe that there could be a good balance of both types in order to experience the two different learnings. Watching videos and instructional materials such as videos and audio recordings can be done best for asynchronous learning. The synchronous learning could be best used for presentations, teacher interaction and more lecture time for any material not fully understood online.

This is in line with the rationale for a flipped classroom model, in which students watch the prerecorded lecture on factual knowledge outside of class and engage in applying knowledge and discussions during class time.

5. Discussion

When reflecting on Moore's theory in relation to our practices, we found that our synchronous course design allowed for quality dialogue. Along with practices to provide structure, we managed transactional distance to an extent that was appropriate for students with the current level of learner autonomy. As stated by Yang & Liu (2007), a synchronous online learning environment "not only delivers course materials, but also provides a live, contextual, and interactive environment for learners" (p. 171).

More specifically, as many learners had no or little prior experience with language courses at the college level, they were satisfied with our highly structured course because it helped them gain a better understanding of course goals and organization, as well as keep up with the pace of our class. As suggested by Moore (2004), instructors should err on the side of providing too much structure than too little because it is easier to take away structure than to add structure. Besides, creating channels for dialogue allowed for the negotiation of structure, which was also important for any kind of teaching, particularly online teaching. Even for highly structured courses like ours, instructors were still open to receiving feedback from students and making adjustments to accommodate students' needs.

It is also noteworthy that the LMS utilized in our course made it easy to structure and deliver course content in an organized way. In the past, our FTF class was enhanced by Canvas. After moving online, Canvas has become the home base for our course. Thus, in the future, even when we return to in-person instruction, it is still worth making an upfront investment in setting up the LMS as a central place where students access course materials, receive information and general help with the class format and technology, and complete various forms of assessments.

In terms of dialogue, our study confirmed the important role of interaction in successful distance learning (Bernard et al., 2009; Haythornthwaite, 2002). Learner-content and learner-instructor dialogue were high, contributing to overall satisfaction with the course. In the current context where teaching occurred 100% online, maintaining high dialogue was crucial to bridging the transactional distance. As shown in the students' opinions above, what they found most helpful for their learning was instructor-learner interaction in the process of using language. Similar to FTF teaching, synchronous online class time allowed instructors to monitor students' performance and provide just-in-time clarification and feedback (Pan & Sullivan, 2005), greatly reducing transactional distance.

In comparison, learner-learner interaction was not perceived as effective as the other two types of interaction, which may be attributed to a lower level of teacher support during group work, as well as a weaker sense of connection among students. However, it did not mean that students did not like student interaction. In contrast, as commented by one student,

One thing that has helped me learn in class is doing the breakout rooms. I feel like if I am confused about something, it is a good time to ask my classmates what they think and it also gives me a chance to test what I know

and make sure I am understanding everything. It also gave me a chance to connect with my classmates when I otherwise would not be able to.

As pointed out by Moore (1993), it was the quality, rather than frequency of learner-learner interaction, that was critical to diminishing learner perception of transactional distance. Therefore, in future synchronous online courses, instructors will need to prioritize the establishment and promotion of quality interaction among students.

According to students' feedback about learner autonomy, language courses generally require a higher sense of independence than other subjects, and even more so in an online setting. Given the gap between the autonomy required by the course and students' actual personal autonomy, it is necessary to provide a high level of structure, as mentioned earlier. Since learner autonomy is not predetermined by the instructor, it is recommended that instructors design a questionnaire to learn about students' learning habits and level of self-directedness before the course starts.

As students gain more experience in language learning, they should be expected to have more ownership in their learning path. In other words, as students advance in their language learning, the course design may transit from +S, -A to -S, +A. As pointed out by Falloon (2011), instructors need to strike a balance between learner autonomy and course structure so that learners can “maintain a sense of empowerment and ownership of their learning” while “working within a structure that provides adequate direction and communicates clear standards and expectations of performance” (p. 206). Overall, promoting a sense of learner autonomy can contribute to learner-learner interaction in the long run. When students become more accountable for their learning, they tend to be more motivated to participate and more engaged in completing tasks and finding resolutions to learning problems.

6. Conclusion

Overall, TTD is a useful pedagogical framework for instructors to design and evaluate remote education practices. In fact, the three elements of structure (course design), dialogue (course implementation), and learner autonomy are crucial to any form of teaching. Our study suggested that our synchronous online learning environment had a relatively low transactional distance, which contributed to students' overall satisfaction with the course. Many of the teaching practices discussed above may have been or can be applied to an FTF class.

Moving forward, we need to take into consideration synchronous and asynchronous learning as a whole and consider what optimal course design might mean for different programs. Blended learning approaches that involve various combinations of online and face-to-face instruction have become a major trend in online learning (Means, Bakia, & Murphy, 2014). With flexibility through asynchronous learning and quality interaction through synchronous learning, blended learning might become the preferred mode even after the pandemic ends. As shown in our survey results, students recognize the value of asynchronous learning, and some also support replacing synchronous lectures with

asynchronous learning, especially during the initial stage of acquiring factual knowledge about language forms. In other words, learners can use the materials (e.g., textbook, slides, handouts, videos, etc.) prepared by the instructors to engage in the learner-content dialogue at their own pace in any place while engaging in additional interactions with instructors and peers in a face-to-face environment.

Furthermore, the technology used in online teaching seems to have a profound impact on students' learning experience. When Moore first proposed his theory, physical and temporal distance was rather prominent in correspondence education (teaching through audio/video recording and broadcast), contributing to a substantial psychological or communicative gap. However, as technology has advanced, it has become easier to achieve both synchronous and asynchronous learning. What instructors need to consider is the effectiveness and efficiency of technology. More specifically, effectiveness refers to whether a specific technological tool can help students to reach their learning goals. Efficiency refers to the time and energy needed in using the tool to achieve such goals. Our experiences have shown that tools as simple as annotation or in-discussion chat can enhance the quality of interaction during class. In essence, what matters most is not how many or how frequently we adopt new tools but rather how effectively and efficiently these tools can help us achieve better learning outcomes.

There is no doubt that the COVID-19 pandemic has majorly disrupted teaching across the world. Nonetheless, it has also provided an opportunity to explore other possibilities in course design. Equipped with online teaching experience, we now have a better understanding of factors that may affect teaching and learning not just in remote classes but also in brick-and-mortar classes. Many of the practices mentioned above can also be applied in FTF classes when the pandemic is over. There is no set formula for these elements in providing effective learning. As stated by Moore (1993), the extent of dialogue and the degree of structure varies from course to course. Technology itself is not the answer; a successful course design also depends on the teaching philosophy of the instructor, the capacity of the learners, and the nature of the subject. Future researchers, instructors, learners, and designers must have an open mind to new approaches and practices in order to optimize course designs for language learning.

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Appendix A

A Survey of student perception in synchronous online class

The purpose of the survey is to learn about your perceptions and experiences studying in a synchronous online class. Your responses will be anonymous and will not affect any grades in this course. Because no identifying data is requested, your answers cannot be traced back to you. This survey is conducted on a voluntary basis. If you agree to participate in this study, the only thing you need to do is to complete the survey and you can choose to quit anytime. Therefore, there is a minimal or no risk to you. If you have any questions or comments, please email the two researchers: Yingling Bao (yingbao@iu.edu) or Yea-Fen Chen (yeafen@indiana.edu).

Please read the following statements and rate your responses on a scale of 1-5.
1 means Strongly disagree; 2 Disagree; 3 Neutral; 4. Agree; 5. Strongly agree

Is this your first semester studying in an online course at college level?

Perceptions of the environment

It is difficult to pay attention to the instructor in an online class.

I have adequate access to the resources I need.

The fact that I am online does not inhibit my class participation.

An efficient system is provided for students and instructors to exchange materials.

I am comfortable using the computer.

It is easy for me to use the technology involved in this course.

The environment outside of class (e.g., home/dorm environment, health, finances, etc.) has been helpful with my learning.

Perceptions of the course structure

The course is organized in a clear manner.

The online course site is informative.
The online course site is easy to navigate.
Course objectives and outcomes are clearly stated.
Assignment requirements and schedules are clearly stated.
Grading policies are present.
The course contains flexible or adaptable learning pathways.

Perceptions of the course content

The content of the course is of great interest to me.
I know our learning objectives.
The course materials are at a level appropriate for me.
My coursework provides various types of language input to help us learn new language forms.
My coursework provides many opportunities for us to apply new language forms in various contexts.
My coursework emphasizes communicating in the target language instead of rote memorization.
The exams in this course have challenged me to do my best.

Perceptions of the instructors in this course

The instructor general answers the students' questions.
The instructor pays attention to students.
I receive prompt feedback from the instructor on my academic performance.
The instructor provides frequent feedback (formal and informal).
The instructor is helpful to me.
The instructor is available to answer my questions.
I can turn to the instructor when I need help in the course.
I pay attention to the interactions between instructor and other students.

Perceptions of other students in this course

I learned a lot from interacting with other students.
The students in this class challenge me to do my best work.
I get along very well with my classmates.
I feel respected by my classmates in this class.
I am good at working with other students in this class.
I feel a sense of kindred spirit with my fellow classmates.
I can turn to my classmates when I need help.
My classmates are supportive.

Learner autonomy

I am self-motivated to learn.
I am a self-disciplined person.
The course can accommodate my learning style.
The course can accommodate my learning goals.
The course can accommodate my learning path.
The course can evaluate various types of learning.
I hope to have more autonomy in identify my learning goals and objectives.
I hope to have more autonomy in determining the pace and sequence of learning.
I hope to have more autonomy in evaluating the usefulness and quality of learning.

Perceptions of the whole course

I am thoroughly engaged in learning in this class.
I enjoy learning in this class.
I often express myself in this class.
I am encouraged to express my opinions.
I feel part of a learning community in this class.
Overall interaction between the instructor and the whole class is high.
In general, students are motivated to interact in class.

I have learned a great deal in this course.
I have learned as much in the online class as in face-to-face class.
I have made great progress towards my goal in this course.
Overall, I am extremely satisfied with this course.

Suggestions and comments

Any thoughts and feedback are welcome and greatly appreciated!

Chinese Online Teaching and Learning: The CMU OLI Chinese Online Program (网上中文教与学: CMU OLI 网上中文课程)

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Abstract: This paper introduces and describes the design of the Online Chinese curriculum developed for the Open Learning Initiative (OLI) platform at Carnegie Mellon University. The course addresses the four skills of speaking, listening, reading and writing, and also includes culture learning components for beginning Chinese. It will provide detailed information on the curriculum design, scope and sequence, content and online tutor exercise modules. It will also showcase the behavior data and assessment outcomes collected by the system and discuss how to effectively incorporate them into a pedagogically effective and efficient Chinese online curriculum.

摘要: 本文介绍描述美国卡内基梅隆大学在网上开放学习计画 (OLI) 平台里所开发的网上中文课程。此网上初级中文课程一共为期两个学期, 课程内容包括听说读写四大技能及文化重点信息。文中将详细地介绍此网上中文课程的范围与顺序, 学习内容及网上的人机互动练习平台等等。文中也将展示一些由 OLI 电脑系统所收集到的学习者的学习行为, 情况及测试评量等数据, 并讨论如何将此学习数据有效地回馈给教师及研究者, 并帮助教师如何把这些学习数据有效地应用到课堂教学里, 以此提供一个更具效用与效率的网上中文教学课程。

Keywords: Open learning resources, Chinese online, technology and Chinese teaching

关键词: 开放学习资源、网上中文、科技与汉语教学

1. Introduction

The Open Learning Initiative (OLI; <https://oli.cmu.edu>) is an open educational resource project at Carnegie Mellon University (CMU). The OLI provides a technological platform for developing, delivering, and assessing learning outcomes in

online courses and activities. It supports the creation of high-quality online courses and learning materials that are open and freely available for anyone to use. As students work through an OLI course, real-time data on their interactions with the learning materials is collected. This data may be used by instructors, course developers or researchers to monitor student learning, test theories of learning, or to inform future improvements to the learning materials.

The Chinese online course was originally developed with the support of a grant from the Pittsburgh Science of Learning Center (PSLC, supported by the NSF; <https://learnlab.org>),¹. It was developed to serve two purposes: (1) help beginning students of Chinese who need a more flexible approach to language learning develop communicative competence in the four basic skills of listening, speaking, reading, and writing Chinese, as well as competence in Chinese culture, and (2) function as the Chinese LearnLab course for the PSLC, facilitating the collection of rich data on student learning and enabling *in vivo* research studies of the learning process, which are studies that take place within the context of the regular course curriculum. It has been offered as a course at CMU for several years now, and has been structured as a hybrid course, with one required class meeting per week and one individual tutor session per week in addition to the online learning exercises. The course is also suitable for use as a fully-online course (Wu et al., 2011; Wu, 2007).

Some challenges were overcome in the design and implementation of the Chinese online course. In particular, successful language study requires students to interact with each other and with their instructor. The high level of transactional distance in a completely online course makes it difficult to provide the instructor-student dialogue necessary to support the learning process (Moore, 1993). This paper also describes how the course is delivered in a hybrid format to help solve these challenges.

2. Chinese Online Content

An Elementary Chinese online course was developed from scratch at CMU from 2004-2006.¹ It was first offered to students in 2006 and is being delivered in a hybrid online/face-to-face format at CMU. A Hybrid (blended) teaching model is a mixture of classroom and online instruction (Martyn, 2003). It is different from the “completely online teaching model” in which teachers and students rarely, if ever, see each other. At CMU, students have a weekly one-hour class, as well as a weekly 20-minute one-on-one instruction session. Thus, we categorize the online Chinese course at CMU as a “hybrid model” of teaching and learning.

The course content is designed according to the 5 Cs principles of the National Standards for Foreign Language Education for the 21st Century - Communication, Cultures, Comparisons, Connections and Communities (ACTFL, 1999; Wu et al., 2005). It is designed to support a two-semester course. At CMU the first-semester course, Elementary Chinese I online, covers units 1 – 8 of the online content, and the second-semester course, Elementary Chinese II online, covers units 9 – 18. Each unit takes from

1.5 to 2 weeks to cover. Table 1 below details the overall scope of the two semesters of Elementary Chinese online.

Table 1: Chinese online curriculum scope and sequence

Elementary Chinese I Online (Units 1-8; first semester)	Elementary Chinese II Online (Units 9-18; second semester)
<ul style="list-style-type: none"> • Pinyin foundation • Main Vocabulary (181 items) • Characters (201) • Text Notes (28 items) • Grammar Points (32 points) • Culture Notes (8 items) • Unit Learning Outcome Assessment 	<ul style="list-style-type: none"> • Main Vocabulary (352 items) • Characters (307) • Text Notes (37 items) • Grammar Points (30 items) • Culture Notes (10 items) • Unit Learning Outcome Assessment

More detailed information on the scope and sequence of the Chinese Online curriculum is included in appendix A.

The online content in the course is delivered through a variety of integrated media, including text, audio and video. The student has many options to control the presentation of the content, for example by clicking on a word to hear its pronunciation, by selecting whether to listen to audio at slow or fast speed, or by selecting how many times to play audio and video elements. Interspersed throughout the content presentation are multimedia tutors that can be utilized for student practice, review or for assessment. These tutors, designed using components developed at CMU, provide students with audio, text, or image prompts. Students are then asked to select the correct answer or answers, or to drag components into the correct order. Like the prompts, the answers the students select from also may be presented as text, audio, or images. The tutors provide students with multiple levels of hints, and also provide feedback that can be customized to apply to distinct errors or types of errors. The tutors provide the ability to tie exercises to specific knowledge components (learning goals), and to provide context-dependent hints and immediate, context-dependent feedback. The Knowledge Components in the online course are organized around the grammatical structure of the Chinese language. Student interaction with course elements is logged in a centralized data repository, which may be accessed by both instructors and researchers. These logs provide data to help the instructor see how students are performing on various knowledge components, and may also be used to facilitate research studies within the course.

Each unit of the online content, with the exception of Unit 1 (the Pinyin unit), is organized in a similar fashion (please see appendix B for an outline). Each unit begins with a multimedia presentation of a main text, which is usually a dialogue. The text is presented first as a video. The videos were filmed in China with native-speaker actors and actresses speaking at natural speed. Figure 1 below shows an example of the video presentation.



Figure 1 An example video from the Chinese online materials

The video presentation is followed by multiple-choice questions to test students' basic understanding of the video. Since the video contains new vocabulary and grammar structures, students need to make inferences from context and language elements they have previously studied in order to answer the questions. The questions are delivered in a tutor format to facilitate hints and logging of student responses in the centralized data repository. This design helps students learn how to pick things they can understand out of a dialogue that also contains elements that they may not understand. Practicing this helps them to feel comfortable engaging with language that contains some elements they have not studied yet.

Following the video, the main text is also presented as written text in Chinese characters. This text is accompanied by the video's audio component, spoken at natural speed. There is also a presentation of the main text in Pinyin, with English translation. This Pinyin text with translation is also accompanied by audio, but this version of the audio is at a speed significantly slower than the speed of the video. This provides more time for learners to imitate the speaker as they repeat after the sound files.

The presentation of the main text is followed by explanatory notes. Chinese words and phrases in the notes have linked audio, so students may click on them to hear their correct pronunciation. Next, new vocabulary is presented. Traditional and simplified character forms, Pinyin, part of speech, and meaning are all presented for each vocabulary item. In addition, clicking on the Pinyin for each item will play audio of that item's pronunciation. This integration of multimedia makes it easy for students to control presentation of the content more easily. First, vocabulary items can be accessed individually without searching through a sound file. Second, the student has control over

whether or not to play the audio for each item, and how many times to play the audio for each item.

The presentation of the new vocabulary items is followed by some multiple-choice tutors testing students' understanding of the main video.

The next section of each online unit focuses on listening skills. Several different types of listening exercises are delivered via multimedia tutors. First, there are Pinyin recognition exercises in which the student must listen to a prompt and select the correct Pinyin representation. Next, there are a variety of exercises in which the prompt, the answer choices, or both are presented as audio. These include both translation exercises and listening comprehension exercises.

The listening skills section of each unit is followed by a grammar section. The grammar section begins with grammar notes presented as English text with Chinese examples. All Chinese in the grammar notes may be clicked on for an audio pronunciation. Each grammar note is followed by several examples, presented in characters and in translation, which can also be clicked on to access audio of the example. The grammar notes are followed by grammar exercises delivered by multimedia tutors that allow students to drag and drop characters or blocks of text into order in response to a text or audio prompt. We use this type of tutor for two types of exercises that allow students to practice character recognition and listening skills, and to reinforce the grammatical structures studied. In one type of exercise the student listens to audio of a sentence pronounced by a native Chinese speaker. The student then drags and drops characters into order to represent the sentence. In the second type of exercise the student is presented with blocks containing phrases or sentences written in Chinese characters. The student must drag the blocks into correct order. There are some instructional hints available for students to click to get some help on the questions. Figure 2 below shows an example of the second type of drag-and-drop tutor.

Module 17 / Dialogue Jumble Exercise

Drag and drop the lines into an appropriate dialogue. Start with "Bingbing, let's go eat together after class on Friday, OK?"

- 冰冰，星期五下課以後我們一起去吃飯，好嗎？ |
- 好極了！ |
- 我想吃韓國菜或者日本菜。 |
- 好。我們吃中餐還是西餐？ |
- 聽說韓國飯館的炒飯好吃極了。我們去那兒吃，怎麼樣？ |

Check My Answer

← 好吃極了[hǎochī jíle] means "extremely delicious" → ×





[Reset this Activity](#)

Figure 2 An example online drag-and-drop tutor

Grammar exercises are followed by reading comprehension exercises in which students read a text with similar vocabulary and theme to the unit's main text and then answer multiple-choice questions. These reading comprehension exercises are followed by consolidation exercises, which encapsulate listening skills, character recognition, vocabulary knowledge and grammar skills all in the same tutor exercise. These consolidation exercises present students with an image and then ask them questions related to the image. The questions can be multiple choice or multiple select, and they can include either text or audio prompts and responses. Figure 3 below shows an example of one of these consolidation exercises.



Listen to the question, then select the most appropriate response

-  Listen
-  Listen
-  Listen
-  Listen

 大杯 means "large-size cup."

 Correct!



Figure 3 An example online tutor (picture description)

The units end with a culture section designed to help learners better understand how phenomena from Chinese society and the Chinese language reflect Chinese culture. The culture section includes a culturally-related dialogue video, reading, multiple-choice

exercises and culture reflection writing based on the dialogue or reading, along with explanatory information related to the dialogue or reading. The multiple-choice questions and the reflection writing exercises are designed to encourage learners to observe, be aware of and compare cultural differences. Figure 4 below shows an example of one of the culture dialogue videos.

I. Cultural Reading



- 人物: 媽媽和孩子
- 地點: 在飯廳
- 劇情大概: 媽媽和孩子在朋友家做客, 吃飯的時候飯桌上有一條魚。孩子看到一側魚肉要吃完了, 想把與翻到有肉的一面。媽媽制止了孩子, 動手把魚骨頭夾走了。
- Characters: A mother, her child and the host
- Location: In the dining room
- Summary: A mother and her child were invited to a friend's house. During dinner, there's a fish on the table. The child sees that one side of the fish has already been finished, and wants to flip the fish over to eat the other side. The mother stops the child and takes the bone away so the other side of the fish is accessible.

Figure 4 An example online tutor (culture note video and reading)

Figure 5 below shows an example of one of these culture reflection writing exercises.

Question 2: Write appropriate responses: Preferences

28 responses

Write down your answer

Are there any specific food used for specific purposes or occasions in your culture?

Response
We eat certain glutinous cakes to celebrate certain times of the year (I'm not sure what). We also eat moon cakes on Mid-Autumn Festival and noodles for birthdays (for longevity).
There are various kinds of foods used for different purposes and occasions. Especially during ancestral rituals, we use specific types of food.
Not to my knowledge
seaweed soup is for birthdays
Noodles are meant to be eaten on your birthday since the length of the noodle represents long life.
Black eyed peas on Memorial Day
Turkey for thanksgiving.
Suckling pig is eaten during festivities.
Yes. Ricecake soup for new years.
Yes, many korean holidays require specific foods that bring good luck.

Figure 5: An example online tutor (culture reflection responses)

3. Chinese Online Assessment Content

There are test pool modules developed for each unit to be used for assessment of learning outcomes of the OLI Chinese online program. There are 18 units in the Elementary Chinese online program. Unit 1 is the Pinyin and Pronunciation unit, and the test pool developed for it focuses on recognition of and discrimination between fundamental Chinese phonetic units such as tones, initials, and finals. Units 2 through 18 share a similar testing format, with exercises covering listening comprehension, character and vocabulary recognition and use, grammar and word order, reading comprehension, consolidation of skills, and cultural knowledge. For each unit around 100 test items were created for the pools. Figure 6 (c.f., next page) shows an example of a unit test pool module, showing a learner's score, time spent on the test module and quick feedback after submission for review.

4. How to Access and Register for the OLI Chinese Online Program

The CMU OLI Chinese Online program provides innovative, flexible, and affordable options for students, independent learners, and instructors looking to enhance their Chinese language education.

Chinese 1 Unit 11 test

Schedule: [Update](#)
Available now.

Started: 12/19/2022 3:19:25 PM EST
Submitted: 12/19/2022 3:25:43 PM EST
Score: 78%
Points: 35 out of 45

Question 39

Read the passage and choose the correct answers. What I want to do for Daming's birthday?

✘ Points: 0 out of 1

我的室友叫李大明,他是法國(国)人,他很會(会)做飯(饭)。今天是我的生日,他為(为)我做了很多法國(国)菜,好吃極了。下個月是李大明的生日,我也要為(为)他做一些中國(国)菜。我要做一盤(盘)炒飯(饭)或者炒麵(面),一些餃(饺)子,還(还)有兩碗湯(汤)。

- A. I want to cook some Chinese dishes for him.
- B. I want to cook some French dishes for him.
- C. I want to cook some Japanese dishes for him.

[Feedback](#)

Incorrect

Figure 6 An example online assessment (Unit test pool module)

The OLI platform is open for registration and use at the OLI website <<https://oli.cmu.edu>>. Users can go to the website, create an account, and then access the content. There are several options available to support different uses:

- As a for-credit course offering – The OLI Chinese Online courses have been designed by language experts at CMU and the materials make an appropriate and effective base for online, face-to-face, and hybrid courses. Instructors first set up the course content by selecting the units, setting due dates if desired, giving the course a title, and creating a course key and a password if desired. Instructors then provide the course key to their students. Each student will create their own account on OLI and enter the course key to join the course. Each student will pay a \$25 key which covers the entire course content, as well as OLI technology updates and maintenance. Instructors and the teaching assistants use the course for free.
- For independent learners – There are two options for independent language learning through OLI at CMU: self-paced courses and instructor-led courses.
 - Self-paced courses – Independent learners may access and use an online language course for only \$10. The auto-graded Chinese Online courses are great

- opportunities for motivated learners looking to improve their Chinese skills. These users can make their own plan to pace themselves through the materials.
- Instructor-led courses – Students who select this option will be part of a language learning cohort community led by an instructor, which includes self-paced language study, 14-week course with auto-graded materials, weekly live class (60 minutes) on Zoom with an expert language instructor, weekly cohort emails with suggested pacing and links to external resources, access to an instructor via email for any questions you may have about grammar, vocabulary, and/or culture, and a certificate or certificate with distinction (based on your progress through the course) upon course completion. This option is planned to launch in Fall 2023 for Chinese online.

Through all these options, the OLI Chinese online language courses are great tools to help users take their Chinese language skills to the next level.

5. Concluding Remarks

We have made a great effort to develop a pioneering and innovative OLI Chinese Online curriculum, integrating the national 5Cs principles of foreign language learning, Content-based instruction (CBI), Technology-enhanced learning (TEL), and flipped classroom learning practices in its content and learning activities. We hope that OLI Chinese online can attract more users from other institutions and individual learners around the world.

Open learning educational resources can provide great benefits for both individuals and institutions. They give institutions an alternative to resource-intensive development of their own online courses, helping institutions meet the needs of students who need more flexibility in their time schedules and allowing them to serve a more geographically-distributed student pool. They also provide potential as a means of gathering data for learning-related research. For individuals they can provide a semi-structured approach to learning without the costs and restrictions associated with formal enrollment at a college or university.

The OLI Chinese course has been a successful experiment, and has enabled students with tight schedules to pursue Chinese study and achieve positive learning outcomes. Moreover, it has promoted interdisciplinary collaboration among professionals from different fields, such as language instructors, psychologists, psycho-linguists, human-computer interaction specialists, and computer tool developers. This collaboration has endeavored to bring about innovative teaching and robust learning, and to have a positive effect on learning research.

By sharing our experience of developing the Chinese online course on the OLI platform, we hope we have provided some useful observations on the nature of the OLI platform, on the benefits of open educational resources, and on the challenges of building a course as an open educational resource.

Note: The Chinese online course is one of the LearnLab courses supported by the Pittsburgh Science of Learning Center (PSLC, <http://www.learnlab.org>), which is funded by National Science Foundation award number SBE-0354420. The Chinese online program was migrated to the OLI platform in 2012. Sue-mei Wu was the leader of the PSLC Chinese LearnLab course. She is also the PI and coordinator of the OLI Chinese online project.

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Appendix A

SCOPE & SEQUENCE 范围和顺序 Unit topics and Communicative Objectives 单元主题, 教学目标 & 交际活动

Unit 1: Foundation: Pinyin introduction & basic expressions (第一单元: 拼音介绍 & 基本用语)	-Pinyin (Chinese phonetic transliteration system) -structure of Chinese syllables -Chinese tones and pronunciation -basic Chinese expressions
Unit 2: Greetings (第二单元: 问候)	-simple greetings -ask and respond to Yes/No questions -meet someone for the first time
Unit 3: Names (第三单元: 姓名)	-ask about names -find out who someone is -ask and respond to a simple inquiry

Unit 4: Nationality and languages (第四单元: 国家和语言)	-introduce people -talk about nationality and languages -talk about others
Unit 5: Talk about studies (第五单元: 谈学习)	-talk about majors in school -talk about what you like to study -find out what someone has
Unit 6 Talk about yourself and your family (第六单元: 自己和家庭)	-self-introduction -talk about family, occupations -discuss what you want to be in the future
Unit 7: Make phone calls (第七单元: 打电话)	-handle various phone situations -ask/tell what someone is doing -make and respond to a plan
Unit 8: Talk about daily schedule (第八单元: 日常时间表)	-describe a daily schedule -talk about your school life
Unit 9: Invitations (第九单元: 邀请)	-talk about ages and birthdays -make and accept an invitation
Unit 10: Requests (第十单元: 请求)	-make / reply to a request -express one's wishes
Unit 11: Order food (第十一单元: 点菜)	-order food at a restaurant -present/choose from alternatives
Unit 12: Shopping (第十二单元: 买东西)	-talk about price, money and currency -go shopping
Unit 13: Locations (第十三单元: 介绍处所)	-describe where something is located -show people around
Unit 14: Hobbies & Sports (第十四单元: 爱好和运动)	-talk about hobbies -describe how well an action is performed
Unit 15: Travel plans (第十五单元: 旅行计划)	-describe the four seasons and weather -talk about means of transportation -talk about travel plans
Unit 16: Illness (第十六单元: 生病)	-go to see a doctor -describe something that has happened
Unit 17: Rent an apartment (第十七单元: 租房)	-describe an event and its cause -rent an apartment
Unit 18: Future plans & wishes (第十八单元: 计划和祝福)	-future plans and expressing wishes

Appendix B

Sample Learning Materials: Each Unit (Units 2-18) contains the following main content and activities:

Scope and Sequence (Units 1-18) 范围和顺序

Elementary Chinese I Online will cover 8 units (Units 1-8). It will take about 2 weeks to finish a unit (including learning, practice, review, online web activities, group class meeting, individual instruction, Character Quiz and tests, etc.). Unit 1 is the Pinyin foundation, and Units 2-8 will cover: Main Vocabulary (生词 181 items), Characters in the Character Book (汉字 201), Text Notes (注解 28 items), Grammar Points (语法点 32 points), and Culture Notes (文化信息 8 items)

Elementary Chinese II Online will cover 10 units (Units 9-18). It will cover: Main Vocabulary (生词 352 items), Characters in the Character Book (汉字 307), Text Notes (注解 37 items), Grammar Points (语法点 30 points), and Culture Notes (文化信息 10 items)

OLI Learning materials: Unit 1 is the Pinyin Foundation and each Unit (Unit 2-8) generally contains the following main content and activities:

I. Main Content 主要学习内容:

- Objectives 目标;
- Main Video (+ questions) 视频和问题;
- Video Preview Exercises 视频课前问题;
- Text of the Video 视频文本 (情景课文/对话);
- Text Translation and Pinyin with Slower Audio 视频文本, 拼音, 英文和慢速录音音频; (***) this section is very important for users to master the main content of the unit: listen and repeat after the sound files)
- Text Notes 课文注解;
- Vocabulary Tables 生词表;
- Video Comprehension Exercises 视频综合理解练习

II. Listening 听力练习

- Pinyin and Vocabulary Recognition Exercise;
- True and False Exercise;
- Translation Exercise;
- Question Answering Exercise

III. Grammar 语法

- Grammar Notes;
- Sentence Jumble Exercise;
- Dialogue Jumble Exercise

IV. Reading Exercises 阅读识字练习

- Reading Comprehension

V. Consolidation Exercises 综合练习

- Picture Description Exercise 看图描述练习;
- Video Description Exercise: (with Video Segments) 视频练习;
- Video Description Exercise : (with Text Scripts) 视频与文本练习

VI. Culture Link 文化点滴

- Culture Video 文化视频;
- Culture Notes 文化信息;
- Culture Reflections Exercise 文化心得写作

VII. Assessment 学习评鉴: Online Test Module (around 100 test questions for each Unit, with computer-automated grading and feedback) 单元综合题库, 电脑随机抓取考题, 递交后即时反馈

VIII. Characters 汉字学习

Characters in the Character Book 写字簿 (繁/简体字) (both traditional and simplified versions are provided, with stroke order, radical meaning and sentences examples)

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