INSIGHTS INTO THE DEMOGRAHICS AND PREFERENCES OF CHINESE DEAF AND HARD-OF-HEARING LEARNERS OF ENGLISH: A MULTI-MODAL APPROACH

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Abstract

The field of second language acquisition has seen numerous empirical studies focusing on language teaching theories and methods for specific learner groups. However, despite recent research increasingly addressing the needs of students with disabilities, deaf and hard-of-hearing students still do not receive the same level of attention as their hearing peers (Ciśżer and Kontra, 2020). Deafness or hearing impairment often results in limited access to language and information. Nevertheless, with modern technical hearing aids, researchers have highlighted the bimodal bilingual capabilities of deaf and hard-of-hearing students, underscoring their potential to learn additional languages. Grounded in the theoretical frameworks of multilingualism and plurilingualism, this thesis explores the demographic characteristics of Chinese deaf and hard-of-hearing students as English learners and their multi-modal language preferences in English classrooms.

This thesis addresses three main research questions: 1) What are the demographic characteristics of Chinese deaf and hard-of-hearing English learners? 2) What are the teachers' perspectives on teaching English to these students? 3)What are the preferences of deaf and hard-of-hearing students for multi-modal key words assistance during English reading tasks? To answer these questions, this exploratory research employed a mixed-methods approach, collecting both qualitative and quantitative data from a series of interconnected studies.

The thesis begins with a pilot demographic study involving fifteen deaf and hard-of-hearing high school students. This study utilized a demographic questionnaire to investigate participants' characteristics related to hearing loss, communication preferences, and experiences learning English as an additional language in a non-English-speaking country. The results revealed a heterogeneous population in English classrooms with Chinese deaf and hard-of-hearing students, raising questions about how teachers manage to address the diverse language backgrounds, communication preferences, and needs of these students. Participants also reported greater difficulties in English reading comprehension.

Building on the pilot study, a semi-structured interview study was conducted with four English teachers from various training backgrounds, who taught deaf and hard-of-hearing students in different educational settings. The findings illustrate how teachers' attitudes and beliefs about the needs of deaf and hard-of-hearing students, as well as the English language subject, are shaped by their knowledge base, which is influenced by their prior training experiences. Due to a lack of systematic training in special education, deaf education, second language acquisition, and pedagogical strategies, it is challenging to conclude that the four interviewed teachers fully addressed the diverse needs of deaf and hard-of-hearing students. Additionally, the teachers expressed a desire for teaching and learning materials specifically designed

for this student group, leading to the design of a multi-modal reading interface in the subsequent experimental study.

The third study expanded on the pilot demographic survey. With modifications to the demographic questionnaire used in the pilot study, the expanded study involved 83 deaf and hard-of-hearing students, including 39 university students and 44 high school students. The results revealed even greater heterogeneity than the pilot study. Additionally, data from this study showed a positive correlation between the perceived difficulty level in reading comprehension and vocabulary among Chinese deaf and hard-of-hearing English learners.

Previous research indicates that deaf and hard-of-hearing students face particular challenges in vocabulary and reading comprehension (Perfetti and Stafura, 2014). In this third study, a reading interface was designed to provide multi-modal word assistance in English reading passages. An experimental study was conducted to investigate the multi-modal preferences of deaf and hard-of-hearing students and their acceptance of this tool as English reading support. The same participants from the expanded demographic study were invited to participate. Using a cross-design, this study collected three sets of data: the participants' mouse clicks on Chinese text translations and CSL interpretation videos, their answers on post-reading exercises, and their responses to an exit questionnaire based on the Technology Acceptance

Model. The findings reveal the multifaceted nature of Chinese deaf and hard-of-hearing English learners. First, participants preferred Chinese text translations over CSL interpretation videos, regardless of their communication language preferences. Second, although the intervention improved overall post-reading vocabulary and comprehension performance, significant differences remained between the university and high school groups, as well as among individual students. Third, high school participants were less positive than university students about using this tool to support their language reading experience, suggesting that students' attitudes toward multi-modal learning technology could be influenced by various factors, such as social backgrounds.

In conclusion, the findings of this thesis are significant for both research and practice. They address the lack of demographic studies on Chinese deaf and hard-of-hearing English learners and emphasize the importance of considering students' subjective roles in the development of learning materials. The research highlights that designing multi-modal learning tools is a complex task, requiring careful consideration of interconnected factors, such as individual differences of students. Thus, it is crucial to involve students in the process to ensure that these tools are both effective and engaging, meeting the diverse needs of deaf and hard-of-hearing learners.

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Declaration

I declare that the work presented here is my own and was conducted during my time as a PhD student at the University of Nottingham.

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Abbreviations

American Sign Language	ASL
China National Knowledge Infrastructure	CNKI
Chinese Sign Language	CSL
decibel	dB
English as a foreign language	EFL
English language learning in non-English-speaking countries	ELL-NESC
English language learners in non-English-speaking countries	ELLs-NESC
Foreign language	FL
First language/Second language	L1/L2
Gallaudet Research Institute	GRI
National Academies of Science, Engineering and Medicine	NASEM
National Institute for Health and Care Excellence	NIHCE
National Institute on Deafness and Other Communication Disorders	NIDCD
Object-Subject-Verb	OSV
People's Education Press	PEP
Second Language Acquisition	SLA
Subject-Object-Verb	SOV
Subject-Verb-Object	SVO
Technology Acceptance Model	TAM
The Central China Normal University	CCNU
The College Entrance Examinations	The Gaokao
The Consortium for Research into Deaf Education	CRDE
The Food and Drug Administration	FDA
The Integration Behavioral Model	IBM
The National Health Commission of the People's Republic of China	NHC
The Universal Hearing Screening Project	UHS
The Theory of Planned Behavior	TPB

The Theory of Reasoned Action	TRA
Verb-Object	VO
World Federation of the Deaf	WFD
World Health Organisation	WHO

Chapter 1 Introduction

1.1 Research gaps and focus of this thesis

Deaf and hard-of-hearing[1] individuals share this globalized world with hearing individuals, and since English is the most widely used international language (Abbas et al., 2021), it is necessary for "SLA professionals to recognize and respond to the special needs of this group of students and to contribute to the realization of their equal rights in foreign language education" (Csiźer and Kontra, 2020, p. 234). However, there remains a notable gap in the exploration of additional language[2] learning and the teaching of deaf and hard-of-hearing learners. Existing literature, exemplified by Csizér, Kontra, and Piniel (2015), Domagała-Zyśk (2016), and Csiźer and Kontra (2020), underscores this dearth of investigation in the field, which is further compounded by a lack of empirical data to inform instructional practices (Sedláčková, 2016).

1 Being hard-of-hearing usually means having a "hearing loss from mild to severe range" (Marschark and Spencer, 2009, p. xiii), and being deaf means "having a hearing loss in the severe-to-profound or profound range" (Marschark and Spencer, 2009, p. xi). In this thesis, unless specified, the term "deaf and hard-of-hearing" is used to describe the group of people with hearing impairments.

2 According to Kalaja and Pitkänen-Huhta (2020), the term "foreign language (FL)" has become increasingly controversial in the context of multilingualism, as it reflects outdated assumptions that no longer align with the linguistic realities of today's societies. Multilingualism is more common than monolingualism, yet foreign language education has traditionally been dominated by a monolingual bias, assuming homogeneous learner groups who share a first language (Kramsch, 2012). Despite significant demographic shifts towards multilingual societies, educational systems and FL classrooms have largely remained structured for monolingual learners, a situation that scholars have critiqued while advocating for a multilingual turn in second language acquisition (SLA) (Douglas Fir Group, 2016; Meier, 2017; Meier and Conteh, 2014). This shift is essential as globalization has destabilized the traditional distinctions between first, second, and foreign languages, challenging the very foundation of FL education (Kramsch, 2014). The concept of elite multilingualism, where new languages are learned without threatening the learner's home language and often in a privileged context, further complicates the term "foreign language" (May, 2019). In light of these developments, this thesis uses the term "additional language" instead of "foreign language" to better reflect the diverse and complex linguistic backgrounds of Chinese deaf and hard-of-hearing learners and to move away from the outdated monolingual assumptions that have traditionally underpinned FL education. This terminology acknowledges that learners are no longer monolingual, and that the status and role of English in their linguistic repertoire vary widely (Kramsch, 2014; May, 2019).

As the title suggests, this thesis is concerned with the experience of students with hearing disabilities[3] learning English in a non-English-speaking country, and their individual preferences when using multi-modal learning materials. It connects three areas of interest: hearing loss, multi-modal materials, and English language learning in non-English-speaking countries (ELL-NESC)[4]. While each of these areas has garnered attention individually in the scholarly literature (Bochner, 1982; Gentry et al., 2004; Miller, 2010; Sedláčková, 2016), the synthesis of these three domains represents a relatively uncharted territory in research.

Deafness and hearing loss is a pervasive and global phenomenon. According to data published by the World Health Organization (WHO, 2024), presently, over 1.5 billion people, constituting nearly 20% of the world's population, live with some form of hearing loss, with 430 million experiencing disabling hearing loss, among which 34 million are children. According to the Basic Statistics of Special Education and Basic Statistics of Special Education Schools[5] (2021) by the Ministry of Education of China, this country has a total of 92,984 students with hearing impairment[6], among which

3 "The term 'disability' encompasses all problems or difficulties a person with hearing loss may encounter when carrying out everyday activities or situations, such as self-care, or going to school or work. 'Disability' in terms of hearing loss refers to the impairments, limitations and restrictions (physical, social, or attitudinal) experienced." (WHO, 2021, p. 39)

4 Awaring the controversy surrounding the term "foreign language" (as discussed in the footnote on "additional language"), this thesis uses the term "English language learning in non-English-speaking countries" (ELL-NESC) to specifically describe the context of English learning in China.

5 According to the classification of the Basic Statistics of Special Education Schools published by the Ministry of Education of the People's Republic of China in 2022, special education schools cover all types of schools dedicated to children with special needs, including visual impairment, hearing impairment, intellectual disability and other disabilities.

6 The term "'impairment' relates to the body-level function" (WHO, 2021, p. 39), and hearing impairment refers to "hearing loss".

64,278 attend deaf schools[7] and 28,706 attend general education schools. Despite the significant presence of students with hearing impairments, their essential well-being does not receive equitable recognition compared to that of their hearing counterparts. As stated by the WHO (2021), "hearing loss has often been referred to as an 'invisible disability', not just because of the lack of visible symptoms, but because it has long been stigmatized in communities and ignored by policymakers" (p. v). Consequently, there remains a scarcity of theoretical and empirical research on ELL-NESC orientation specifically tailored to this group in the Chinese context.

The primary focus of this thesis is on deaf and hard-of-hearing English learners in non-English-speaking countries (DHH-ELLs-NESC). The WHO (2021, p. 38) has classified degrees of hearing loss into grades of mild, moderate, moderately severe, severe, profound or complete, as seen in Table 1.1.

Table 1.1 Degrees of hearing loss

Degrees of hearing loss (WHO)	Hearing threshold[8] in better hearing ear in decibels[9] (dB)
Normal hearing	Less than 20 dB
Mild hearing loss	20 to < 25 dB
Moderate hearing loss	35 to < 50 dB
Moderate severe hearing loss	50 to < 65 dB
Severe hearing loss	65 to < 80 dB
Profound hearing loss	80 to < 95 dB
Complete or total hearing loss/deafness	95 dB or greater

7 In the context of this thesis, the term "deaf schools" denotes educational institutions designed specifically for children with hearing impairments. In the Chinese special education system, these schools constitute a distinct category within the spectrum of special education schools.
8 "'Hearing threshold' refers to the minimum sound intensity that an ear can detect as an average of values at 500, 1000, 2000, 4000 Hz in the better ear. (WHO, 2021, p. 38)
9 The decibel (dB) is a measurement unit used to quantify the intensity of sound on a logarithmic scale.

As outlined by the WHO (2021), individuals experiencing **mild hearing loss** may encounter challenges in understanding conversational speech, specifically in noisy settings. Those with **moderate hearing loss** may struggle to hear conversational speech even in quiet surroundings and face difficulties in participating in conversations in noisy environments. Those with **moderate severe hearing loss** may find it hard to hear conversational speech but can manage raised voices without difficulty in quiet settings. However, they encounter challenges in understanding most speech and participating in conversations in noisy environments. Individuals with **severe hearing loss** may not hear most of the conversational speech, and they may face difficulties in understanding raised voices. In noisy environments, they experience extreme challenges in hearing speech and engaging in conversations. **Profound hearing loss** leads to extreme difficulties in hearing raised voices even in quiet environments, and individuals with this condition cannot perceive conversational speech in noisy surroundings. **Complete hearing loss** results in an inability to hear speech and most environmental sounds in both quiet and noisy settings. It should be noted that the China's Disabled Persons Federation published an official document named the Measures for the Administration of the Certificate for Persons with Disabilities[10] of the People's Republic of China. In this document, which aligns with the Law of the People's Republic of China on the Protection of Persons with Disabilities and relevant legal provisions, hearing disabilities are categorized into

10 Measures for the Administration of the Certificate for Persons with Disabilities is an English translation of 《<中国残疾人证>管理办法》, published by the China's Disabled Persons Federation in 2022.

four distinct levels[11]. However, given that the standards outlined in this document for characterizing hearing impairment do not encompass hearing loss thresholds below 41 dB, this thesis adheres to the classification criteria established by the WHO.

According to Marschark and Spencer (2009), Deaf people, with a capitalized D, are used to indicate a specific community whose members proudly share a deaf identity and culture and take the national sign language as the main means of communication (Ladd and Lane, 2013). The participants in this thesis demonstrate diverse levels of hearing impairment, and it is not confirmed that all of them have embraced a Deaf identity. Moreover, acknowledging that the term "hearing impaired" may have unfavorable connotations for those identifying with Deaf culture (Marschark and Spencer, 2009), this thesis picks up the term "deaf and hard-of-hearing", instead of "deaf and hearing impaired", to refer to the participants.

Hearing loss can negatively impact multiple aspects of life, including access to language development (Sarant et al., 2009), cognitive development (Mayberry, 2002;

11 According to the Measures for the Administration of the Certificate for Persons with Disabilities of the People's Republic of China (China's Disabled Persons Federation, 2022), **Tier I Hearing Disability** signifies an extremely serious impairment to the structure and function of the auditory system, featuring an average hearing loss of ≥91 dB HL in the better ear. Individuals at this level face an inability to rely on hearing for speech communication without the assistance of hearing aids, leading to substantial limitations in activities such as comprehension and communication, with extreme obstacles to participation in social life. **Tier II Hearing Disability** involves severe damage to the auditory system, with an average hearing loss between 81- and 90-dB HL in the better ear. This level is characterized by significant limitations in activities like understanding and communication without the support of hearing aids, accompanied by severe impairment in participation in social life. **Tier III Hearing Disability** indicates moderately severe damage to the auditory system, with an average hearing loss between 61- and 80-dB HL in the better ear. Individuals at this level experience moderate limitations in activities such as understanding and communication without the assistance of hearing aids, along with a moderate impairment in participating in social life. **Tier IV Hearing Disability** involves moderately damaged structure and function of the hearing system, with an average hearing loss between 41- and 60-dB HL in the better ear. Without the aid of hearing aids, individuals at this level face mild limitations in activities like understanding and communication, accompanied by mild obstacles in participating in social life.

Taljaard et al., 2016), educational attainment (Korver et al., 2017; Rydberg et al., 2009), and employment prospects (Davis et al., 2016; Punch, 2016). Furthermore, individuals with hearing loss, particularly deaf and hard-of-hearing students, encounter significant challenges in accessing crucial information, as highlighted by Onuigbo et al. (2020). Consequently, there has been a growing interest in the literature in exploring potential compensatory solutions for addressing the impact of hearing loss.

Researchers have proven the efficacy of wearing technical hearing devices, including hearing aids and cochlear implants, as one of the main solutions to hearing loss (Cruz et al., 2020; Geers et al., 2017; Niparko et al., 2010; Smith and Wang, 2010). More specifically, the use of hearing aids and cochlear implants has been proven to be effective in reducing deaf and hard-of-hearing students' listening efforts (Cruz et al., 2020), promoting the development of spoken language (Niparko et al., 2010), and encouraging speech recognition abilities and reading outcome (Geers et al., 2017).

However, due to the financial burden (Li et al., 2016), not every deaf and hard-of-hearing student has access to technical hearing devices. Based on the statistical data from China's Disabled Persons Federation, in 2022, 141,092 out of 3,329,227 persons with hearing disabilities[12] were provided with hearing aids, and 961 individuals underwent cochlear implantation. The limited utilization of hearing aids and cochlear

12 The term "persons with hearing disabilities" follows the terminology employed on the official website of the China Disabled Persons' Association when referring to deaf and hard-of-hearing individuals.

implants among individuals who are deaf or hard-of-hearing suggests that, in the present Chinese context, depending solely on technical hearing devices is not a practical solution to address all the challenges associated with hearing loss.

With limited access to spoken language, sign languages are widely used by deaf and hard-of-hearing groups (Sandler and Lillo-Martin, 2003). According to Marschark and Spencer (2009), Deaf people, who proudly identify themselves as being a specific community, take the national sign languages as their first languages. Some scholars believe that language education for deaf and hard-of-hearing students must fully recognize the importance of sign language (McAnally et al., 2007). As stated by Hall et al. (2019), "Sign languages should be considered as a primary option as it is the safest intervention for children at risk for language deprivation" (p. 383).

However, only deaf and hard-of-hearing children born with deaf parents acquire sign languages naturally in a language-rich environment (Lederberg, 2006). Most deaf and hard-of-hearing children born with hearing parents begin formal education with severely delayed sign language skills (Beal, 2021). Liu (2013) highlights that, in the context of China, there is a lack of standardized use of sign language in classroom settings. As a result, considering these circumstances, depending solely on sign language to address the issue of limited information accessibility may exacerbate the challenges faced by deaf and hard-of-hearing students in understanding the information conveyed through the language.

Previous studies have established that technical hearing devices and sign language each have their limitations in addressing the challenges faced by deaf and hard-of-hearing individuals with restricted access to information (e.g., Beal, 2021; Li et al., 2016; Liu, 2013). Hence, another focus of this thesis is exploring the preferences of deaf and hard-of-hearing students regarding information modalities. Applying for multi-modal assistance in the classrooms of deaf and hard-of-hearing students has been suggested by researchers to take advantage of the visual preference of this group of students (Berent et al., 2007; Berent et al., 2009; Birinci and Sariçoban, 2021; Marschark and Hauser, 2012; Rodrigues et al., 2022a). As listed by Birinci and Sariçoban (2021), traditional visual materials include flashcards, pictures, objects, videos and more. Apart from these, as highlighted by David, Kiose and Tzelepi (2023), scientists are interested in applying information communication technology into classroom settings, such as e-learning, technology-related programs, augmented reality games and mobile games.

However, these studies overlook the fact that the information modalities involved are indeed recognized and readily accepted by deaf and hard-of-hearing students. According to Collins (2015), it is crucial to consider the perspectives of users and their experiences with the service. Marschark et al. (2017) also point out in their article “Don't Assume Deaf and Hard-of-hearing Students are Visual Learners” that it is arbitrary to identify deaf and hard-of-hearing students as visual learners solely

based on the sensory compensation theory[13] and their skills in sign languages. However, there is a lack of discussion in the literature regarding deaf and hard-of-hearing students' preferences for the information modalities provided by learning materials, and how these preferences relate to their demographic features, such as degrees of hearing loss, language backgrounds, communication preferences, and educational backgrounds. This thesis aims to address these gaps by exploring these preferences and their relationships to demographic characteristics.

This thesis revolves around the English learning experience of deaf and hard-of-hearing students in non-English-speaking countries, especially within the context of China. Numerous studies have delved into the language development of deaf and hard-of-hearing children, encompassing learning a national sign language (e.g., Beal, 2021), a national spoken language (e.g., Niparko et al., 2010; Sarant et al., 2009), and literacy skills in a national spoken language (e.g., Cates et al., 2022; Harris et al., 2017b; Luckner and Handley, 2008). Nevertheless, as emphasized by Sedláčková (2016), there is a scarcity of research focusing on how deaf and hard-of-hearing students approach learning English in non-native English-speaking countries.

This scarcity is also evident in the Chinese context. The search for Chinese articles was conducted by examining the core journals indexed by China National Knowledge

13 When contemplating potential visual-spatial benefits resulting from sensory compensation in deaf and hard-of-hearing individuals, Tharpe, Ashmead and Rothpletz (2002, p. 403) argue that "interaction and integration of input from the various senses are normal aspects of the developmental process. As a result, it is expected that impairment of one sensory system influences the organization and functioning of the remaining senses."

Infrastructure (CNKI). Kong and Ali (2024) state that CNKI is among the most comprehensive and authoritative academic databases in China, covering a wide range of scholarly journals across numerous disciplines. Through a literature search of keywords including “deaf”, “hearing impaired”, “English”, “EFL”, “teaching and learning” and “China” in the CNKI, there are only 17 journal articles from 2009 to 2024. The primary themes of these articles include systematic research reviews into English teaching for deaf and hard-of-hearing students in China (e.g., Wang, 2014), language use in the classrooms of the deaf and hard-of-hearing students (e.g., Guo, 2017), language teaching and learning strategies of deaf and hard-of-hearing students related to English vocabulary and grammar (e.g., Xu et al., 2021), and factors influencing the English learning experiences of Chinese deaf and hard-of-hearing students (e.g., Zhang, 2009). With the same keywords, Google Scholar found three articles published within the same period, including Xu’s case study (2018) of using multimedia in teaching English reading and writing to Chinese deaf and hard-of-hearing students, Chen’s doctoral thesis (2018) of a case study with two Taiwanese deaf and hard-of-hearing English learners and Jiang et al.’s systematic review (2022) on the influence of technology in educating English language learners at risk or with disabilities. The limited number of studies suggests that the educational needs of Chinese deaf and hard-of-hearing students in the context of ELL-NESC and additional language education have not received substantial attention.

In summary, there is a significant research gap in investigating deaf and hard-of-hearing students' English learning experiences in non-English-speaking countries, especially in the context of China. Even though multi-modal instructions have been proven to be effective in promoting positive language learning outcomes for deaf and hard-of-hearing students (Berent et al., 2007; Berent et al., 2009), there is a lack of studies investigating the preferences regarding the provided information modalities from a students' perspective.

1.2 Contextual background of the thesis

The following sections provide an overview of the contextual background of this thesis, concentrating on the English curriculum, teachers, and teaching materials for deaf and hard-of-hearing students in China.

1.2.1 Curriculum development

Several regulations have been promulgated to standardize the curriculum design for deaf education (Piao, 2009). Through those regulations, the Chinese government has stipulated the objectives for deaf education, the subjects to be taught, and the requirements for deaf school settings (Huang, Zeng and Liu, 2019).

Based on the objectives for deaf education, the Ministry of Education of China initiated the design of textbooks specifically tailored for deaf schools, focusing on subjects such as Chinese literature and mathematics. The first edition of Chinese Sign Language Alphabets was published in 1994, and by 1997, these specially designed

textbooks were adopted by all deaf schools in China (Editorial Board of China Education Yearbook, 1997). In response to the unique needs of deaf and hard-of-hearing students, curriculum adjustments were made, including the removal of music courses and the introduction of rhythm instructions (which refers to instructions on rhythmic patterns, timing, and tempo in music and other activities that involve rhythmic coordination). Schools were also granted the autonomy to develop their individualized curricula (Piao, 2014). Over time, significant changes have occurred in the curriculum structure for deaf schools, emphasizing the concept of individualized education and offering a broader range of subjects, including English (Ministry of Education of China, 2014).

However, critiques have been raised regarding the existing deaf education curriculum in China. Lytle et al. (2005/2006) highlight that the curriculum for deaf and hard-of-hearing children is essentially modeled on the curriculum for non-disabled children, leading to practical challenges when adapting it to the needs of students with special requirements. Moreover, an overemphasis on speech and "hearing retrieval" in primary education, neglecting the development of other essential skills like literacy, contributes to the academic lag and skill development gap between deaf and hard-of-hearing students and their hearing peers (Lytle et al., 2005/2006). Despite government calls for diversified student assessments (Ministry of Education of China, 2007), the strong influence of scores of the College Entrance Examinations (the Gaokao) has impeded the realization of government goals. Consequently, the current curriculum

for hard-of-hearing children remains teacher-centered and examination-oriented, and it inadequately accommodates individualized development. These challenges are also evident in the development of the English curriculum for Chinese deaf and hard-of-hearing students (Wang, 2022).

No official, unified document has been issued for English curriculum standards in high schools catering to deaf and hard-of-hearing students (Wang, 2022). While English is designated as an elective course in the Implementation Plan for Compulsory Education Curriculum for Deaf Schools (2007) by the Ministry of Education, specific curriculum standards for the English course are absent in the Curriculum Standards for Compulsory Education for Deaf Schools (2016 Edition) (Ministry of Education of China, 2016a). The Shanghai English Curriculum Standards for High Schools for the Deaf (Shanghai Municipal Education Commission, 2007) is the primary reference available to discuss the overarching objectives of the English curriculum for Chinese deaf and hard-of-hearing students.

Outlined in the Shanghai English Curriculum Standard for High Schools for the Deaf (Trial Draft), the objectives encompass "mastering the most basic language knowledge; strengthening some language skills (reading and writing); and mastering the basic methods of learning English; developing an interest in and a habit of learning English; having awareness of using English, and encouraging teamwork among students" (p. 50). However, through a mixed-method study with 31 deaf

schools across China, Wang (2022) concludes that, “most of the schools and teachers regard English teaching as a test-taking exercise, and the teaching contents are mainly examination contents, with few extra-curricular English learning activities” (p. 19).

According to Wang’s study (2022), English language education is available in all deaf schools located in provincial-level cities (directly governed municipalities, such as Beijing and Shanghai), 70% of those in district-level cities (municipal districts at the provincial level, such as Wuhan), and are typically not offered in county-level areas or county-level cities (district-level municipal districts). The settings of the English curriculum are demonstrated in Table 1.2.

Table 1.2 Settings of English curriculum in deaf schools in China (Wang, 2022, p. 18)

Number of schools (%) curriculum settings	Curriculum objectives	Grades	Weekly lesson amounts	Instruction focuses	Extra-curricular activities
Provincial-level cities (total number of schools: 21)	Entering higher education: 15 (71%)	Grade 3-6: 3 (14%)	1-2: 16 (76%)	Reading and writing: 15 (71%)	Have: 9 (43%)
	Others: 6 (29%)	Grade 7-9: 18 (86%)	3-4: 5(24%)	Reading, writing and speaking: 6 (29%)	Do not have: 12 (57%)
District-level cities (total number of schools: 10)	Entering higher education: 6 (60%)	Grade 3-6: 0 (0%)	1-2: 9 (90%)	Reading and writing: 7 (70%)	Have: 2 (20%)
	Others: 4 (40%)	Grade 7-9: 10 (100%)	3-4: 1(10%)	Reading writing and speaking: 3 (30%)	Do not have: 8 (80%)

Table 1.2 provides a detailed comparison of English language educational settings for deaf schools in provincial-level and district-level cities in China, covering the aspects of curriculum objectives, grades, weekly lesson amounts, focus of instruction, and extra-curricular activities. In provincial-level cities, 15 out of the 21 schools (71%) offer English curricula aimed at preparing students for higher education. Among these 21 schools, 18 schools (86%) design English courses for grades 7-9, while three (14%) cater to grades 3-6. Most schools (76%) offer 1-2 weekly lessons, focusing mainly on reading and writing (71%), with six (29%) also including speaking in their instruction. Additionally, nine (43%) of these schools provide extra-curricular activities.

In contrast, district-level cities have 10 schools, with six (60%) schools targeting higher education. All these schools offer English courses to grades 7-9, and nine (90%) offer 1-2 weekly lessons. The instructional focus is similar, with seven (70%) emphasizing reading and writing and three (30%) including speaking. However, only two (20%) district-level schools offer extra-curricular activities, highlighting a significant disparity in the availability of such programs compared to provincial-level cities.

As demonstrated by Table 1.2, significant differences exist in the English curriculum settings among deaf schools across different administrative district levels in China. Deaf schools located in provincial-level cities, which are of higher administrative levels and are generally more developed, offer English language education from

earlier grades and with more weekly classes. Wang (2022) concludes that such differences will cause challenges. First, Given that deaf schools recruit students from various districts, if School A introduces English lessons at an earlier stage and admits a student from School B who has not been exposed to English or has limited proficiency, teaching and learning difficulties may arise. This discrepancy can also create challenges for the student from School B when attending classes with peers from School A, potentially hindering their future English learning in college. Second, as Wang (2022) highlights, general education schools[14] offer English language education from Grade 3, which is not a common case for deaf schools. This variation in English curricula poses challenges for deaf and hard-of-hearing students when transitioning between deaf schools and general education schools.

In summary, in China's present scenario, English curricula designed for deaf and hard-of-hearing students primarily centers around preparing them for the Gaokao and subsequent admission to colleges. Additionally, the lack of standardization in the timing and instructional emphases of English language courses across various deaf schools nationwide implies potential challenges for both educators and students.

[14] As per Article 18 of the Regulations of the People's Republic of China on the Education of Persons with Disabilities, children and adolescents with disabilities attending special education schools may be recommended for transfer or advancement to general education schools for compulsory education under specific conditions. Simultaneously, those with disabilities in general education schools facing challenges in adapting to the learning environment may be advised to transfer to designated special education schools for compulsory education. The term "general education schools" refers to institutions catering to students with or without relatively low levels of specific learning or developmental disabilities, whereas the term "special education schools" represent schools serving students with specific learning or developmental disabilities. The distinction between "general education" and "special education" is also acknowledged by Idol (2006).

1.2.2 Teachers

As reported by Ayantoye and Luckner (2016), both deaf and hard-of-hearing students and their parents acknowledged the significant impact of teachers as well as sign language interpreters on their academic achievements. When discussing the specific contributions that teachers make to the academic success of deaf and hard-of-hearing students, Ayantoye and Luckner (2016) summarize several key points, including those of providing vocabulary support and encouragement, expressing availability to the students, providing accommodations to students, such as preferential seating, sign language interpreting, etc.

Lichtert et al. (2016), drawing insights from documents used in teacher trainer institutions in Europe, categorize the expected competencies of teachers for deaf and hard-of-hearing students into three groups: knowledge and understanding, professional skills, and personal attributes. Specifically, knowledge and understanding competencies involve strong communication, consulting, and training skills, as well as knowledge of factors contributing to an optimal learning environment for all deaf and hard-of-hearing children/teenagers. Professional skills encompass understanding the impact of language problems on learning across the curriculum, comprehending the effects of deafness on language acquisition and communication, and recognizing how auditory and visual information processing influences education. Personal attributes include the acquisition of a minimum level of sign language skills.

Based on the perspectives of researchers, teachers of deaf and hard-of-hearing students need to be equipped with professional knowledge in deaf education (Marschark and Hauser, 2012), and be able to provide necessary communication and language support to students (Al-Dababneh et al., 2016; Ayantoye and Luckner, 2016; Lichert et al., 2016; Ntinda et al., 2019). Apart from these competencies, pedagogical skills are also reported to be necessary to teachers of deaf and hard-of-hearing students, including skills to develop instruction plans (Al-Dababneh et al., 2016), skills to adapt to teaching materials and methods (Al-Dababneh et al., 2016), and classroom and behavior management (Engler and Macgregor, 2018).

However, as indicated by the literature, existing teacher preparation programs do not sufficiently cover the mentioned competencies for teachers of deaf and hard-of-hearing students (Al-Dababneh et al., 2016; Lichtert et al., 2016; Marschark and Hauser, 2012; Ntinda et al., 2019).

Article 42 of the “Regulations of the People’s Republic of China on the Education of Persons with Disabilities” (published in 1994 and reviewed in 2017, hereinafter referred to as “the Regulations”) also specifies the qualifications for special education teachers engaged in the education of students with hearing disabilities. First, teachers should obtain the teaching qualification following the provisions of the “Law of the People's Republic of China on Teachers”. Second, they should graduate from special education majors or attend special education professional training and pass the

assessments organized by education administrative departments. Third, they should meet the national standards for sign language proficiency. In 2015, based on the Regulations and related laws, the Ministry of Education introduced "the Professional Standards for Special Education Teachers (Trial)" (hereinafter referred to as "the Professional Standards").

According to the Professional Standards (issued by the Ministry of Education in 2015), special education teachers are expected to demonstrate competence in three key areas: **theoretical knowledge and moral standards**, **professional knowledge**, and **professional skills**. In terms of **theoretical knowledge and moral standards**, teachers are required to possess a comprehensive understanding of the country's educational policies, as well as fundamental concepts in special education. Additionally, they should maintain positive attitudes toward their profession and students, upholding high moral standards and self-esteem. **Professional knowledge** encompasses a range of areas, including understanding the developmental regulations of students, subject-specific teaching knowledge, pedagogical expertise, and general knowledge involving proficiency in information technology relevant to modern educational content and teaching strategies. **Professional skills** necessitate the ability to create a safe, equal, suitable and inclusive educational environment tailored to students' needs, develop instructional plans and assessments, engage in effective communication with students, colleagues, and parents, foster collaboration between

schools, parents, and communities, and engage in reflective practices to enhance teaching experiences.

In essence, China's policies and regulations impose high professional competence requirements on special education teachers, including those responsible for educating deaf and hard-of-hearing students. The "Second Phase of the Special Education Improvement Plan (2017-2020)" (hereinafter referred to as "the Plan"), as issued by the Ministry of Education (2017), underscores the importance of enhancing the expertise of special education teachers. According to the Plan, universities and colleges are encouraged to expand the enrollment of students majoring in special education and improve the quality of training. Additionally, as part of efforts to strengthen teacher training, special education teachers are required to undergo a minimum of 360 training hours within a five-year cycle, and the "National Training Plan" has been introduced for school principals and head teachers in special education schools.

As highlighted by Wang (2022), English teachers in Chinese deaf schools face numerous challenges. Many of these teachers graduate with non-English majors, often teach English on a part-time basis, some handling two courses, and there is a lack of comprehensive professional training programs for English teachers in deaf schools. Wang (2022) further emphasizes that these deficiencies inevitably lead to identity issues for English teachers in deaf schools, impacting their attitudes toward teaching

and professional development, and highlighting the crucial role of identity in the teaching profession.

Hence, given that there is a lack of comprehensive and systematic training programs on special education, deaf education and subject-area education, Chinese teachers specializing in deaf and hard-of-hearing students encounter a lack of professional support concerning deaf education, subject knowledge, and pedagogical skills (Liu, 2013; Wang, 2022). Recognizing that teachers' training experiences can significantly influence their beliefs and attitudes toward teaching practices (Katz and Shahar, 2015), this thesis also conducted semi-structured interviews with English teachers to explore their training experiences and perspectives as English language teachers of Chinese deaf and hard-of-hearing students.

1.2.3 Textbooks and information technologies used in English classrooms of deaf and hard-of-hearing students in China

There is a scarcity of research dedicated to the examination of English textbooks employed in classrooms catering to deaf and hard-of-hearing students within the Chinese educational context.

In a doctoral thesis and two journal articles, Zhang (2013) provides an overview of the English textbooks utilized in deaf schools and offers recommendations for the development of potential textbooks tailored to deaf and hard-of-hearing students. Liao (2021) explores the practical challenges of adapting English textbooks designed for

general education settings to classrooms with deaf and hard-of-hearing students and offers suggestions for effective utilization of those textbooks in teaching. Wang (2022) gathers and analyzes data on the English textbooks being used in 31 deaf schools across China. However, it is important to highlight that none of the recommendations provided by the researchers have been empirically validated for their effectiveness in English language teaching practices for Chinese deaf and hard-of-hearing students.

According to the viewpoints of Zhang (2013), Liao (2021), and Wang (2022), the absence of textbooks specifically designed for deaf and hard-of-hearing students has led most Chinese deaf schools to rely on English textbooks intended for general education contexts. As pointed out by Liao (2021), these textbooks typically emphasize listening and speaking activities, making them less suitable for deaf and hard-of-hearing students. Consequently, English teachers, as highlighted by Liao (2021), need to adjust the general education textbooks to fit into the needs of deaf and hard-of-hearing students, by, for example, transforming listening and speaking activities into grammar or reading exercises. A similar scenario is presented in Wang's (2022) study. According to Wang (2022), many English teachers prefer standardized textbooks for exam preparation, but the absence of such resources for deaf and hard-of-hearing students forces them to resort to English textbooks tailored for general education settings which meet the standards set by the Gaokao.

Zhang (2013) advocates for the development of English textbooks specifically designed for the needs of deaf and hard-of-hearing students. However, as Wang (2022) suggests, considering the current lack of empirical data to support the development of textbooks explicitly for deaf and hard-of-hearing students, a more realistic approach involves adapting existing textbooks to better suit their needs. In this thesis, sign language interpretation videos are introduced as supplementary aids to the existing textbooks. Inspired by Wang's suggestion, this thesis developed a multi-modal reading interface that provides Chinese text translations and Chinese Sign Language interpretation videos for key words in reading passages. In the experimental study using this reading interface, deaf and hard-of-hearing students were encouraged to use both modalities freely as reading assistance and reflect on their experiences.

Education informatization has always been a key focus of China's education reform. The "National Medium and Long-term Education Reform and Development Outline (2010-2020)" (Ministry of Education, 2010, hereinafter referred to as "the Education Outline") explicitly states: "Information technology has a revolutionary impact on educational development and must be highly valued." According to the Education Outline (2010), accelerating the process of education informatization involves three key areas of work: accelerating the construction of education information infrastructure, strengthening the development and application of high-quality educational resources, and building a national education management information system. Among them, accelerating the construction of education information

infrastructure includes establishing an education information system covering schools at all levels in urban and rural areas; building advanced, efficient, and practical digital education infrastructure; accelerating the popularization of terminal facilities, promoting the construction of digital campuses, and achieving various ways of Internet access.

Based on the "Education Outline" (2010), the Ministry of Education formulated a ten-year action plan[15] with three primary objectives (2012). First, it aims to address the challenge of broadband Internet access and Internet learning environments in schools of all levels and categories. Second, there is a focus on enhancing the construction and sharing of high-quality educational resources, ensuring that every class has access to such resources. Third, the plan emphasizes the establishment of a real-name online learning space environment, intending to promote individual independent learning and facilitate pedagogical interaction.

Therefore, guided by national policies, significant improvements were made in the school's online teaching environment by 2016. The nationwide Internet access rate for primary and secondary schools reached 87%, with an 80% prevalence of multimedia classrooms (Ministry of Education, 2016b). Additionally, the availability of high-quality digital educational resources increased, contributing to the widespread

[15] Ministry of Education of the People's Republic of China (2017) *教育部等七部门关于印发《第二期特殊教育提升计划（2017-2020年）》的通知 (Notice on Issuing the Second Phase of the Special Education Improvement Plan (2017-2020) by the Ministry of Education and Six Other Departments).* Available at: http://www.moe.gov.cn/srcsite/A06/s3331/201707/t20170720_309687.html.

adoption of information technology in teaching. Building upon these achievements, the “Thirteenth Five-Year Plan for Educational Informatization” (Ministry of Education, 2016b), released by the Ministry of Education, proposed accelerating the “broadband network school connectivity”. This included enhancing the export bandwidth of various schools and teaching points, ensuring that urban schools now have an average export bandwidth of no less than 10 Mbps, and rural schools meeting the conditions have an average export bandwidth of no less than 5 Mbps. Additionally, the plan aimed to promote the construction of “wireless campuses”, with schools in the eastern region and those with suitable conditions achieving full wireless network coverage. The overall objective was to ensure that schools at all levels and types universally possessed an informationized teaching environment. In 2017, the Ministry of Education issued the “Second Phase of the Special Education Improvement Plan (2017-2020)”, which explicitly emphasized the need to “strengthen the construction and application of information technology in special education” and achieve the widespread use of information technology in classrooms.

According to Sun (2014), benefiting from policy support, deaf schools have utilized various types of information technology, including speech-to-text conversion systems, electronic whiteboards, computer labs, wireless network-based mobile learning platforms, and multi-sensory life service systems that provide students with various information through compound signals such as audio, video, text and vibration. This

suggests that the utilization of information technology in assisting teaching is feasible in classrooms of Chinese deaf schools.

Several studies have investigated the integration of information technology in teaching various subjects to deaf and hard-of-hearing students, including Chinese language (Liang, 2021), mathematics (Chen, 2019), Arts (Li, 2021), and physics (Ma, 2018). However, while the effectiveness of information communication technologies has been demonstrated in special education classrooms (Drigas and Ioannidou, 2013) and English language classrooms in general education settings (Chang and Hsu, 2011), there is a dearth of research examining the efficacy of these technologies in English classrooms catering to deaf and hard-of-hearing students, particularly from a student's perspective and exploring their preferences on the use of information technology.

1.3 Research questions

Based on the research gaps and contextual background of English language education to deaf and hard-of-hearing students in China, this thesis aims to better understand the current English language teaching and learning situations of such students, and their information modality preference by addressing the following research questions:

1. What are the demographics and characteristics of Chinese deaf and hard-of-hearing English learners?
2. What are the teachers' perspectives on teaching English to Chinese deaf and hard-of-hearing students?

3. What are the preferences of deaf and hard-of-hearing students for multi-modal keyword assistance during English reading tasks?

The outcomes of this research have practical implications for language learning and teaching and contribute to raising awareness of the unique requirements of deaf and hard-of-hearing students in learning English in non-English-speaking countries.

1.4 Significance of the research

Considering the identified gaps in existing research and the educational policies set by the government, this thesis holds significance for future research endeavors, English teachers, deaf and hard-of-hearing students learning additional languages, policymakers and relevant stakeholders.

First, this thesis aims to address the lack of empirical studies focusing on English language teaching for deaf and hard-of-hearing students in China. Previous research has primarily explored the circumstances of English teaching in deaf schools (Wang, 2022), as well as analyzed, from the teacher's perspective, how to enhance the quality of English teaching in deaf schools using corresponding teaching tools and methods (e.g., Guo, 2017; Xu et al., 2021). However, the voices of students have not been adequately represented in these studies. Moreover, deaf and hard-of-hearing students' preferences regarding the teaching approaches mentioned in previous research have not been supported by empirical evidence. Therefore, this thesis will adopt a student-centered approach. By investigating the demographic information, language and

communication preferences, and English learning experiences of deaf and hard-of-hearing students, this thesis can provide qualitative and quantitative data to further understand this student population in the context of additional language education. Furthermore, in the third phase of the thesis, deaf and hard-of-hearing students are required to use a multi-modal reading interface for English reading practice. By collecting students' usage data and grading their scores on the post-reading tasks, this study will explore students' preferences for Chinese text translation and sign language interpretation videos concerning their demographic characteristics and communication preferences and investigate the influence of providing multi-modal key word assistance on their post-reading task performances.

Second, the outcomes of this thesis will be advantageous for both English language teachers and deaf and hard-of-hearing students in China. Utilizing a mixed-method design to collect qualitative and quantitative data, this study aims to offer a more nuanced understanding of deaf and hard-of-hearing students as multilingual language learners. Consequently, English teachers will gain enhanced insights into their students, encompassing the diverse needs rooted in their personal backgrounds, language development, communication preferences, and experiences with English learning. The data gathered in the third phase of the study will specifically inform teachers about students' inclinations toward multi-modal information. These findings can assist teachers in customizing their instructional strategies to improve the English learning experience for Chinese deaf and hard-of-hearing students.

Third, the second phase of this research, involving semi-structured interviews with English language teachers working with deaf and hard-of-hearing students, holds significance for policymakers aiming to enhance existing teacher training programs. More precisely, through these interviews, teachers were prompted to introspect about their training experiences and articulate their attitudes and beliefs regarding their teaching practices. Consequently, the interview results can illustrate how teachers' perspectives are shaped by their training background and highlight the existing limitations in current teacher training programs. Given the scarcity of studies examining the identities of teachers instructing additional language subjects in special education settings, particularly in deaf schools, such findings can serve as crucial references for policymakers seeking to refine teacher training initiatives.

Furthermore, in the third phase of the study, deaf and hard-of-hearing students were asked to evaluate their level of acceptance of the use of a multi-modal reading interface and their preferences for various information modalities, including textual translation and sign language interpretation videos, in English reading exercises. As the development of information technologies for educational use aligns with strong government backing, the data derived from this research can serve as a valuable point of reference for stakeholders.

1.5 Structure of the thesis

The thesis comprises seven chapters. In Chapter 1, an introduction to the study is presented. This includes a discussion on the primary subjects of investigation: hearing loss, ELL-NESC, and the utilization of multi-modal teaching materials. Identified research gaps in these domains and contextual insights into deaf education in China are explored, covering aspects such as curriculum development, teacher qualifications, and the integration of textbooks and information technology in classrooms. The research gaps and contextual backgrounds lead to the main research questions of the thesis. The significance of the research is also outlined in this chapter.

Chapter 2 conducts a literature review of the key concepts central to this research. The initial focus is on the detailed review of language development and languages used by deaf and hard-of-hearing children. This chapter begins by discussing how deafness impacts the language development of deaf and hard-of-hearing students, emphasizing the diverse language backgrounds of this population. It then introduces the various languages and means of communication used by these students, including sign languages, spoken languages, signed language, lip reading, and more. Deaf and hard-of-hearing students often have bimodal and bilingual language repertoire, highlighting the benefits of providing multi-modal information in their classrooms. The second segment of the chapter is dedicated to literature on reading and deafness. It covers the definition of the reading process, the impact of hearing loss on reading, and the importance of vocabulary knowledge in reading. The chapter concludes with a

discussion of why vocabulary presents challenges to the English reading experience of deaf and hard-of-hearing students in ELL-NESC contexts.

Chapter 3 serves as the methodology section. This chapter starts with an introduction of the mixed-method design of this thesis, highlighting the interconnection between the studies which include a demographic questionnaire with deaf and hard-of-hearing students, a semi-structured interview with the English teachers and an experimental study on using the multi-modal reading interface. Rationales for conducting these studies are presented in this chapter. The whole thesis is built based on a small-scale pilot demographic study of deaf and hard-of-hearing students. Thus, this chapter also discusses the design of the pilot demographic questionnaire and reports the findings and limitations.

Chapter 4 discusses the outcomes of the expanded demographic questionnaire survey. The data presented includes the participants' demographic characteristics, communication preferences, and experiences in learning English. The findings illustrate the heterogeneous demographic characteristics and communication preferences of deaf and hard-of-hearing students. These students reported a high level of difficulty with English reading, and a correlation analysis indicated that this perceived difficulty was significantly linked to challenges with vocabulary. Based on these findings, I conducted a semi-structured interview study with English teachers of deaf and hard-of-hearing students to explore how they address the diverse needs of

this group. To support their reading experience, I also designed a reading interface that provided Chinese text translations and Chinese Sign Language (CSL) interpretation videos for key words.

Chapter 5 presents a semi-structured interview study with English language teachers of Chinese deaf and hard-of-hearing students. This study explores the topic of teaching English to such students from the point of view of the teachers and starts with a literature review on teacher's training experiences, attitudes and teaching practices. Then, this chapter presents the findings of the semi-structured interviews by relating them to how teachers' perspectives and training experiences are different from each other. The results of this study lead to a discussion on the need to have systematic and comprehensive teacher training programs for teachers of deaf and hard-of-hearing students.

In Chapter 6, a mixed-method study involving a multi-modal reading interface is presented. Commencing with a literature review exploring the multi-modal instruction, input enhancement and the Technology Acceptance Model (TAM), the chapter proceeds to introduce the development and design of the interface. Subsequently, it presents data and findings related to the participants' demographic information, post-reading performance with and without the multi-modal key word assistance, preferences regarding information modalities, and their acceptance level regarding the reading interface and multi-modal translations using the TAM measurement. The

chapter concludes with a discussion of the study's design limitations and offers suggestions for future research.

Chapter 7 provides a summary of the thesis, highlighting the key findings from the studies presented in Chapters 4, 5, and 6. This chapter discusses the implications of these findings and outlines the limitations of the thesis.

Chapter 2 Literature Review

This literature review chapter discusses studies related to the language experience and knowledge of deaf and hard-of-hearing children, alongside theories of reading comprehension and word knowledge. The research questions of this thesis focus on deaf and hard-of-hearing English learners in China. Specifically, as mentioned in Chapter 1 (refer to Section 1.3), this thesis explores research questions related to three key areas: the demographic characteristics of Chinese deaf and hard-of-hearing English learners, the perspectives and experiences of their English teachers, and the students' experiences with multi-modal learning assistance.

In the first part of this chapter, the linguistic characteristics of deaf and hard-of-hearing students are introduced, starting with the impacts of hearing loss on language development and concluding with a discussion of their language competency. The second part focuses on reading as a literacy skill for deaf and hard-of-hearing students, detailing the challenges faced by them in reading. More detailed discussions on how the research questions are addressed in each study are reviewed in the following individual chapters (refer to Chapters 4, 5 and 6). The main purposes of this chapter are to review studies that demonstrate the influence of hearing loss on language acquisition in deaf and hard-of-hearing children, their multilingual repertoire, and theories related to the English reading process and comprehension.

2.1 Deaf and hard-of-hearing students and their languages

Inspired by the literature (e.g., Sedláčková, 2016; Swanwick, 2016), this thesis adopts the perspective that deaf and hard-of-hearing students possess multiple competencies and are capable of learning additional languages. Furthermore, it is built upon the plurilingualism framework, within which deaf and hard-of-hearing students have a linguistic repertoire that allows them to flexibly utilize various modalities to make meaning in communication and learning processes. However, given that hearing loss (or deafness) inevitably influences the language acquisition process of this unique group of children (Scott & Dostal, 2019), there is concern among researchers that these children are at risk of language deprivation (Hall, 2017; Hall et al., 2019; Humphries et al., 2014), which could negatively affect their language development (Scott & Dostal, 2019).

To begin with, the following section reviews studies related to how the language development of deaf and hard-of-hearing children is shaped by their hearing loss (or deafness) and what causes their linguistic heterogeneity. This section also explores the language repertoire of deaf and hard-of-hearing children, providing evidence for their multilingual competence.

2.1.1 Impacts of deafness on the linguistic backgrounds of deaf and hard-of-hearing students

As highlighted by Knoors and Marschark (2015), the phrase "'Deaf children are not hearing students who just cannot hear' is often used in deaf education classrooms and

research" (p. 2). This perspective recognizes that deaf and hard-of-hearing students possess unique needs and experiences that differ significantly from those of hearing students in various aspects, including language development (Swanwick, 2016), visual perception, attention, working memory (Marschark & Knoors, 2012), and social cognition (Hintermair, 2008; Morgan, 2015). These differences necessitate recognizing the distinctive characteristics and needs of deaf and hard-of-hearing students, conducting demographic studies to better understand their specific contexts, and developing English language learning materials specifically tailored for them as most existing concepts and strategies regarding on ELL-NESC have been tested primarily with hearing language learners.

Moreover, researchers have observed a growing heterogeneity among deaf and hard-of-hearing students in recent decades (Archbold, 2015; Mitchell, 2017), further underscoring the importance of understanding the diverse characteristics within this population. Building upon the discussion of the impact of hearing loss on individuals' daily lives, language, and educational experiences in the preceding chapter (refer to Section 1.1), this section will delve into a discussion of how hearing loss influences language acquisition and learning processes.

Researchers widely agree that the accessibility of language during the early phases of life significantly shapes the language development of children (Scott & Dostal, 2019). Moreover, access to language acts as a protective factor in fostering children's overall

development, emphasizing that deprivation of language during the early stages can lead to adverse outcomes (Scott & Dostal, 2019). However, as noted by Levine et al. (2016), because language development begins at or even before birth, severe hearing loss can significantly impede this process, limiting deaf and hard-of-hearing children's opportunities for accessing language and communication.

Consequently, the development of language fluency (in a sign or a spoken language) of deaf and hard-of-hearing children is usually delayed compared with their normally-hearing peers (Swanwick, 2016). Furthermore, researchers suggest the lack of access to language and communication carries substantial implications for their access to both the language used for instruction and the curriculum within educational settings, as well as for their development of literacy skills (Swanwick, 2016). According to Hall (2017), the absence of language access results in negative implications such as cognitive delays, mental health issues, reduced quality of life, and increased possibility of trauma. Korver et al. (2017) assert that deaf and hard-of-hearing children who lack early intervention and rehabilitation will lag behind their peers with normal hearing in areas including reading skills, cognition, and social skills. As highlighted by Holcomb et al. (2023), lack of access to language does not only exist in early ages: deaf and hard-of-hearing children may face chronic language deprivation which, "as a result, they have missed opportunities to access information throughout critical times in their young lives ... and have difficulty with receptive and expressive language and in learning to read and write" (p. 28). Researchers also point

out that earlier onset of hearing loss and longer duration of deafness increase the severity of these deficits (McCreery and Walker, 2022) and reduce the performance of technical hearing assistance (Bernhard et al., 2021).

To get access to communication and language, parents must decide on whether to communicate with their children through a visual way, which is sign language, or to restore hearing through digital hearing aids or cochlear implants so that deaf and hard-of-hearing children may have access to spoken language (Knoors, 2015). According to Sedláčková (2016) and Lederberg (2006), deaf children born to deaf parents who are native signers undergo a natural language development process similar to that of hearing children in terms of both pace and sequence. This similarity arises because these children are exposed to a rich linguistic environment with understandable input (Spencer and Marschark, 2010). However, as scholars have pointed out, only a small percentage, ranging from 5 to 10 percent, of deaf children fall into this category (Marschark et al., 2014). The majority of deaf and hard-of-hearing children are born to hearing parents (Marschark et al., 2014; Scott and Dostal, 2019; Sedláčková, 2016). For this group of the population, as stated by Sedláčková (2016), the language environment experienced by them is significantly different, which further leads to the linguistically diverse nature of deaf and hard-of-hearing children (Archbold, 2015). To specify, as noted by Swanwick (2016), deaf and hard-of-hearing children may be raised with sign language, one or more spoken languages, or a combination of these at home. Moreover, researchers have also highlighted that even when hearing parents

learn sign language and utilize a combination of sign and spoken languages at home, it does not equate to the same fully accessible, fluent language exposure from birth experienced by hearing children (Mayberry, 2007).

To summarize, previous research indicates that deafness extends beyond mere hearing loss, significantly impacting deaf and hard-of-hearing students' language accessibility and communication (Hall et al., 2019; Henner et al., 2016). This influence extends to language development (Humphries et al., 2012; Sedláčková, 2016), linguistic backgrounds (Archbold, 2015; Swanwick, 2016), and educational experiences (Swanwick, 2016). As Swanwick (2016) suggests, recognizing how deafness alters children's learning approaches has implications for understanding language diversity in educational contexts.

This thesis is grounded in the recognition that deaf and hard-of-hearing students are linguistically diverse (Archbold, 2015), and their language use is bimodal bilingual (Snodden & Weber, 2021; Swanwick, 2016; Swanwick et al., 2016). Based on this understanding, the research design assumes that developing multi-modal learning tools in language classrooms would be beneficial in catering to deaf and hard-of-hearing students' diverse communication preferences. As discussed in Chapter 1 (refer to Section 1.1), there are significant gaps in the research literature on the demographics of deaf and hard-of-hearing English learners in China and learners' preferences for multi-modal learning technologies. The results of this study will

address these gaps and provide evidence concerning the language diversity of this group of students in educational contexts.

2.1.2 Language use and experiences of deaf and hard-of-hearing students

This section focuses on the bimodal bilingual language use of deaf and hard-of-hearing students. The term "bimodal bilingual" refers to individuals, either deaf and hard-of-hearing or hearing, who use sign and spoken/written languages (Ormel and Giezen, 2014). According to Swanwick (2016), "Although the two main modalities in question here are sign and speech, it is recognized that in most cases the use of a spoken language also implies an interaction with the written form of the language" (p. 13). To delve into the issue of language use of deaf and hard-of-hearing students, this section starts with a thorough description of the languages and means of communication used by deaf and hard-of-hearing students and then discusses their language repertoires.

2.1.2.1 Languages and means of communication of deaf and hard-of-hearing students

According to Knoors (2015),

> When a baby is born deaf or when it acquires deafness early in life, during the first stages of language development, the goal of intervention becomes to either provide an ideal situation for language development or to approach this ideal as closely as possible (p. 1).

Scott and Dostal (2019) point out that deaf and hard-of-hearing children can have access to communication either through natural languages, such as spoken language

and sign language, or through communication systems, such as signed languages. In other words, languages and means of communication utilized by deaf and hard-of-hearing students are complex and various (Sedláčková, 2016). Researchers have found that this population is of great linguistic diversity (Snodden and Weber, 2021; Swanwick, 2016). To further understand the language use of deaf and hard-of-hearing individuals, this section presents the most common means of communication used by this specific population.

2.1.2.1.1 Sign language

Exposure to sign language is widely advocated by scholars (e.g., Caselli et al., 2021; Hall, 2017; Hall et al., 2019; Humphries et al., 2014). Sign language is considered a natural language, not invented but developed organically by communities of language users (Sandler and Lillo-Martin, 2003; Scott and Dostal, 2019). According to Sandler and Lillo-Martin (2003), "One of the fundamental properties of human language is that it can be used to create an unlimited number of utterances given a limited number of pieces" (p. 534). Being a natural language, Sedláčková (2016) claims that sign languages fit into these criteria.

It is important to note that sign languages are distinct from spoken languages, possessing their own independent vocabulary and grammatical structures (Sandler and Lillo-Martin, 2003). A single sign in a sign language typically encompasses five parameters: hand shape, location of hands, orientation of palms and direction of fingers, movement of hands and fingers, and non-manual features (Yang, 2015). As

illustrated by Sandler and Lillo-Martin (2003), handshapes, locations, and movements are the foundational elements of sign language phonology, with a change in any of them possibly resulting in a change in the meaning of a sign (Sedláčková, 2016). Non-manual features include facial expression, mouthing words, mouth gestures, and head and body movements (Yang, 2015), and are used as important markers in syntax structures in sign languages (Liddell, 2021; Sandler and Lillo-Martin, 2003).

Additionally, even though vocabulary signs differ from sign language to sign language, Sandler and Lillo-Martin (2003) note that the grammatical structure in different sign languages is remarkably similar. Being visually motoric, sign languages employ space for grammatical purposes, and their structures are simultaneous rather than linear (Lyu, 2019; Sedláčková, 2016). For example, as illustrated by Lyu (2019), in CSL, to demonstrate the meaning that someone is reading while eating, instead of signing “read”, “eat” and “simultaneously” in a linear sequence, the signer signs “book” by one hand, and with the eyes looking at the “book”, the other hand signs “eating”. In other words, the actions “read” and “eat” are signed by different hands simultaneously.

Not only that, partly due to this simultaneous nature, but word order in sign languages is also hard to identify (Lyu, 2019). Sandler and Lillo-Martin (2003) highlight how sign language word orders are flexible and can be modified in different contexts. This statement is supported by Lyu (2019) by noting that CSL has various word orders,

including SVO (Subject-Verb-Object), SOV, OSV,and VO. Interestingly, all the word orders can be used to express a similar meaning with the assistance of non-manual features in different contexts (Lyu, 2019).

According to Sedláčková (2015), the different features of sign languages may cause interference in the development of the spoken language of deaf and hard-of-hearing people. Therefore, some researchers express concern that early exposure to sign languages may have negative impacts on deaf and hard-of-hearing children's speech recognition skills and speech intelligibility (Geers et al., 2017). From the perspective of auditory-verbal therapy, the use of visual communication methods, such as sign language, should be minimized to encourage the development of auditory communication skills (Estabrooks et al., 1994; Estabrooks et al., 2016). However, this point of view is criticized by Hall et al. (2017; 2019), who highlight the harmful consequences of language delay and deprivation, and call for early exposure of sign language, as a first language, to deaf and hard-of-hearing children (see also in Section 2.1.1.1).

According to Yang (2015), research into CSL is relatively recent and began with attempts to compile and edit a dictionary of its central vocabulary. Researchers and deaf and hard-of-hearing individuals in China generally believe that CSL originates from the traditional schools for deaf and hard-of-hearing individuals as a means of communication between teachers and students (Gao and Gu, 2013; Lyu, 2019; Yang,

2015). In general terms, CSL is categorized into two main dialect regions: the southern dialect area and the northern dialect area (Lyu, 2019). Within these regions, Shanghai Sign Language serves as the representative of the southern dialect area, whereas Beijing Sign Language represents the northern dialect area (Yang, 2015).

As highlighted by Gao and Gu (2013), to unify Chinese regional varieties of natural signs, the China Deaf and Blind Association first published a CSL lexicon "Longyaren Tongyong Shouyu Caotu" (《聋哑人通用手语草图》) in 1959 with around 2000 vocabulary items. This lexicon was later revised in 1980, adding 1070 new vocabulary items and renaming it "Longyaren Tongyong Shouyu Tu" (《聋哑人通用手语图》), which is translated as "The Chinese Signs: Lexicon of the Standard Sign Language for the Deaf in China" (Yau, 1977, as cited in Yang, 2015) and "Common Sign Language Pictures used by Deaf People" (Yang, 2015). Despite these efforts, as highlighted by Gao and Gu (2013), this version of a CSL lexicon still failed to meet the needs of deaf and hard-of-hearing people. In response to this, the China Disabled Persons' Foundation and the China Association of the Deaf published "Chinese Sign Language"(《中国手语》) in 1987, which collected over 5,000 commonly used Chinese words represented by signs from Beijing and Shanghai, covering both northern and southern varieties (Gao and Gu, 2013). However, as introduced by Yang (2015), to ensure that Chinese words and CSL signs are one-to-one matched, the editorial team intentionally made up signs when there was no lexical equivalent, which caused dissatisfaction among the Deaf community as the published

lexicon (1987, revised in 2013) missed a lot of natural sign language vocabulary (Yang, 2015). In 2009, “Basic Signs of Chinese Sign Language” (《中华人民共和国国家标准: 中国手语基本手势》, coded GB/T 24435-2009) was published, and this lexicon has since been used as the national standard of CSL (Gao and Gu, 2013; Yang, 2015). As emphasized by Chinese researchers (Yang, 2015; Xiao and Li, 2013), the Deaf community in China has expressed their desire for a unified version of CSL to be utilized in various domains, including educational settings, conferences, and television broadcasts. However, the project to standardize CSL nationally has not been completed due to complex reasons (Yang, 2015), leaving unresolved issues and challenges, particularly in the field of education (Guo, 2017; Lytle et al., 2005/2006; Zhang, 2009; Zhang, 2013).

2.1.2.1.2 Assistive hearing technology and spoken language

The field of assistive hearing technology for deaf and hard-of-hearing children has seen significant progress over the past decades (Frush Holt, 2019). Studies have illustrated the effectiveness of hearing aids and cochlear implants in providing sufficient auditory access for these children to develop spoken language skills (Scott and Dostal, 2019). I will begin with an exploration of the mechanisms underpinning technical hearing devices, as well as governmental policies regarding their usage among deaf and hard-of-hearing children.

The two primary types of hearing technology are hearing aids and cochlear implants. As introduced by Frush Holt (2019):

> Hearing aids and cochlear implants each take fundamentally different approaches to delivering acoustic signals to the listener. Hearing aids amplify signals and transmit them to the listener's ear canal, whereas cochlear implants convert the acoustic signal into pulses of electrical current that are emitted directly into the listener's organ of hearing—their cochlea. The electrical pulses stimulate neural units from the auditory nerve along a portion of the cochlea. Those neural units then propagate information from the signal up the auditory pathway to the auditory cortex in the brain. (p. 2)

According to Frush Holt (2019), cochlear implants are designed to directly stimulate auditory nerve fibers, bypassing a loss of sensory hair cells within the inner ear that convert sounds into neural signals. In other words, cochlear implants are intended for listeners who do not benefit from hearing aids. Even though most profoundly deaf and hard-of-hearing children are eligible for cochlear implantation across the world, access to these devices and eligibility vary from country to country.

In the UK, children meeting the criteria outlined by the UK's National Institute for Health and Care Excellence (NICE, 2019) for cochlear implantation are provided with devices for both ears through the National Health Service, while those with less severe hearing loss typically receive hearing aids. The NICE criteria (2019) mandate a minimum trial period of three months using acoustic hearing aids before considering cochlear implantation. Similarly, in the United States, as outlined by Deep et al. (2019), the Food and Drug Administration (FDA) criteria stipulate that children with severe-to-profound hearing loss must undergo a three-month trial with hearing aids before cochlear implantation is considered. Additionally, the FDA criteria specify a

minimum age requirement of 12 months for children undergoing cochlear implantation, although age limits may vary among different centers (Deep et al., 2016). In 2006, the National Health Commission of the People's Republic of China (HCPRC) issued "The Cochlear Implant Clinical Practice Guidelines" ("The Guidelines"), which established criteria for cochlear implantation in China. According to The Guidelines (HCPRC, 2006), individuals with bilateral severe-to-profound sensorineural hearing loss are deemed suitable candidates for cochlear implantation if conventional hearing aids prove ineffective. Furthermore, The Guidelines (HCPRC, 2006) recommend that children with pre-lingual deafness undergo cochlear implantation between the ages of 12 months and five years; however, no age limitation is specified for individuals with post-lingual deafness.

Accessibility to hearing aids and cochlear implantation also varies from country to country. According to the Consortium for Research into Deaf Education (CRIDE, 2024), by 2023, 7053 deaf children in the UK had received cochlear implants. With a total of 10,196 children having severe or profound deafness, it is estimated that approximately 48% of these children have at least one cochlear implant. Assuming that most children with cochlear implants have profound deafness, this percentage increases significantly to 83% (CRIDE, 2024). In the United States, as reported by the National Institute on Deafness and Other Communication Disorders (NIDCD, 2024), approximately 38,000 children have received cochlear implants. Whereas in China, as it has been mentioned in Chapter 1, out of a total number of 3,329,227 persons with

hearing disabilities, only 141,092 individuals wear hearing aids, and 961 individuals have undergone cochlear implantation (refer to Section 1.1).

In summary, eligibility and accessibility for cochlear implantation vary across different countries, necessitating individual contextual studies; however, there are also two common agreements. First, cochlear implants are typically reserved for individuals with severe-to-profound levels of hearing loss, whereas hearing aids are typically prescribed for those with less severe hearing loss. Second, a trial period of at least three months with hearing aids is generally required before considering cochlear implantation. As emphasized by Levine et al. (2016), time is crucial in children's language development. However, access to hearing for deaf and hard-of-hearing children may not occur immediately after birth. It often requires the provision of hearing devices and a prolonged period of intensive therapy (Knoors, 2015). Consequently, the concerns about language and communication accessibility (refer to Section 2.1.1) are relevant to users of technical hearing devices as well (Scott and Dostal, 2019).

Earlier detection and intervention, and the quality of linguistic input are often considered important predictors of the spoken language development of deaf and hard-of-hearing children. To specify, Scott and Dostal (2019) point out that early intervention, family involvement and purposeful interactions provide deaf and hard-of-hearing children with a high volume of language exposure and meaningful

linguistic input, which are vital to spoken language development. According to Geers et al. (2017), earlier detection and intervention generally yield improved spoken language outcomes. This finding is supported by Yanbay et al. (2014), who conclude that children diagnosed with hearing loss at an early age and children with a high level of family involvement have better post-implant language scores than children diagnosed later and with lower levels of family involvement. Additionally, in a study by Holzinger et al. (2020), parental linguistic input during the first years after cochlear implantation strongly predicts later child language outcomes. Likewise, Miller, Lederberg and Easterbrooks' study (2013) found that five preschool deaf and hard-of-hearing children benefited from explicit instruction on phonological awareness despite their heterogeneous backgrounds of communication mode and language abilities.

However, in Ching et al.'s study (2013), given that 56% of the 451 children were fitted with hearing aids before six months of age, their spoken language outcomes were well below population norms, on average. Further, researchers note that there is great variability regarding the impact of technical hearing devices on deaf and hard-of-hearing children's proficiency and rate of spoken language acquisition (Geers et al., 2017; Johnson and Goswami, 2010; Li et al., 2016; Niparko et al., 2010; Pimperton et al., 2017; Scott and Dostal, 2019; Sheikh et al., 2023). Such variability demonstrates a complex interplay of factors influencing spoken language outcomes in deaf and hard-of-hearing children (Frush Holt, 2019; Sheikh et al. 2023).

To specify, apart from early detection and intervention, researchers have also found that socioeconomic status (Niparko et al., 2010; Wu et al., 2015), maternal education (Geers et al., 2009; Välimaa et al., 2018), cognitive abilities (Sarant et al., 2010) and etiology (Frush Holt, 2019) of deaf and hard-of-hearing children are influential to their spoken language outcomes. In general, deaf and hard-of-hearing children from more affluent backgrounds, with parents of higher education levels, with higher cognitive abilities generally exhibit better spoken language skills. Additionally, according to Frush Holt (2019), the etiology of hearing loss can impact language development, particularly when it affects the central nervous system, leading to poorer spoken language outcomes. This point of view is also illustrated by Sheikh et al. (2023) who identify ear swelling as a prevalent factor affecting both hearing aid fitting and subsequent spoken language outcomes. In addition, researchers have noted that children with cochlear implants learning tone languages such as Mandarin Chinese face unique challenges (Li et al., 2022a). Pham et al. (2015) highlight that this is because pitch information, the primary acoustic cue to tones, is not effectively transmitted through cochlear implants due to their poor spatial resolution and the limited number of channels available to convey the rich frequency information inherent in human speech. To enhance speech perception development for this population, researchers recommend an early and prolonged cochlear implant experiences (Chen et al., 2016; Tang, 2021). Numerous studies focus on the impact of

modern hearing technology on the development of literacy skills of deaf and hard-of-hearing individuals.

For instance, Johnson and Goswami (2010) conducted a study to explore the phonological awareness abilities of deaf children with cochlear implants and their association with vocabulary and reading proficiency. Their research comprised 78 participants, including 59 deaf and hard-of-hearing students and 19 hearing students. By examining factors such as the age at which cochlear implants were received and incorporating two control groups—one consisting of deaf individuals using hearing aids and the other of hearing students matched for reading ability—the researchers analyzed various aspects such as visual memory development, speech reading, auditory discrimination, speech intelligibility, phonological awareness, and the impact of educational environments. The results indicate that cochlear implantation, particularly when performed early, enhances phonological awareness and auditory memory capabilities, leading to improvements in both reading accuracy and comprehension (Johnson and Goswami, 2010).

Nevertheless, the literacy proficiency of deaf and hard-of-hearing children varies, mirroring the discrepancies observed in their spoken language abilities. For instance, Geers and Hayes (2011) observe that most deaf and hard-of-hearing children who undergo cochlear implantation during preschool years attain age-appropriate literacy levels in adolescence; however, they exhibit significant delays in spelling and written

expression compared to their hearing counterparts. In another study conducted by Harris et al. (2017a), 41 children with severe-to-profound pre-lingual hearing loss, utilizing hearing aids and cochlear implants, were evaluated on various literacy measures at three different points in time. The results indicate that these children demonstrate slow progress in vocabulary development during primary school years, highlighting the need for additional support in both vocabulary and phonological skills to foster proficient reading (Harris et al., 2017a).

Furthermore, gaps in literacy skills achievement persist between deaf and hard-of-hearing children utilizing hearing aids and/or cochlear implants and their hearing peers (Dillon et al., 2012; Harris et al., 2017a; Spencer and Tomblin, 2009). As pointed out by Mayer and Trezek (2018), "not every child with a cochlear implant is successful in achieving age-appropriate literacy outcomes and/or maintaining these outcomes over time" (p. 14). These findings lead to the conclusion that language development, including that of spoken language outcomes and literacy skills, of deaf and hard-of-hearing children is a complex issue which needs more nuanced exploration (Marschark et al., 2009; Scott and Dostal, 2019).

2.1.2.1.3 Other means of communication

In addition to sign language and spoken language, individuals who are deaf or hard-of-hearing utilize a variety of communication methods. Their preferences for means of communication are influenced by factors such as the nature of their hearing loss, family background, personal identity preferences, and the communication partners

involved in specific interactions (Sedláčková, 2016). In this section, I will introduce the three communication methods most frequently used by deaf and hard-of-hearing people: signed language, lip reading, and written forms of communication (writing, typing and speech-to-text technology). According to the self-reports in the demographic surveys in this thesis, signed language, lip reading, writing and typing are also frequently used by the deaf and hard-of-hearing participants in this thesis (refer to Chapter 4).

As per Sedláčková (2016), **signed language** ranks as the second most commonly utilized form of communication among individuals who are deaf or hard-of-hearing. Marschark and Spencer (2009) delineated the distinctions between sign languages and signed languages. Specifically, sign languages are natural languages primarily reliant on the production and interpretation of visual symbols, typically evolving independently from spoken languages in their respective cultures. Conversely, signed languages are artificial systems of signs created to complement spoken language (Marschark and Spencer, 2009). To elaborate, CSL, American Sign Language (ASL), and British Sign Language are examples of natural sign languages. As discussed in previous sections, natural sign languages are characterized by their unique simultaneous nature (refer to Section 2.1.2.1.1). However, in signed languages like Signed Chinese and Signed English, signs or fingerspelling are created to represent grammatical concepts linearly, mirroring the structure of the local spoken language.

Marschark and Spencer (2009) highlight that the development of signed language systems is partly attributed to interactions between deaf adults and hearing adults who acquire sign languages later in life. Signed languages are frequently utilized by hearing parents, educators of deaf and hard-of-hearing students, and television programs (Marschark and Spencer, 2009; Yan, 2012). However, opinions regarding the effectiveness of signed languages, particularly in educational contexts, are contentious.

For example, according to Marschark and Spencer (2009), signed languages, being artificial systems of signs,

> do not fully represent the lexicon or grammar of either the hearing culture's spoken language or the naturally developed sign language of the corresponding deaf culture. They typically include some of the non-manual meaning units (such as specialized facial expressions) of natural sign language and omit many of the grammatical morphemes expressed in the spoken language. (p. 50)

However, this point of view is opposed by Rendel et al. (2018), who argue that Signing Exact English, which is an updated term for Signed English,

> is a viable option to Listening and Spoken Language or American Sign Language (ASL) ... and can be an effective primary method of communication for many children who are deaf and hard-of-hearing and their families. (p. 27)

Similarly, in China, some scholars argue that Signed Chinese is not an effective communication method in classrooms for deaf and hard-of-hearing students because it

fails to accurately convey information and does not align with the thinking patterns and communication habits of deaf and hard-of-hearing students (Liu, 2020; Yan, 2012). However, as Wang (2018) emphasizes, considering that Signed Chinese adheres to the syntax structure of the spoken language, it could serve as a useful and effective tool for learning Chinese. Additionally, according to Wang (2018), not all students in deaf schools are native signers, and some students with hearing aids and/or cochlear implants still rely on listening to the teacher. In such cases, given that CSL has its structure, Signed Chinese becomes a preferable option when the teacher needs to speak and sign simultaneously (Wang, 2018).

As highlighted by Sedláčková (2016), **lip reading** (also known as **speech reading**) is commonly employed by deaf and hard-of-hearing individuals. Besides, according to Muljono et al. (2019), given that the majority of the hearing population does not know sign language, lip reading arises as a necessity for communication between deaf and hard-of-hearing individuals and people with normal hearing.

Marschark and Spencer (2009) explain that lip reading involves visually interpreting the movements of a speaker's mouth and facial expressions, along with an understanding of the language, to understand the meaning of the spoken message. (p. 22). As described by Kovačević and Isaković (2024),

> lip reading represents a complex psychophysiological process, of which three elements are important: the visual perception of oral movements, the

> kinaesthetic memorization of speech and the psychological act of recognizing (identifying) words for their better understanding. (p. 925)

In other words, lip reading is a demanding means of communication (Abou-Abdallah and Lamyman, 2021; Sedláčková, 2016). Successful lip reading requires the knowledge of the speaker (expedient) to be partially matched with the knowledge of the one who reads the speech (percipient) (Kovačević and Isaković, 2023).

According to Sedláčková (2016), lip reading is most effectively utilized by individuals who are hard-of-hearing or post-lingual deaf, whereas deaf individuals commonly employ it as a supplementary tool to decipher individual words rather than fluent speech. This is partly attributed to the fact that being familiar with the knowledge of a spoken language is crucial for proficient lip reading (Campbell & Mohammed, 2010; Oliveira, Soares & Chiari, 2014). Kovačević and Isaković (2024) further summarize that this knowledge encompasses vocabulary, sound, and grammar, as well as everyday and idiomatic expressions of a spoken language. Moreover, the success of lip reading is associated with a high level of working memory capacity and the ability of verbal reasoning, given that processing the speech-language information received visually imposes significant demands on short-term memory (Kovačević and Isaković, 2024). External environmental factors, such as lighting conditions and noise, along with internal factors, like motivation, concentration, and fatigue, also influence lip reading effectiveness (Kovačević and Isaković, 2024; Sedláčková, 2016).

Consequently, individuals require training to enhance their lip reading skills (Kovačević and Isaković, 2024; Sedláčková, 2016).

Apart from lip reading, written forms of communication, such as **writing and typing**, are also frequently used by deaf and hard-of-hearing individuals when communicating with hearing persons who do not know sign language (Salkić et al., 2018). Writing and typing Chinese need different skills. Since Zhou, Youguang developed the Hanyu Pinyin (汉语拼音, also known as Pinyin) system in the 1950s, typing Chinese using Pinyin requires phonological knowledge of the language while writing and reading Chinese at least requires basic orthographic knowledge and word segmentation skills (Zhang et al., 2021). Nowadays, **speech-to-text** phone apps and software, allow deaf and hard-of-hearing people to have real-time captioning in different settings (Millett, 2021). However, researchers note that the accuracy of speech recognition is the main concern for this technology to be used in real conversations (Lyall, 2016; Millett, 2021). To specify, Dong et al. (2020) conducted a study with 208 deaf and hard-of-hearing students to test the effectiveness of using speech-to-text technology (ViaScribe) in university classrooms and found that this technology could effectively address the challenge when teachers lack sign language skills and support students in enhancing their reading abilities. Nonetheless, according to Dong et al. (2020), the software (ViaScribe) has inherent limitations that may hinder students' comprehension of the speaker's message. First, the accuracy in recognizing speech is influenced by factors such as the speaker's speed and clarity, and second, it struggles

to appropriately handle intonation and break down lengthy sentences (Dong et al., 2020). Therefore, researchers recommend that speech-to-text technology can be used as a pedagogical assistant to supplement teaching in the classroom of deaf and hard-of-hearing students (Dong et al., 2020; Millett, 2021).

2.1.2.2 Language competence and repertoire of deaf and hard-of-hearing students

Interventions, such as modern hearing technologies, enable deaf and hard-of-hearing students to use sign language, spoken and written forms of language, and various means of communication when interacting with others (refer to Section 2.1.2). This understanding contributes to a more comprehensive grasp of deaf and hard-of-hearing students' educational needs and preferences. However, there is a notable lack of studies focusing on classroom language use from the students' perspective. To address this research gap, this thesis investigates the multi-modal and multilingual preferences of Chinese deaf and hard-of-hearing students in an English reading classroom. Recognizing that these students can employ multiple modes of language highlights the need for further research into their language competence. The ability to use both separate and mixed forms of languages is part of what is known as the bilingual language repertoire (Hornberger and Link, 2012).

Swanwick (2016) utilizes the term "repertoire" to describe the linguistic capabilities of individuals and how deaf children utilize all accessible language resources for communication. Li Wei (2011) suggests that the language repertoires of deaf and

hard-of-hearing children include sign, spoken, and written languages, but extend beyond mere language skills. As emphasized by Blommaert and Backus (2013), a repertoire comprises various communicative tools with varying degrees of functional specialization, each serving a unique purpose. Thus, the concept of repertoire provides a framework for understanding how individuals employ their diverse resources to fulfill communicative functions (Kusters et al., 2017).

Based on previous studies, the following section starts with a discussion of deaf and hard-of-hearing children's bimodal bilingualism and education and then delves into the issue of the plurality, diversity, and multi-competency of deaf and hard-of-hearing students.

2.1.2.2.1 Bimodal bilingualism and education

Bimodal bilingualism refers to the use of a sign and a spoken language. Based on Swanwick's (2016) definition:

> The use of this term makes clear the differences between bilingualism that involves two or more spoken languages and bilingualism that involves a sign language as well as a spoken language. The term "bimodal" communicates the fact that the reception and production of sign language and spoken language takes place through different channels: sign language deploys primarily, the use of vision and gesture, whereas spoken language relies on audition and voice. (p. 24)

To comprehend the development of bimodal bilingual skills and the interaction between sign and spoken languages, it is essential to acknowledge the similarities in

properties and functions shared by these language modalities (Swanwick, 2016). As outlined by Sedláčková (2016), sign languages fulfill linguistic, social, and cognitive functions akin to spoken languages. Moreover, both sign languages and spoken languages are predominantly processed in the left hemisphere of the brain (Cheng et al., 2019; Hickok et al., 1996; Hickok at al., 2002). Consequently, as Swanwick (2016) asserts, the difference in modality does not hinder the potential for bimodal bilingual language development. As emphasized in previous sections, for deaf and hard-of-hearing children, the development of bimodal bilingual language skills depends on various factors, including early language experiences, nature of hearing loss, the timing and experiences of intervention, and access to hearing technologies (refer to Section 2.1.2.1).

The literature has seen fruitful findings in terms of bimodal bilingual language development and deaf education. Researchers have extensively explored this language situation and its implication for language planning and educational policies (see, e.g., Kusters et al., 2017; Skutnabb-Kangas, 2017; Snodden and Weber, 2021). One of the most commonly argued issues concerns the role of sign languages and their interactions with spoken languages. Sign languages are often considered to be the first languages of deaf and hard-of-hearing students, whereas spoken languages are often described as the second languages (Skutnabb-kangas, 2012; Skutnabb-kangas, 2017; Svartholm, 1994). Therefore, researchers have called for full accessibility of sign languages in the educational settings of deaf and hard-of-hearing students (e.g., Hall,

2017; Hall et al., 2017; Hall et al., 2019). However, the dichotomy of first language and second language may be problematic considering that most deaf children are born with hearing parents who do not know sign languages, and the parents may choose to raise their children without recourse to them (Swanwick, 2016). Therefore, in this thesis, instead of talking about which language predominates for deaf and hard-of-hearing students, the focus is centered on their bimodal bilingual language repertoire.

Inspired by Swanwick's work (2016), there are two types of language mixing in the bimodal bilingual language used by deaf and hard-of-hearing individuals. These are language switching and language blending. According to Goodman and Tastanbek (2021), language switching denotes the transition from one language to another, occurring between sentences or mid-sentence. For instance, during real-life conversations, deaf and hard-of-hearing individuals might begin with sign languages but switch to spoken languages upon realizing that their communication partners do not understand sign languages. On the other hand, as Emmorey et al. (2020) outline, language blending involves the simultaneous use of two different languages. For instance, deaf and hard-of-hearing individuals may mouth certain words while simultaneously signing. Additionally, as Wang (2018) highlights, teachers may employ Signed Chinese while concurrently speaking in classrooms of deaf and hard-of-hearing students.

Rinaldi and Caselli (2014) report deaf and hard-of-hearing students' dynamic and flexible use of languages in meaning-making. Additionally, as per Rinaldi and Caselli (2014), deaf and hard-of-hearing children attending a school with a bimodal bilingual curriculum performed significantly better in several tasks assessing linguistic abilities. The bimodal bilingual educational approach acknowledges the equal status of sign languages and spoken languages, while emphasizing the need for full accessibility to natural sign languages and the development of linguistic skills in spoken languages (Sedláčková, 2016). As Swanwick (2016) highlights,

> Philosophically, bilingual education strives toward the humanitarian and democratic goals of social inclusion and diversity. It is an approach to education that recognizes the unique and distinctive features of deaf language and culture, validates the linguistic and cultural choices of deaf people, and celebrates this diversity. (p. 33)

As discussed in previous sections (refer to Section 2.1.2.1), the languages used by deaf and hard-of-hearing students are bimodal and bilingual. Based on this understanding, this thesis adopts Swanwick's (2016) position that bilingual education can effectively meet the diverse linguistic needs of this unique group of students. Furthermore, this thesis aims to provide evidence supporting this approach by investigating how deaf and hard-of-hearing students cope with bimodal information during the language learning process in the ELL-NESC context.

The national policy for educating deaf and hard-of-hearing children in China primarily focuses on an oral/aural approach, aimed at listening and speech

rehabilitation (Yang et al., 2015). In real teaching situations, as Wang and Andrews (2017) point out, most deaf schools use oral communication supplemented by sign language and finger spelling. According to Swanwick (2016), there is no agreement in the literature regarding an apparent bimodal bilingual pedagogical model about how sign and spoken and written language can be effectively deployed in the teaching process. In this domain, some researchers believe that to ensure fluent exposure to sign languages, it would be better for teachers to treat sign languages as the main language of instruction, and to avoid the blended use of sign and spoken language (Andrews and Rusher, 2010). On the contrary, other studies specifically explore ways that sign and spoken language can be used together in spoken language-based signing to support deaf children's literacy development (Wang, 2018).

However, this thesis is not centered on this debate about which language, or languages, should be used in classrooms with deaf and hard-of-hearing students. Rather, inspired by Swanwick's (2016) suggestion, it explores language as a tool through which learning is mediated. In the design of this thesis, both language modalities are provided to deaf and hard-of-hearing students as vocabulary learning assistance. As pointed out by Swanwick (2016), language use in classrooms of deaf and hard-of-hearing students needs to be flexible and consider individual communication and learning styles. This perspective is further supported by Archbold (2015), who suggests that the interaction between sign language and spoken language

is evolving into a more adaptable and flexible aspect of communication for deaf and hard-of-hearing children in both social and educational settings.

In this thesis, students were given the chance to choose their preferred language modality to support their English reading experiences. Thus, by demonstrating how individual demographics influence students' choices of language modalities, the design of this study would be beneficial to not only teachers and students but also to research literature as it adds to the knowledge base about the cognitive and social dynamics of interaction between sign and spoken languages.

2.1.2.2.2 Plurality, diversity and multi-competence

Swanwick raises two questions in her book called *Language and Languaging in Deaf Education: A Framework for Pedagogy* (2016). The first question revolves around the languages and experiences of deaf and hard-of-hearing children within the framework of the contemporary understanding of language plurality and diversity. According to Swanwick (2016), "The use of the terms 'plurality' and 'diversity' is intended to widen attention from two languages and two modalities to many languages and many different ways of using those languages to make meaning" (p. 15) and "a plurilingual individual gathers a repertoire of linguistic skills that he or she is able to deploy flexibly to make meaning" (p. 59). The concept of plurilingualism and diversity underlines two fundamental understandings of this thesis: first, deaf and hard-of-hearing students are capable of learning an additional language, and second, this group of students is highly linguistically diverse.

Researchers have widely acknowledged that advancements in modern hearing technologies and the increasing linguistic diversity of society have expanded the potential for deaf and hard-of-hearing children to acquire one or more spoken languages (Swanwick, 2016). As per Sedláčková (2016), when deaf and hard-of-hearing individuals, who know sign languages and the domestic spoken languages, are learning an additional language, this situation could be considered within the concept of multilingualism. According to the definition provided by the Council of Europe (2007), multilingualism typically pertains to the language behaviors observed in communities and societies, specifically the simultaneous presence of multiple languages in a particular area, regardless of the individuals who utilize them.

On the other hand, plurilingualism is a term that signifies multilingualism at the level of the individual (The Council of Europe, 2007):

> "Plurilingualism" refers to languages not as objects but from the point of view of those who speak to them. It refers to the repertoire of varieties of language which many individuals use and is, therefore, the opposite of monolingualism; it includes the language variety referred to as "mother tongue" or "first language" and any number of other languages or varieties. Thus, in some multilingual areas, some individuals may be monolingual, and some may be plurilingual. (p. 8)

In other words, the group of deaf and hard-of-hearing people is multilingual with diverse languages being utilized. Not only that, some deaf and hard-of-hearing individuals are plurilingual as they use varieties of language to make meaning.

According to Snodden and Weber (2021), pluralingualism offers a broader and more optimistic perspective on language diversity than the traditional binary notion of bilingualism. Moreover, it embraces a variety of languages, modes, and communication channels, and considers partial language competencies as essential components of an individual's overall linguistic repertoire (Snodden and Weber, 2021). Some researchers, such as Sedláčková (2016), may question the applicability of the pluralingualism concept to deaf and hard-of-hearing individuals considering their restricted speaking and listening skills. Snodden and Weber (2021) argue that the radical and emancipatory nature of plurilingualism lies in its recognition of partiality, encouraging us to value the experiences of incompetence and disability that have led to less-than-ideal language acquisition. In other words, this concept provides a framework suggesting that even though hearing loss limits the listening and speaking skills of deaf and hard-of-hearing students, they still have the potential to acquire reading and writing skills in an additional language. Additionally, the concept of plurilingualism highlights the multi-modal language repertoire of deaf and hard-of-hearing students, which includes the use of sign language, written language, and other forms of communication. This framework supports the idea, as suggested by this thesis, that deaf and hard-of-hearing students can leverage their diverse linguistic resources to successfully engage in learning English as an additional language.

According to Snodden and Weber (2021), further investigation is required to understand how plurilingualism manifests in classroom teaching pedagogy. In their

opinion (Snodden and Weber, 2021), it is necessary to revitalize sign language as a medium of instruction. However, noticing that not all deaf and hard-of-hearing students are proficient in sign languages (refer to the discussion on the first and second languages of deaf and hard-of-hearing children in section 2.1.1.2.1), the perspective presented by Snodden and Weber (2021) may pose challenges if plurilingualism is intended to respect and acknowledge the diverse linguistic repertoires of deaf and hard-of-hearing students and their families (Swanwick et al., 2021). Therefore, this research does not seek to favor one language mode over another in classroom settings for these students. Instead, its objective is to underscore the advantages and potential of offering multi-modal information while respecting the diverse language preferences of students.

As stated by Sedláčková (2016), adopting a multilingual and plurilingual perspective when approaching deaf and hard-of-hearing students' experiences of acquiring additional languages (in addition to their local sign and spoken languages) could help understand the interconnections among these languages and the functions sign language and spoken language serve in learning and utilizing the additional language. However, there is limited research in this field. Despite the global prevalence of hearing loss and the likelihood of multilingualism within this diverse group, Swanwick (2016) points out the scarcity of published studies on multilingualism among deaf and hard-of-hearing students, particularly in non-English-speaking

countries. Focusing on such students learning English in China, this thesis hopes to address this literature gap.

2.2 Reading as literacy skill of deaf and hard-of-hearing students

Since part of the main research questions in this thesis is related to English reading experiences of Chinese deaf and hard-of-hearing students, the following sections review research literature in this area. This review consists of three parts. The first part concerns theories in reading and how deafness impacts reading experiences, the second part focuses on word knowledge and reading, and the third part discusses vocabulary instruction in language classrooms, especially in the ELL-NESC context.

2.2.1 Reading and deafness

In the first part of this section, regardless of the language and the characteristics of specific readers, reading is discussed concerning reading processes, reading skills and reading literacy. Then, in the second part of the review, the focus of the discussion goes to explore how deafness influences the reading experiences.

2.2.1.1 Reading process

Reading is a complex skill involving the orchestration of several components (Rayner and Reichle, 2010). As suggested by Sedláčková (2016), contemporary reading models describe the foundation of reading comprehension as the ability to draw meaningful connections between the text and the reader's prior knowledge of the text's language and content. These connections then allow the reader to form mental representations of the text (Helder et al., 2013; McNamara and Magliano, 2009).

However, according to Grabe and Stoller (2019), it is hard to use a simple one-sentence definition to comprehensively understand the nature of reading abilities. To clarify, Grabe and Stoller (2019) mark four issues to address reading abilities, including reading purposes, reading skills and strategies, the cognitive process of reading and the social context in which reading takes place. As per Verhoeven et al. (2011), both cognitive and linguistic factors have great impacts on the complex reading process. This point of view is further developed by Grabe and Stoller (2019) when they describe reading processes as cognitive activities involving skills, strategies, attentional resources, knowledge resources, and their integration.

To outline the connections among the various elements involved in reading, according to Rayner and Reichle (2021), there are reading models that address (1) word identification, (2) syntactic parsing, (3) discourse representations, and (4) how factors, such as language processing, influence the movement of readers' eyes. However, Raymer and Reichle (2010) also mention that these models lack interconnection with each other: "For example, the models of word identification seldom make contact with models of eye movement control, and vice versa" (Raymer and Reichle, 2010, p. 788). Raymer and Reichle (2010) further highlight that the difficulty for reading models to contact each other is partly due to the complexity feature of reading itself.

Verhoeven et al. (2011) state that reading models describe the process of reading as the relationship between bottom-up word recognition processes and top-down

comprehension processes. Similarly, according to Helder et al. (2013), the whole reading process occurs on two levels: a lower processing level requiring fundamental reading skills and a higher processing level including advanced reading abilities. Sedláčková (2016) explains that the lower processing level, also called the language processing level, is the stage at which the reader breaks down written text into its parts and links them to their corresponding phonological, orthographic, and semantic representations, while the higher processing level is associated with a higher level of comprehension abilities. It is important to note that the label lower processing does not indicate a lower level of complexity but the potential for automatization (Sedláčková, 2016).

Researchers generally agree that the automatization of lower-level processes provides the reader with sufficient capacity to be used for higher-level processes (Verhoeven et al., 2011). As pointed out by Cates et al. (2022), the automatization of lower-level processes is a predictor of reading fluency and comprehension. Although the primary focus of this thesis is not on the reading comprehension of deaf and hard-of-hearing students, it does treat their knowledge of lower-level processes as an influential factor in the students' English as an additional language reading experiences. Specifically, in Chapter 6, the participants were given bimodal assistance on vocabulary in a reading task. Further discussions on vocabulary and reading are reviewed in Section 2.2.2.

2.2.1.2 Reading abilities of deaf and hard-of-hearing students

As emphasized by Grabe and Stoller (2019), the skills required for reading comprehension are multifaceted and are interconnected with the nature of reading tasks, individual motivation, objectives, and language proficiency. Based on previous research, several factors significantly impact the ability to comprehend text: the capacity for rapid and accurate letter recognition facilitating lexical access (particularly through phonological decoding processes) (Cárnio et al., 2017; Hogan et al., 2005; Grabe and Stoller, 2019), the ability of working memory to effectively integrate diverse information (Borella and de Ribaupierre, 2014; Carretti et al., 2009; Swanson and Berninger, 1995), and the influence of pre-existing background knowledge (Gilakjani and Sabouri, 2012; Kaefer et al., 2015). Even though those highlighted areas are not specifically based on research into deaf and hard-of-hearing readers, Sedláčková (2016) notes that these three areas appear to align with the factors commonly cited as contributors to challenges in the reading achievement of this population.

2.2.1.2.1 Phonological decoding processes

According to Sedláčková (2016), the processes of letter recognition are most efficiently facilitated by the processes of phonological coding, which is of strong significance for deaf and hard-of-hearing readers. Similarly, Miller (2010) points out that, based on studies of hearing students who are dyslexic, weak phonological decoding skills may lead to the undermining of proper reading comprehension. Not only that, according to Miller et al. (2013), given that prelingually deaf readers have

limited access to the auditory features of spoken words, their sensitivity to the phonological structure of words would be restricted as well. However, this conclusion (Miller et al., 2013) does not mean that deaf and hard-of-hearing children are unable to develop phonological skills.

Modern hearing technologies, such as cochlear implants, have made it possible for deaf and hard-of-hearing children to get access to sound and phonology (Spencer and Tomblin, 2009). Not only that but researchers have also found that although deaf and hard-of-hearing children's phonological development is delayed, they develop phonological awareness in a similar sequence as hearing children (e.g., Geers and Hayes, 2011). According to Harris et al. (2017a), deaf and hard-of-hearing children develop phonological awareness in line with reading. This finding fits into the conclusion of Kyle and Harries (2006), who noticed that these children develop their phonological abilities through the process of reading acquisition, and their phonological awareness grows in importance as a concurrent factor of their ages.

Moreover, according to McAnally et al. (2007), auditory input is not a prerequisite for development. Given that deaf and hard-of-hearing children are restricted in auditory information, researchers, such as Harries et al. (2017a; 2017b), have highlighted the importance of taking advantage of the visual components of speech to develop phonological skills. Moreover, as per Sedláčková (2016), strategies, including lip

reading, cueing and visual phonics, make it possible for deaf and hard-of-hearing children to develop phonological awareness.

To investigate how phonological decoding skills influence reading comprehension of deaf and hard-of-hearing children, Yan et al. (2021) conducted an eye-tracking study to investigate phonological coding during sentence reading with Chinese deaf and hard-hard-of-hearing readers. According to this study, the authors found that there were no significant differences between homophones and unrelated words in all eye movement measures for the deaf and hard-of-hearing students when they were analyzed as a single group. However, when the participants were divided into more-skilled and less-skilled groups, the more-skilled readers demonstrated a homophone advantage for the total reading time measures. Therefore, Yan et al. (2021) concluded that a higher level of reading skill in Chinese deaf and hard-of-hearing readers is associated with the utilization of phonology, and a greater reliance on sign phonology may hinder less-skilled deaf and hard-of-hearing readers from effectively employing phonological coding before reading. This aligns with Sedláčková's (2016) perspective that successful deaf and hard-of-hearing readers primarily employ phonological coding rather than relying on other coding strategies based on sign, finger spelling, or visual (orthographic) information.

According to Yan et al. (2021), more-skilled deaf and hard-of-hearing readers differed from less-skilled readers in phonological coding. Namely, poor phonological word

processing skills help explain the failure in reading comprehension of readers with hearing disabilities. However, this relationship does not represent a whole framework of the reading difficulties. Some researchers contest the idea that weak phonological word processing abilities account for the reading comprehension difficulties observed in deaf and hard-of-hearing readers. For instance, in a study involving 83 participants, Miller (2010) discovered that the reading difficulties of deaf and hard-of-hearing individuals may not stem from weak phonological decoding skills but rather from a lack of adequate structural (syntactic) knowledge.

2.2.1.2.2 Working memory

The second aspect to be considered, as emphasized by Sedláčková in 2016, is working memory. According to Borella and de Ribaupierre (2014), "working memory is defined as the cognitive resources available for storing information while processing incoming or recently accessed information for use in other cognitive tasks" (p. 86). In Gui and Ismail's (2024) study, working memory refers to "the temporary storage and manipulation of information essential for ongoing cognitive tasks" (p. 5).

Numerous studies have shown that working memory is involved in reading comprehension. For example, Borella and de Ribaupierre (2014) explored the joint influence of working memory and inhibition regarding text comprehension with children from 10 to 12 years old and confirmed the crucial role of working memory in text processing. Later, Nouwens et al. (2017) investigated the contribution of phonological and semantic storage (within the working memory framework) and

phonological and semantic processing to reading comprehension. More recently, Levlin et al. (2024) have conducted a longitudinal study to explore the educational attainment in Swedish (L1) and English (L2) for students with reading difficulties and to identify working memory as an important factor influencing reading and writing difficulties among the participants.

The initial model of working memory was introduced by Baddeley and Hitch in 1974 (see: Baddeley, 2000). This model has three components, a central executive and two storage components: the visuospatial sketchpad and phonological loop (Baddeley, 2000). Previous research indicates that deaf and hard-of-hearing individuals have the same components of working memory as their hearing peers; however, each population exhibits different biases in the extent to which they engage these memory storage components (Hall and Bavelier, 2011). To be more specific, as demonstrated by Brentari (2019), the phonology of sign languages is expressed by hand shapes, locations and movements. Additionally, deaf and hard-of-hearing individuals who are native signers have been found to score higher on visual-spatial memory tasks than on verbal-sequential tasks than hearing individuals who do not know sign languages (Hall and Bavelier, 2010; Marschark et al., 2016).

However, Trezek et al. (2010) assert that deaf and hard-of-hearing individuals exhibit a reduced capacity in working memory compared to their hearing counterparts when processing linguistic material. As proposed by Sedláčková (2016), this limited

working memory capacity may result in disadvantages in both lower-level and higher-level reading processes, consequently leading to challenges in reading comprehension. The limitation in phonological coding could potentially be a factor contributing to the disadvantage experienced by deaf readers in working memory (Trezek et al., 2010). Spencer and Marschark (2010) also contend that deaf and hard-of-hearing individuals with stronger phonological skills exhibit enhanced memory functioning. As per the findings of Marschark et al. (2016), the working memory abilities of deaf and hard-of-hearing individuals exhibit a positive correlation with spoken language, especially in situations where the materials can be verbally encoded.

Additionally, according to Marschark et al. (2016), the differences often observed between individuals with and without hearing disabilities in both simple and complex working memory tasks are not solely attributed to their hearing status, but rather to the influence of their respective experiences and cognitive abilities. This conclusion aligns with McAnally et al. (2007), who argue that the lack of prior knowledge related to language poses an increased burden on working memory capacity.

2.2.1.2.3 Background knowledge of language

As proposed by Sedláčková in 2016, possessing prior knowledge of language holds crucial importance in the reading process for deaf and hard-of-hearing individuals. To explore this matter further, this prior knowledge is shaped by the language and family background of deaf and hard-of-hearing readers.

Reading comprehension processes of deaf and hard-of-hearing individuals are different from their hearing peers from the very beginning (Sedláčková, 2016). Nation (2008) highlights that hearing individuals undergo a preparatory phase before learning to read in their first languages which involves exposure to picture books and engaging in shared reading sessions with parents and educators. Although reading is a complex cognitive process (refer to Section 2.2.1.1), Hjetland et al. (2017) focus on the framework of a simple view of reading, in which reading comprehension is defined as the product of decoding and linguistic comprehension, to explain the necessary abilities that young children need to have for reading comprehension. Hjetland et al. (2017) constructed a meta-analytic structural equation model drawn from 42 studies. Consistent with the simple view, their findings provide evidence for two separate pathways leading from preschool to later reading comprehension. The first pathway involves language comprehension (a latent construct derived from vocabulary and grammar), while the second pathway involves letter/sound skills (a latent construct incorporating phoneme awareness and letter knowledge), both of which contribute to reading comprehension through decoding (Hjetland et al., 2017). In summary, when starting to read, hearing individuals typically possess significant language proficiency, and to some extent, both lower and higher-level comprehension processes are already well-established before formal reading instruction.

However, the reading development of deaf and hard-of-hearing children is very different from hearing children. As has been reviewed in the previous sections (refer

to section 2.1.1), deaf and hard-of-hearing children experience distinct first language development. Due to hearing loss, this group of children are restricted in language access unless they are born with deaf parents (e.g., Scott and Dostal, 2019). As a result, the acquisition of language fluency, whether in sign language or spoken language, is typically delayed in deaf and hard-of-hearing children compared to their hearing counterparts, which subsequently leads to delays in literacy development and reading comprehension skills (Swanwick, 2016).

According to McAnally et al. (2007), compared with deaf and hard-of-hearing children born to hearing parents, such children born to deaf parents benefit from early access to language. This perspective corresponds to Padden and Ramsey's (2000) study which claims that some deaf and hard-of-hearing students who are proficient in ASL possess the necessary associative skills to help them read and understand written information, and the presence of these skills is related to their demographic backgrounds. However, Spencer and Marschark (2010) claim that there is not enough clear evidence that fluency in "sign language will provide a means of strengthening literacy skills in another language" (p. 107). As pointed out by Sedláčková (2016), researchers hold different perspectives on the role of sign language in reading comprehension development. This debate focuses on whether sign language knowledge can be directly bridged to the learning of English print (using various bridging strategies, such as code-switching and finger spelling) or a mediating system

based on the spoken form of the target language (such as visual phonics) is required (Smith and Wang, 2010).

In some respects, the early stages of reading development in deaf and hard-of-hearing learners share similarities with the early stages of second language reading in hearing individuals (Sedláčková, 2016). As per Netten et al. (2011), the differences between reading development in second and first languages could be explained by the readers' pre-existing linguistic knowledge (decoding and other language skills) and cognitive skills, as well as some other aspects, such as motivation and self-confidence. However, given that deaf and hard-of-hearing students generally lag behind their hearing peers in language development and cognitive development, they experience disadvantages in the development of reading literacy and comprehension skills (Sedláčková, 2016).

In summary, the three issues of phonological decoding processes, working memory, and prior language knowledge draw a complex framework of the challenges that deaf and hard-of-hearing individuals face in the reading process. By stating that deaf and hard-of-hearing readers who rely mostly on sign language phonology are less likely to activate phonological coding, researchers conclude that language background is vital in these readers' phonological coding abilities (Yan et al., 2021). Together with language knowledge background, failing to activate phonological coding further negatively affects deaf and hard-of-hearing individuals' working memory capacity.

The studies reviewed above demonstrate that it is hard to attribute deaf and hard-of-hearing individuals' challenges in reading to simple factors. As stated by Marschark et al. (2009), the factors contributing to reading challenges in deaf and hard-of-hearing students are multifaceted. Considering this complexity, Marschark et al. (2009) recommend redirecting the focus from continuously seeking explanations for deaf and hard-of-hearing students' text difficulties to examining the relationships between cognitive processing, language comprehension, and learning. They (Marschark et al., 2009) propose concentrating on reader variables such as lexical knowledge, metacognition and information processing strategies.

2.2.2 Vocabulary and reading for deaf and hard-of-hearing students

Perfetti and Stafura (2014) proposed that for a comprehensive understanding of reading, a broader framework is needed. This framework should encompass not only the higher-level comprehension processes commonly studied but also the word-level processes that are integral to reading (Perfetti and Stafura, 2014). The role that vocabulary plays in reading comprehension has been widely discussed by previous studies. As pointed out by Perfetti and Hart (2002), reading comprehension rests, to a considerable extent, on knowledge of words.

To answer the question of how word processing can vary in a way that affects comprehension, Perfetti and Hart (2002) proposed the lexical quality hypothesis as a possible answer. According to Perfetti and Hart (2002), the lexical quality hypothesis is based on linguistic code manipulation, and the basic idea is that "in any modality,

efficiency is the rapid retrieval, from inactive memory of codes that are part of a stored linguistic symbol" (p. 190). In other words, lexical and comprehension skills are closely linked, and ineffective word identification will further lead to comprehension problems.

Through a longitudinal study, Harris et al. (2017a) found that "English vocabulary and speech reading were the most consistent longitudinal predictors of reading for deaf children" (p. 233). Thus, the importance of vocabulary knowledge to deaf and hard-of-hearing students' reading is widely agreed upon by researchers, including those who have conducted studies in China (Zhao et al., 2019; Zhao et al., 2021).

The conclusion by Perfetti and Hart (2002) suggests that proficient or skilled reading is built upon having well-constructed word knowledge, including detailed information related to the visual form of words (orthography), the sound of words (phonology), and the meaning and structure of words within sentences (semantics-syntactics). Studies on how vocabulary knowledge affects deaf and hard-of-hearing children's reading comprehension also focus on these three aspects. For example, Zhao et al. (2019) conducted a study with 141 deaf and hard-of-hearing children at the primary school level to examine the relative contributions of phonological awareness and vocabulary knowledge to Chinese deaf and hard-of-hearing children's reading fluency. In 2021, Zhao et al. observed 116 deaf and hard-of-hearing students from Grades 4 to 6 to determine the roles of word segmentation and reading fluency in the contribution

of vocabulary knowledge to Chinese deaf and hard-of-hearing students' reading comprehension. Zhang et al. (2021) investigated how phonological, orthographic, and semantic skills contribute to reading fluency of Chinese school-age children with hearing loss, compared to their hearing peers. The results of previous studies generally agree that with restricted vocabulary knowledge in orthographic skills, phonological awareness and semantic competence, deaf and hard-of-hearing children lag behind their hearing peers in reading performance.

It should be noted that all the research discussed above focuses on reading in the local spoken language of deaf and hard-of-hearing students. In this thesis, English is an additional language for such students. This distinction highlights a significant gap in the research that this thesis aims to address. By exploring how deaf and hard-of-hearing students learn to read in English, as an additional language, this thesis seeks to contribute new insights and evidence to the existing body of knowledge, which has predominantly been centered on developing deaf and hard-of-hearing individuals' literacy skills in their domestic spoken languages.

Birinch and Sariçoban (2021) have suggested that

> vocabulary knowledge is also the most significant component in learning a foreign language. Hence, teaching vocabulary must be considered as the most important component of foreign language teaching for deaf and hard-of-hearing learners (p. 634).

Compared to their hearing peers, deaf and hard-of-hearing students generally have smaller vocabulary sizes, limited vocabulary knowledge, and a narrower range of context. This results in them learning new vocabulary items at a slower rate (Birinch and Sariçoban, 2021). Thus, it can be inferred that the limit in vocabulary could further influence deaf and hard-of-hearing students' reading experiences in the ELL-NESC context. This assumption is supported by Sedláčková (2016), who found that in all of her four case studies, deaf and hard-of-hearing participants claimed vocabulary to be the most important and frequent cause of their comprehension problems in English reading. Inspired by previous studies, in the third study of this thesis, I designed a reading interface that provides multi-modal assistance for vocabulary in English passages. While the overall aim of the thesis is not specifically to promote reading comprehension, it is assumed that offering vocabulary assistance would help improve the post-reading performance of Chinese deaf and hard-of-hearing students on both vocabulary and comprehension questions.

2.3 Summary

In the literature review above, terms and concepts relevant to the language experiences of the participants in the thesis were introduced. The impact of deafness was initially discussed, with a particular emphasis on communication methods, language-focused educational approaches for deaf and hard-of-hearing learners, and the development of sign and spoken languages among this population. More specifically, it has been established that hearing loss restricts the opportunities for deaf and hard-of-hearing children to get enough access to language input, especially

in the first years of life. Consequently, this population experiences different first language development which leads to linguistic heterogeneity. Languages and means of communication utilized by deaf and hard-of-hearing individuals are not limited to sign languages, spoken languages, signed languages, lip reading/speech reading, writing, and typing. Considering this language diversity feature, a bimodal bilingual educational approach is recommended by researchers. This will provide abundant language input to deaf and hard-of-hearing students. Moreover, the diverse linguistic repertoire of such students fits into the theoretical framework of plurilingualism. Being plurilingual means individuals of this population are using multi-modal and multilingual communication methods to make meaning. Not only that, deaf and hard-of-hearing students are believed to have the competency to learn additional languages.

The second part of this chapter was concerned with reading processes and their specifics in connection to deafness. Although in individual cases deaf and hard-of-hearing learners can achieve proficiency in reading and become skilled readers, in general, the reading achievement of deaf and hard-of-hearing learners has been observed as falling behind their hearing peers, and reading comprehension has been presented as one of the central issues in deaf education. Three issues were identified to explain the challenges that deaf and hard-of-hearing students have in reading comprehension: phonological decoding processes, working memory capacity, and prior language knowledge. It should be noted that these three issues are interconnected and cause difficulties in both lower-level processes and higher-level

processes. Given that reading comprehension is a complex cognitive process, this thesis will focus on one aspect of lexical knowledge in the lower-level processes.

Based on the lexical quality hypothesis, lexical and comprehension skills are closely linked, and ineffective word identification can lead to further comprehension problems. However, deaf and hard-of-hearing students are limited in word knowledge when they start to read. Therefore, given that there is a lack of research regarding vocabulary instruction in additional language reading classrooms of these students, the third study of this thesis is designed to provide bimodal bilingual assistance on key words to support participants' language reading experiences in the context of ELL-NESC.

However, this thesis is not designed to promote reading comprehension. The key focus of the research is to test deaf and hard-of-hearing students' language preferences within the framework of multilingualism and plurilingualism. Given that listening and speaking are not accessible to all the participants, this research focuses on reading as an important literacy skill in learning English in non-English-speaking countries.

Chapter 3 Methodology

This chapter consists of two parts. The first part introduces the mixed-method design of the four studies in this thesis. The second part reports on a pilot study of the demographic features of deaf and hard-of-hearing students, including the rationale for the study, the design of the questionnaire, and the results and discussion.

3.1 Mixed-method design of the thesis

In a language classroom, there are two significant roles: teachers and students. Teachers design and deliver the lessons based on the curriculum and the needs of the students. Meanwhile, students follow the instructions and take part in class activities to learn the language. In this case, to achieve teaching and learning goals, effective communication is necessary between teachers and students.

However, facilitating classroom communication becomes challenging when students are deaf or hard-of-hearing. Their hearing impairment restricts their access to information, and this group exhibits significant diversity in language backgrounds (refer to section 2.1.1 for a detailed review of the language backgrounds of these students). Acknowledging these realities, it is recognized that deaf and hard-of-hearing students encounter more obstacles in language learning compared to their hearing counterparts (Herman et al., 2017). Thus, it becomes imperative to establish a communication environment that is accessible to them (Falkowska, 2016).

To create such an environment, teachers must make decisions regarding the languages to be employed in classrooms with deaf and hard-of-hearing students. The ongoing debate revolves around the utilization of sign versus spoken languages. However, considering the diverse needs of such students, there is uncertainty regarding whether teachers' decisions concerning classroom language usage adequately cater to these students. Therefore, there is still an ongoing question regarding how to provide comprehensive information to deaf and hard-of-hearing students, particularly in an additional language classroom. Recent research emphasizes the importance of adopting multi-modal and multilingual approaches in teaching to better address these needs (Alasim, 2019; Scott and Cohen, 2023). The incorporation of translanguaging strategies, which use multiple languages and modalities during instruction, is one suggested method to enhance understanding and engagement for deaf and hard-of-hearing students in content areas (Scott and Cohen, 2023).

Given the existing gap in research in this area, this thesis is designed to be exploratory, aiming to investigate current practices, pose inquiries, uncover new perspectives, evaluate phenomena from a fresh standpoint, and generate ideas and hypotheses for future research (Al-Ababneh, 2020). Specifically, this thesis will examine the multi-modal and multilingual preferences of deaf and hard-of-hearing students in an English reading classroom in a non-English-speaking country. The research will employ a mixed-method approach, incorporating both quantitative and qualitative data

collection methods, including questionnaire surveys, interviews, and an experimental study that records participants' experiences using a multi-modal reading interface. The research will explore how deaf and hard-of-hearing students interact with various forms of language input, such as sign language and written text, and how these information modalities impact their reading experiences. By doing so, the thesis aims to provide a fundamental understanding of the educational needs and preferences of deaf and hard-of-hearing students, offering valuable insights for educators and policymakers to develop more effective teaching strategies and inclusive educational practices. To be more precise, the thesis aims to address questions including: "Who are Chinese deaf and hard-of-hearing English learners?", "How do English teachers of Chinese deaf and hard-of-hearing students respond to their students' diverse needs?" and "What are the preferences of deaf and hard-of-hearing students for multi-modal keyword assistance during English reading tasks?"

According to Dörnyei (2007), mixed-method research involves "the collection or/and analysis of both quantitative and qualitative data in a single study with some attempts to integrate the two approaches at one or more stages of the research process" (p. 163). It is further pointed out by Hashemi (2012) that

> high-quality mixed-method research requires high degrees of integration at different stages of the study; that is, while forming research questions, during sampling, data collection and analysis, while making interpretations, and drawing conclusions. (p. 206)

Mckinley (2019) suggests advanced and innovative mixed-method research designs to be used in studies of applied linguistics. According to Hashemi (2019), "In advanced mixed designs, qualitative and quantitative strands can be used in repeated cycles creating a dynamic interaction between the strands and their components" (p. 43). In this thesis, to investigate deaf and hard-of-hearing students' experiences of learning English in China, as well as their multi-modal preferences regarding learning assistance, both quantitative and qualitative methods have been used in the four studies, including the pilot study.

3.1.1 Demographic questionnaire studies

There are two demographic questionnaire studies in this thesis: a pilot demographic study involving 15 high school deaf and hard-of-hearing students and an expanded demographic study with 83 participants, consisting of 39 university students and 44 high school students. As highlighted by Mitchell (2017), conducting demographic studies with such students is essential because understanding who these students are is one of the most basic concerns in deaf education. Given the scarcity of studies on the demographic features of Chinese deaf and hard-of-hearing students, this thesis begins with a pilot demographic study. It yields qualitative data on participants' demographic characteristics, communication preferences, and experiences of learning English. Collecting this data builds a foundational understanding of this population, which supports the entire thesis. For a more detailed discussion of this pilot demographic study, refer to Section 3.2 of this chapter.

Due to limitations identified in the pilot study, an expanded demographic questionnaire survey was conducted with several modifications to its design and a larger sample size. The expanded demographic questionnaire provided both qualitative and quantitative data, supplementing the pilot study. Specifically, the expanded demographic survey tested whether the characteristics of deaf and hard-of-hearing students identified in the pilot study could be generalized and whether a larger sample size revealed additional characteristics. In other words, these demographic questionnaires were directly relevant to the research questions of the thesis, which aimed to address gaps in understanding the unique needs and preferences of Chinese deaf and hard-of-hearing English learners. This information is essential for developing effective educational strategies and creating inclusive learning environments that cater to the diverse linguistic capabilities of these students.

3.1.2 Semi-structured interviews with English teachers

Based on the findings of the pilot demographic questionnaire, a semi-structured interview study was conducted with English teachers of Chinese deaf and hard-of-hearing students. The primary purpose of conducting these interviews was to explore English classrooms for Chinese deaf and hard-of-hearing students from teachers' perspectives. Semi-structured interviews allow respondents to elaborate on the interview topics in an exploratory manner (Dörnyei, 2007), providing deeper insights into the teachers' experiences, beliefs, and practices (Magaldi and Berler, 2020).

For example, the semi-structured interview study asked the teachers how they

responded to their students' diverse needs, as reflected in the demographic questionnaire studies. By comparing the teachers' responses with the students' answers, it was possible to identify whether the students' needs were fully met by the teachers and what additional support would have been beneficial for them. This approach allowed for a richer analysis of the educational landscape, highlighting both commonalities and unique challenges in the population of the learners. This holistic perspective helped to identify gaps in current teaching practices and areas where additional support and resources may be needed. It also ensured that the recommendations derived from the study were grounded in the lived experiences of both teachers and students, thereby enhancing their relevance and potential impact. Ultimately, the insights gained from these interviews will contribute to the development of targeted interventions and policies aimed at improving the educational outcomes of deaf and hard-of-hearing students learning English in non-English-speaking countries. For a more detailed discussion of the semi-structured interview study, refer to Chapter 5 of this thesis.

3.1.3 The experimental study with a multi-modal English reading interface

This experimental study is crafted based on the findings from the demographic questionnaire and the semi-structured interviews. The primary purpose of this study is to explore deaf and hard-of-hearing students' preferences for Chinese text translation and CSL interpretations of key words when performing English reading tasks.

Briefly, the reading interface offered both Chinese text translations and CSL

interpretation videos for key words in English reading passages. The participants could freely choose their preferred modality. While using the reading interface, the participants' selections of modalities (recorded via mouse clicks) and their answers to post-reading questions were saved for analysis. Furthermore, the results of the demographic questionnaire for the students and the semi-structured interviews with their teachers were utilized to analyze the data from the experimental study.

As identified in Chapter 1 (refer to Section 1.1), even though researchers suggest providing multi-modal assistance in classrooms for deaf and hard-of-hearing students, there is still a research gap regarding the acceptance of this assistance from the students' point of view. The results of this experimental study aim to address this gap by investigating deaf and hard-of-hearing students' preferences for the information modalities provided by learning materials and analyzing how these preferences relate to their demographic features, including degrees of hearing loss, language backgrounds, language preferences in communication, and educational backgrounds. The findings from this study are also important to teachers and the educational industry as they highlight the role of students in developing multi-modal learning materials and the importance of creating these materials based on their needs.

A more detailed introduction to the design of this study and the reading interface is provided in Chapter 6 of this thesis.

As introduced by Paltridge (2019),

> Triangulation is a research strategy that involves analyzing data from multiple sources (e.g., surveys and diaries), using multiple groups of participants (e.g., students, teachers, and parents) and/or multiple research techniques (e.g., observations and interviews) to examine the matter under investigation. (p. 29)

The mixed-method design of this thesis enables an exploration of deaf and hard-of-hearing students' multi-modal language preferences and their experiences in the context of ELL-NESC from various perspectives, facilitating a more multifaceted understanding of these issues.

All the studies have received ethics approval from the School of English, University of Nottingham. The participants provided informed consent before participation. To maintain confidentiality, the names of schools, teachers, and students are anonymize when excerpts from their data are presented in the findings report.

3.2 The pilot demographic study with deaf and hard-of-hearing students

As pointed out in Chapter 1, relatively few studies focus on how deaf and hard-of-hearing students learn English in China. Existing research tends to emphasize the development of the English language curriculum and to test the effectiveness of teaching strategies (e.g., Xu et al., 2021; Zhang, 2009). A common shortcoming of these studies is that they often refer to research literature in the Western context regarding the characteristics of deaf and hard-of-hearing students. It is important to

note that the situation for these children learning English in an English-speaking country differs significantly from the situation in a non-English-speaking country (Swanwick, 2016). Based on this understanding, this thesis aims to specifically investigate on Chinese deaf and hard-of-hearing students' demographics and preferences as English language learners. To achieve this goal, the design of this thesis needs to consider the unique characteristics and educational challenges faced by these students, therefore raising a need to conduct a demographic study with them. Since communication and information are often identified as barriers in deaf and hard-of-hearing children's development (Freitas et al., 2022), it was decided that the demographic study would attempt to identify the languages used by the students, their communication preferences and their experiences of learning English in China. Such information could provide important insights into the linguistic backgrounds and communication needs which underlie the potential challenges they face when they learn English in China, thereby contributing to the development of more effective and inclusive teaching practices.

To determine whether this line of research was viable, a small-scale pilot demographic study was conducted to address the following research questions:

RQ 1: What are the demographic features of deaf and hard-of-hearing students in China?

RQ 2: What are their language and communication preferences, and how do they evaluate the quality of communication with their teachers?

RQ 3: What are the English learning experiences for Chinese deaf and hard-of-hearing students?

3.2.1 Design of the pilot demographic questionnaire

To conduct this demographic survey, a questionnaire was designed. The primary rationale for selecting a questionnaire over interviews was to minimize the risk of miscommunication. Given my relatively low proficiency in CSL, conducting interviews with deaf and hard-of-hearing students would necessitate the presence of a CSL interpreter. This reliance on an interpreter could potentially impede the direct acquisition of information from participants and compromise the accuracy of the interpreted responses. Utilizing a questionnaire allowed for a more straightforward data collection process, reducing the likelihood of errors associated with interpretation.

3.2.1.1 Questionnaire structure and rationale

The questionnaire was separated into three parts: Part 1 “Demographic Information”, Part 2 “Communication Preferences” and Part 3 “English Learning Experiences”. The participants were asked to provide information about their hearing impairment and to share experiences related to communications and English language learning.

3.2.1.1.1 Demographic information

Researchers have identified numerous factors that will influence deaf and hard-of-hearing people’s language learning. These include the age of hearing loss, the age at which identification and intervention took place (Levine et al., 2016), nonverbal IQ

(Spencer and Marschark, 2010), parental involvement and socioeconomic status (Holzinger et al., 2020; Yao, 2016), quantity and quality of linguistic input (Levine et al., 2016; Schorr et al., 2008), the modality of language instruction (Wolbers, Dostal and Bowers, 2012), and the use of technical hearing devices (Johnson and Goswami, 2010; Lederberg, 2006; Li et al., 2017). Based on these studies, the pilot demographic questionnaire collected participants' demographic information, including the degree of hearing loss, age of detection and speech development, experiences with technical hearing devices, family history, and self-identification.

In the pilot questionnaire, participants were asked to identify if their hearing loss happened before or after three years old, based on the assumption that children who lose hearing before the age of three may not have the opportunity to acquire spoken language. Additionally, to explore the literacy skill background of the participants, they were asked to determine if their hearing loss happened before they had learned to read and write in Chinese. This distinction is crucial because early hearing loss can significantly impact the development of foundational language and literacy skills (Levine et al., 2016). To be more specific, deafness that occurs before learning speech or language, known as pre-lingual deafness, may cause functional impairment with difficulties in processing phonological information (Levine et al., 2016; Miller, 2010; Spencer and Tomblin, 2009). Moreover, according to Harris et al. (2017a), being unable to develop sufficient phonemic awareness, reading comprehension skills are also challenged. In other words, it is reasonable to assume that participants who are

prelingually deaf may face more challenges in learning a language compared to those who have already acquired spoken language or even developed literacy skills in a spoken language.

To investigate the self-identification of the participants, the pilot study asked the participants to self-identify themselves as being Deaf, hard-of-hearing or hearing impaired. According to Marschark and Spencer (2009), Deafness (with a capital "D") is considered to be a distinct identity and culture of Deaf people, rather than a disability. According to Kožuh et al. (2016), from the standpoint of Deaf culture, being Deaf and having a Deaf identity are considerably more closely tied to being a member of a linguistic minority. However, because teens are still forming their identities, their self-identifications as Deaf may shift over time (Skelton and Valentine, 2003). The terms “deaf”, “hard-of-hearing” and “hearing impaired” carry different implications in English. While “deaf” and “hearing impaired” both denote individuals with varying degrees of hearing loss, the term “impaired” suggests a disability and a sense of being different from others (Marschark and Spencer, 2009). Skelton and Valentine (2003) note that some teenagers may prefer to identify as “partially deaf” or “hard-of-hearing” because they may not have been born deaf or because they wear hearing aids and do not consider themselves completely deaf.

Few deaf and hard-of-hearing children born to deaf parents develop Deaf identity spontaneously (Kontra, Csizér, and Piniel, 2015). Deaf children, for the most part,

grow up with their hearing parents; as a result, their Deaf cultural identities are not naturally and readily acquired unless they are taken to specific Deaf society organizations and social activities (Kontra, Csizér, and Piniel, 2015). Such a practical situation further leads to discussions on first language acquisition of deaf and hard-of-hearing children. Even though the World Federation of the Deaf (WFD) strongly advocates for the importance of regarding the national sign languages as the first language of this population and the primary language in deaf classrooms (World Federation of the Deaf, 2016, p. 1), the reality does not follow this recommendation. It should be noted that the sign language used by Chinese deaf and hard-of-hearing people is not fully standardized (refer to section 2.1.1.1 in Chapter 2). Even though CSL has been published for decades, deaf and hard-of-hearing individuals and teachers of deaf and hard-of-hearing children are still using other forms of signed language, such as Signed Chinese, to communicate (Jones et al., 2021; Yan, 2012). Asking participants for their self-identification can provide valuable insights into their language preferences in classroom settings. If most participants identify CSL as their first language, while the language used in the classroom is not standardized CSL, such a mismatch may cause communication difficulties between deaf and hard-of-hearing students and their teachers.

Family background is a significant factor associated with the self-identification and language development of deaf and hard-of-hearing children. As noted by Holzinger et al. (2020), the influence of family on children is profound, and family-related

variables can contribute to individual communication disparities in both hearing and deaf and hard-of-hearing children. Language outcomes in deaf and hard-of-hearing children are strongly linked to family involvement and cognitive abilities (Holzinger et al., 2020). In this context, the pilot demographic questionnaire also explored the potential relationship between deaf children's family background, self-identification, parent-child communication, and language development.

3.2.1.1.2 Communication and the evaluation of quality of communication

The second focus of this questionnaire was language and communication preferences. Specifically, this part of the questionnaire was designed to address the second research question of this pilot study (refer to Section 3.2.1.1), which relates to: (1) how deaf and hard-of-hearing individuals communicate with others, (2) whom they prefer to communicate with, and (3) how they evaluate the quality of communication with their teachers.

Chapter 2 has discussed the bimodal bilingual language repertoire of deaf and hard-of-hearing individuals. As highlighted by Rinaldi and Caselli (2014), such students use multi-modal languages flexibly according to their communication partners and needs. However, in the educational context, most studies regarding communication with deaf and hard-of-hearing students focus on the language choices made by caregivers (e.g., Jones and Robert, 2024; Scarinci et al., 2018), parents (e.g., Ching et al., 2018; Giese, 2020), and professionals (Dorn, 2019). In these studies, deaf and

hard-of-hearing students were often placed in a passive role where hearing individuals or professionals made assumptions about their communication preferences and decided which language to use. However, this pilot study aimed to give deaf and hard-of-hearing children an active voice in understanding and expressing their communication preferences and needs.

Research regarding deaf and hard-of-hearing individuals' communication preferences is well documented in healthcare programs. For instance, findings from semi-structured ASL interviews conducted by Anderson, Wolf Craig, and Ziedonis (2017) with 16 trauma-exposed deaf and hard-of-hearing individuals indicated that, when undergoing behavioral treatments, this group of patients preferred working with providers proficient in sign language and knowledgeable about Deaf culture, history, and experiences. Middleton et al. (2010) similarly suggest that enhancing Deaf awareness training for healthcare professionals, increasing the availability of specialized sign language interpreters, and ensuring that healthcare professionals are proficient in sign language could help meet the communication preferences of most deaf and hard-of-hearing individuals in hospital settings.

Based on these studies, the questionnaire asked participants to report the languages they used when communicating with deaf and hard-of-hearing friends, teachers, and people without hearing impairments. The participants were first asked to identify whom they preferred to communicate with when facing difficulties and then to select

the languages they used when communicating with these individuals.

To evaluate the communication effectiveness between deaf and hard-of-hearing students and their preferred support providers, statements based on the Quality of Communication Questionnaire were utilized (see in Engelberg, Downey and Curtis, 2006). The questionnaire, designed by the University of Washington School of Medicine, has been used to assess the quality of end-of-life communications. Statements in the questionnaire evaluate various aspects of communication, regarding content and style, such as active listening, attentiveness, empathy, and the use of clear and understandable language. According to Engelberg, Downey, and Curtis (2006), this questionnaire is proven to be valid and effectively measures both general communication and end-of-life communication needs.

3.2.1.1.3 English learning experiences

The third part of the pilot demographic questionnaire focused on Chinese deaf and hard-of-hearing students' English learning experiences in China. In this section, I designed a series of questions to answer RQ 3 (refer to Section 3.2.1.1) from three aspects: (1) **experience**, which included questions asking participants how many years they had been learning English and how they ranked the difficulty levels of learning English vocabulary, grammar, reading, and writing, (2) **motivation**, which asked participants why they were learning English in China, and (3) **resources**, which asked participants if they had access to English learning resources outside of the

classroom.

The information gathered from the questions related to the participants' experiences and accessible resources. This information was instrumental in guiding the design of the follow-up studies in this thesis. For example, if the participants had similar years of English learning experience, it could be assumed that they entered the English classroom with similar language proficiency levels. Conversely, if their English learning experience varied, it would raise questions about how their teachers managed to address such diverse needs in the classroom. Additionally, asking participants to rank the difficulty levels of learning English literacy skills helped identify their specific challenges and needs.

The questions about their learning resources aimed to explore the current conditions for deaf and hard-of-hearing students learning English in China. While the development of English language learning materials for students with normal hearing is well documented (e.g., Azizah et al., 2021; Bergström et al., 2023; Nordlund & Nordberg, 2020), materials specifically for deaf and hard-of-hearing students are relatively scarce. Researchers suggest using visual aids and multimedia for developing materials for this group (Adnyani et al., 2021; Birinci & Sariçoban, 2021). However, there is still a need to understand what types of learning resources these students currently have access to. This pilot study aimed to explore these conditions to address this gap.

In terms of why deaf and hard-of-hearing students learn English in a non-English-speaking country, the pilot demographic study asked participants about their intrinsic and extrinsic motivations. According to Deci and Ryan (1985), intrinsic motivation revolves around internal feelings of satisfaction and enjoyment derived from language learning, while extrinsic motivation involves the desire to attain external rewards through language learning activities.

With the Chinese Ministry of Education mandating English as a compulsory subject in the national curriculum from elementary school to the second year of university, extensive research has been conducted on the effects of intrinsic and extrinsic motivations on learning English as an additional language among Chinese learners (e.g., Peng and Fu, 2021; You and Dörnyei, 2016). However, these studies have primarily focused on students without hearing impairment. Deaf and hard-of-hearing students may have different motivations and reasons for learning an additional language. Reed et al. (2008) emphasized the importance of interpersonal motivation in contributing to academic success among deaf and hard-of-hearing individuals. They noted that some students were motivated by the desire to perform as well as their classmates, while others were driven by the pursuit of good grades. More recently, Csiźer and Kontra (2020) demonstrated that deaf and hard-of-hearing students share intrinsic motivations with their hearing peers, such as being interested in learning English or hoping to use English on the Internet. Additionally, Chinese

high school deaf and hard-of-hearing students are required to learn English as a compulsory subject and pass examinations to enter college. This requirement serves as a significant motivating factor for them.

Using Csiźer and Kontra's study (2020) and Ye's questionnaire on additional language learning motivation (2021), the pilot questionnaire asked the participants to identify their learning motivations from several options, including: "I hope one day I can study/travel abroad", "I hope I can be more competitive", "I need to learn English to get into a college", "English is one of my mandatory courses", and "others" where the participants could write down any motivations not listed among the selections. By providing these specific options, the questionnaire aimed to capture a wide range of motivational factors, while the open-ended "others" category allowed for additional insights into unique or less common motivations that might have influenced these students' English learning experiences.

3.2.2 Participants and delivery of the pilot demographic questionnaire

Fifteen Grade 10 deaf and hard-of-hearing students from No.1 Deaf School in Wuhan participated in the pilot demographic study, which was conducted using the Jisc. Online Surveys platform. The participants were asked to consent to the collection of personal data about their hearing loss. The original pilot questionnaire was written in English and then translated into Chinese.

To ensure that both the deaf and hard-of-hearing students fully understood the survey's goals and settings and could easily navigate the online platform, they were provided with an introduction to the study, containing detailed information about the questionnaire. Additionally, they were asked to watch a tutorial video instructing them on how to use the Jisc. platform before answering the questions.

3.2.3 Results of the pilot demographic questionnaire

The following sections present the data gathered from the questionnaire. This data includes detailed information on the participants' demographic characteristics, communication preferences, and English learning experiences. The analysis of this data provides valuable insights into the unique needs and preferences of deaf and hard-of-hearing students, which will inform the subsequent phases of this thesis.

3.2.3.1 Background information of the participants

A class of 15 Grade 10 (first year of high school) deaf and hard-of-hearing students participated in the survey, comprising eight boys and seven girls. Although the participants were of similar ages, their English learning experiences varied. As shown in Table 3.1, among the 15 students, 13 had learned English for one year, one male student had learned the language for three years, and one female student had five years of English learning experience. This suggests that there was a gap in English language proficiency between the two participants and their classmates. This diversity highlights the varied educational backgrounds of deaf and hard-of-hearing students

and provides evidence that English learning was not widely available for primary and middle school deaf and hard-of-hearing students in China.

Table 3.1 Gender, grade, age and years of learning English of participants in the pilot study

	Gender	Grade	Age	Years of learning English
1	Male	Grade 10	16-18	1
2	Male	Grade 10	16-18	1
3	Male	Grade 10	16-18	1
4	Male	Grade 10	16-18	1
5	Male	Grade 10	16-18	1
6	Female	Grade 10	16-18	1
7	Male	Grade 10	16-18	1
8	Male	Grade 10	13-15	3
9	Female	Grade 10	16-18	5
10	Female	Grade 10	16-18	1
11	Female	Grade 10	16-18	1
12	Male	Grade 10	16-18	1
13	Female	Grade 10	16-18	1
14	Female	Grade 10	16-18	1
15	Female	Grade 10	16-18	1

As presented in Table 3.2, the participants exhibited varying degrees of hearing loss, ranging from mild hearing loss in both ears to profound hearing loss in both ears. According to the WHO (2021), individuals with mild hearing loss may find it difficult to follow speech in noisy environments, whereas those with profound hearing loss may be unable to hear raised voices even in quiet environments without using hearing aids or cochlear implants. In other words, the participants in this classroom experienced very different hearing conditions, which suggests that technical hearing devices might be useful in compensating for the significant gaps in hearing abilities among them.

Table 3.2 Degree of hearing loss of participants in the pilot study

	Left ear hearing loss level	Right ear hearing loss level
1	Profound hearing loss	Profound hearing loss
2	Moderate hearing loss	Mild hearing loss
3	Moderate severe hearing loss	Moderate severe hearing loss
4	Moderate hearing loss	Mild hearing loss
5	Moderate severe hearing loss	Moderate severe hearing loss
6	Profound hearing loss	Severe hearing loss
7	Moderate hearing loss	Mild hearing loss
8	Profound hearing loss	Profound hearing loss
9	Mild hearing loss	Mild hearing loss
10	Moderate hearing loss	Moderate hearing loss
11	Moderate hearing loss	Moderate hearing loss
12	Profound hearing loss	Profound hearing loss
13	Moderate hearing loss	Mild hearing loss
14	Mild hearing loss	Normal hearing
15	Moderate severe hearing loss	Moderate severe hearing loss

However, it turned out that technical hearing devices were not widely used by the participants. According to the results, only four students had experiences wearing hearing aids, and none of the 15 students had received cochlear implants. Among the four students, three wore hearing aids for 8 to 10 hours per day, while one girl reported that she had stopped wearing hearing aids at age nine because they were not effective in improving her hearing experience.

The four participants were asked to assess their hearing ability in both loud and quiet situations while wearing their hearing aids using the Children's Auditory Performance Scale (Smoski, Brunt, and Tannahill, 1998). The data reflected the participants' dissatisfaction with the performance of hearing aids, particularly in noisy settings.

Table 3.3 Experiences with technical hearing devices of participants in the pilot study

When wearing hearing aids in a noisy environment	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
I have difficulty hearing and understanding face-to-face communication when I pay attention to it.			1	3	
I have difficulty hearing and understanding when being asked a question.			1	2	1
I have difficulty understanding simple instructions.	1		1	2	
I have difficulty understanding complex instructions.			2	2	
I have difficulty hearing and understanding when I am doing other activities, such as reading.			2	1	1
I have difficulty hearing and understanding group communication.			1	3	
When wearing hearing aids in a quiet environment	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
I have difficulty hearing and understanding face-to-face communication when I pay attention to it.		1	1	2	
I have difficulty hearing and understanding when being asked a question.			2	2	
I have difficulty understanding simple instructions.		1	1	2	
I have difficulty understanding complex instructions.			1	3	
I have difficulty hearing and understanding when I am doing other activities, such as reading.			3		1
I have difficulty hearing and understanding group communication.			2	2	

As presented in Table 3.3, deaf and hard-of-hearing students reported they had the most difficulty in understanding complicated instructions and participating in group activities. In quiet classrooms, two of the four students had difficulties with face-to-face communication, two found it difficult to respond to questions, two had difficulties with simple instructions, three struggled with complex instructions, one could not function well when listening and doing other activities simultaneously, and two found it hard to follow group communication.

Therefore, it was reasonable to indicate that technical hearing devices made very limited contributions to improving participants' auditory performance in this English language classroom.

In terms of family backgrounds, only two of the 15 students had other family members who were deaf, and one of them was born to deaf parents. This result aligned with Mitchell and Karchmer's (2004) statement that about 90% of deaf children are born to hearing parents. According to Kontra, Csizér, and Piniel (2015), children born to deaf parents naturally develop their Deaf identity. Both of the participants with a deaf family background identified themselves as being Deaf. Among the other 13 participants, eight identified themselves as being Deaf, four chose "hearing impaired", and one identified as being "hard-of-hearing".

According to the WHO (2021), the term “impairment” refers to limitations at a body level. Namely, being “hearing impaired” means the person has hearing loss.

As stated by Marschark and Spencer (2009), the terminology “hearing impaired” seems to have some negative connotations compared to “hard-of-hearing”. However, the participants in this study did not appear to have such concerns. There was no significant difference in hearing loss degrees between the “hearing impaired” and the “hard-of-hearing” groups. In this case, it might be assumed that this group of students had not fully accepted their unique Deaf identity and identified themselves because they were “partially deaf” rather than embracing Deaf culture. Therefore, deaf and hard-of-hearing students in this class had different identifications. Some of them had embraced their Deaf identity, whereas others had not.

Ladd and Lane (2013) claim that deaf people with a Deaf identity take the national sign language as their main means of communication. This suggests that, according to Table 3.4, only 10 participants considered CSL their first language, while the other students might have had various preferences in language use.

Table 3.4 Family history of hearing loss and self-identification of participants in the pilot study)

	Do you have hearing parents or deaf parents	Does your family have a history of hearing loss?	If you selected yes, please specify	How would you prefer to identify yourself?
1	My parent(s) are hearing people.	I don't know.		I am Deaf.
2	My parent(s) are hearing people.	I don't know.		I am Deaf.

	Do you have hearing parents or deaf parents	Does your family have a history of hearing loss?	If you selected yes, please specify	How would you prefer to identify yourself?
3	My parent(s) are hearing people.	I don't know.		I am Deaf.
4	My parent(s) are hearing people.	No.		I am hard-of-hearing.
5	My parent(s) are hearing people.	I don't know.		I am Deaf.
6	My parent(s) are hearing people.	No.		I am hearing impaired.
7	My parent(s) are hearing people.	No.		I am hearing impaired.
8	My parent(s) are hearing people.	No.		I am Deaf.
9	My parent(s) are hearing people.	No.		I am Deaf.
10	My parent(s) are hearing people.	I don't know.		I am Deaf.
11	My parent(s) are hearing people.	Yes.	grandmother	I am Deaf.
12	My parent(s) are deaf people.	Yes.	grandparents	I am Deaf.
13	My parent(s) are hearing people.	No.		I am hearing impaired.
14	My parent(s) are hearing people.	No.		I am hearing impaired.
15	My parent(s) are hearing people.	No.		I am Deaf.

Participants' self-identification, on the other hand, revealed that deaf and hard-of-hearing students had a variety of linguistic backgrounds and preferences. This tendency was also supported by their responses to questions on their linguistic development before hearing loss. As presented in Table 3.5, among all 15 participants, seven lost their hearing before acquiring a language, four had acquired speaking skills, and four had learned to read and write. In other words, seven of the deaf and hard-of-hearing students could be identified as having pre-lingual deafness, while eight had post-lingual deafness.

Table 3.5 Language backgrounds and self-identification of participants in the pilot study

	Hearing loss before 3	Pre/Post-lingual deafness	How would you prefer to identify yourself?
1	Yes.	Pre-lingual	I am Deaf.
2	No.	Post-lingual, with literacy skills	I am Deaf.
3	Yes.	Pre-lingual	I am Deaf.
4	No.	Pre-lingual	I am hard-of-hearing.
5	Yes.	Pre-lingual	I am Deaf.
6	No.	Post-lingual, with literacy skills	I am hearing impaired.
7	No.	Post-lingual, with speaking skills	I am hearing impaired.
8	Yes.	Pre-lingual	I am Deaf.
9	No.	Post-lingual, with speaking skills	I am Deaf.
10	No.	Post-lingual, with speaking skills	I am Deaf.
11	No.	Post-lingual, with literacy skills	I am Deaf.
12	Yes.	Pre-lingual	I am Deaf.
13	No.	Post-lingual, with speaking skills	I am hearing impaired.
14	No.	Post-lingual, with literacy skills	I am hearing impaired.
15	Yes.	Pre-lingual	I am Deaf.

Connecting participants' language backgrounds with their self-identification, as shown in Table 3.5, it was interesting to find that four participants were post-lingually deaf but took Deaf identities, and two of these four students had even gained Chinese literacy skills. Given that being Deaf means taking sign language as their first language, this finding reveals the complexity of defining the languages used by Deaf children. As mentioned in Chapter 2 (refer to Section 2.1.2.2.1), the dichotomy of having a first language and a second language is problematic as deaf and hard-of-hearing children experience different language development processes compared to children with normal hearing. Overall, the participants' linguistic experiences turned out to be heterogeneous, which might add even more complexity to the communication environment of a language classroom, particularly in the context of

ELL-NESC.

To sum up, the participants' demographic information demonstrates great diversities in multiple aspects, including those of English learning experience, self-identification and linguistic development before deafness. The rationale of this study is to review how those factors could influence deaf and hard-of-hearing students' additional language learning. Just as Falkowska (2016) claims, people with hearing impairments are perhaps the most heterogeneous group of students a language classroom may encounter, and their distinctive peculiarities may make classroom communications more challenging.

3.2.3.2 Communication preferences

The subsequent sections present questionnaire data about the participants' communication experiences. The first part of the section delves into their preferences regarding communication modalities. The second part concentrates on the participants' preferred communication partners, particularly when encountering difficulties. The final part of the section prompts participants to assess the quality of their communication experiences.

Different demographic information provided by the participants suggests that the languages used by deaf and hard-of-hearing students in communications will not be uniform. Even though students who have obtained their Deaf identities prefer to use

CSL as their major mode of communication, individuals who identify themselves as being hard-of-hearing or hearing impaired may have alternative options. Furthermore, for Deaf children who have gained language speaking and reading abilities, particularly those born to hearing parents, alternative modalities of language may be used by them while interacting with others. That is to say, language classroom with deaf and hard-of-hearing students is not monolingual, and this depends on the students' prior language experiences.

The participants' responses indicate a multilingual classroom environment. As shown in the Table 3.6, 12 out of 15 students used CSL as their preferred communication modality. However, they also employed other communication channels, both auditory and visual, concurrently.

Table 3.6 Preference of communication modality of participants in the pilot study

Communication modals	Number of participants
Sign language	12
Spoken language	3
Speech reading/lip reading	4
Body language/gestures	2
Writing	4
Typing	2

It is important to recognize that the languages utilized by participants reflects individual differences. When examining the language preferences of deaf and hard-of-hearing students alongside their degree of hearing loss and speech abilities before experiencing hearing loss, it becomes evident that their choice of communication

modality is not solely based on personal preferences. Rather, it is influenced by a multitude of factors, including their prior linguistic background, communication environment, and experiences with language rehabilitation and sign language training. For example, as demonstrated in Table 3.7, being able to use both sign language and spoken language, student No. 4 (mild to moderate level of hearing loss, pre-lingual) could have taken speech rehabilitation training before. Meanwhile, with linguistic literacy skills, students No. 2 (mild to moderate level of hearing loss) and No. 14 (mild hearing loss) only picked sign language as their primary means of communication, suggesting that their language decision was impacted by their surroundings. These special cases, along with other notable exceptions, are highlighted in Table 3.7 for further clarity.

Table 3.7 Combinations of the degrees of hearing loss, communication preferences and the language backgrounds of the participants in the pilot study

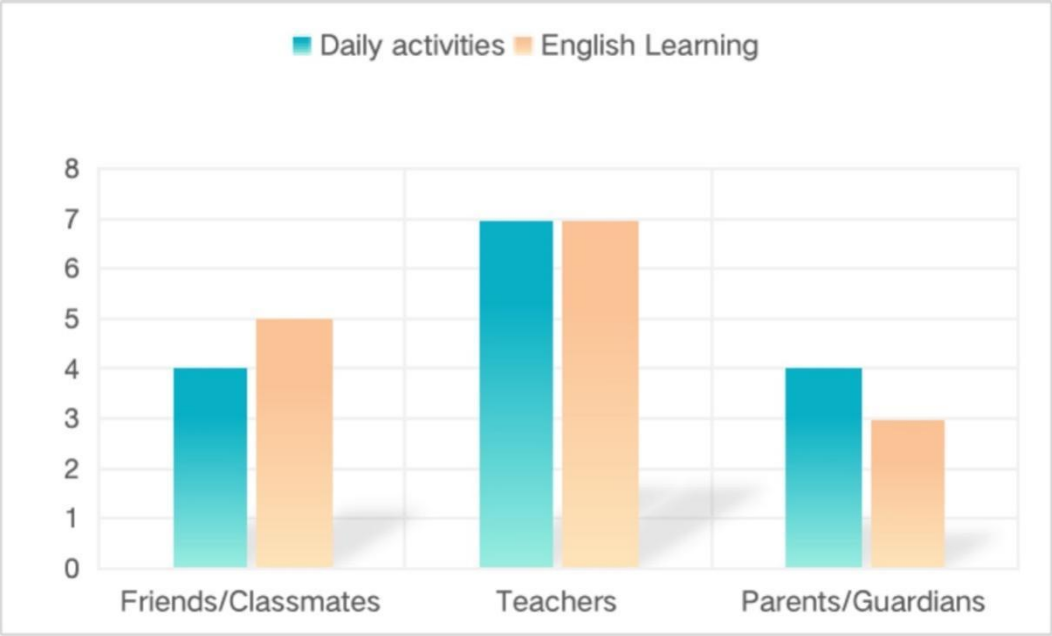
	Left ear hearing loss level	Right ear hearing loss level	Communication modalities	Pre/Post-lingual deafness
1	Profound hearing loss	Profound hearing loss	Sign language	Pre-lingual
2	Moderate hearing loss	Mild hearing loss	Sign language	Post-lingual, with literacy skills
3	Moderate severe hearing loss	Moderate severe hearing loss	Sign language	Pre-lingual
4	Moderate hearing loss	Mild hearing loss	Sign language, spoken language	Pre-lingual
5	Moderate severe hearing loss	Moderate severe hearing loss	Sign language	Pre-lingual
6	Profound hearing loss	Severe hearing loss	Sign language, spoken language, speech reading/lip reading	Post-lingual, with literacy skills
7	Moderate hearing loss	Mild hearing loss	Spoken language, body	Post-lingual, with speaking skills

	Left ear hearing loss level	Right ear hearing loss level	Communication modalities	Pre/Post-lingual deafness
			language/gestures	
8	Profound hearing loss	Profound hearing loss	Sign language, spoken language, body language/gestures, speech reading/lip reading	Pre-lingual
9	Mild hearing loss	Mild hearing loss	Speech reading/lip reading, writing	Post-lingual, with speaking skills
10	Moderate hearing loss	Moderate hearing loss	Sign language, speech reading/lip reading, writing, typing	Post-lingual, with speaking skills
11	Moderate hearing loss	Moderate hearing loss	Sign language	Post-lingual, with literacy skills
12	Profound hearing loss	Profound hearing loss	Sign language	Pre-lingual
13	Moderate hearing loss	Mild hearing loss	Writing	Post-lingual, with speaking skills
14	Mild hearing loss	Normal hearing	Sign language	Post-lingual, with literacy skills
15	Moderate severe hearing loss	Moderate severe hearing loss	Sign language, writing, typing	Pre-lingual

Overall, the diverse language modalities used by the participants reflected a complex classroom communication environment. It should also be noted that the image of deaf and hard-of-hearing students using all available tools to express meanings might also indicate the difficulty that the participants had in communication.

The pilot questionnaire also asked the participants for the person they preferred to communicate with regarding challenges in learning English and difficulties in everyday activities.

Figure 3.1 Preferred support providers of participants in the pilot study



As indicated in Figure 3.1, teachers were the top choice for participants seeking assistance in both situations, followed by friends and classmates, with parents being the last option. According to Anderson et al. (2017), deaf and hard-of-hearing individuals expect their help providers to be familiar with Deaf culture and sign language. It is reasonable to assume that the proficiency in sign language and English among language teachers and deaf and hard-of-hearing peers made them the most effective helpers. On the other hand, given that most parents of the participants are hearing people, despite being the closest to their children's everyday lives, the low preference of deaf and hard-of-hearing students for interacting with their parents might be due to their lack of proficiency in sign language.

The preference for using sign language in communication was also reflected in Table

3.8. As shown in the table, sign language was widely used when talking to teachers and friends. However, among the six students who sought help from their parents for either English learning problems or daily activity difficulties, only one communicated solely through sign language, while the rest used multi-modal communication. This finding indicates that being more proficient in sign language, the participants preferred to communicate with their teachers and classmates when they encountered difficulties. Additionally, using multi-modal methods to communicate with their hearing parents also indicates that deaf and hard-of-hearing participants' multi-modal multilingual repertoire shows flexibility in using different approaches to make meaning (Swanwick, 2016).

Table 3.8 Preferences of support providers, preferences of communication modalities and family backgrounds of participants in the pilot study

	Communication partner when having English learning problems	Communication partner when having problems in daily activities	Communication modalities	Do you have hearing parents or deaf parents
1	Friends/Classmates	Friends/Classmates	Sign language	Hearing parents
2	Teachers	Teachers	Sign language	Hearing parents
3	Friends/Classmates	Parents/Guardians	Sign language	Hearing parents
4	Parents/Guardians	Teachers	Sign language, spoken language	Hearing parents
5	Teachers	Teachers	Sign language	Hearing parents
6	Friends/Classmates	Friends/Classmates	Sign language, spoken language, speech reading/lip reading	Hearing parents
7	Teachers	Teachers	Spoken language, body language/gestures	Hearing parents
8	Teachers	Parents/Guardians	Sign language, spoken language, body language/gestures, speech reading/lip	Hearing parents

	Communication partner when having English learning problems	Communication partner when having problems in daily activities	Communication modalities	Do you have hearing parents or deaf parents
			reading	
9	Teachers	Teachers	Speech reading/lip reading, writing	Hearing parents
10	Friends/Classmates	Friends/Classmates	Sign language, speech reading/lip reading, writing, typing	Hearing parents
11	Teachers	Teachers	Sign language	Hearing parents
12	Teachers	Teachers	Sign language	Deaf parents
13	Parents/Guardians	Friends/Classmates	Writing	Hearing parents
14	Parents/Guardians	Parents/Guardians	Sign language	Hearing parents
15	Friends/Classmates	Parents/Guardians	Sign language, writing, typing	Hearing parents

It must be acknowledged that the design of this question had flaws. In the pilot questionnaire, participants were first asked a Likert scale question: “Do you talk to your teachers, parents, friends/classmates and seek help when you have difficulties in learning English and everyday activities?” with responses ranging from never to always. They were then asked to rank from 1 to 3, with 1 being the most frequent: “How often do you communicate with the following groups of people (teachers, parents, friends/classmates) and seek help from them when you have difficulties in everyday activities?” This question was repeated to address difficulties in learning English. Finally, participants were asked: “How do you communicate with the person who ranks first in the last question? Please tick any that apply.”

This design may have caused confusion. First, the Likert scale question and the repetitive ranking question were conflicting. During the study, participants were

confused about the differences and may have provided inconsistent responses. Second, the phrasing of the question regarding communication preferences was unclear. By asking the participants, “How do you communicate with the person?”, the question aimed to identify the communication modalities used by deaf and hard-of-hearing students. However, there may be a difference between the modalities they use and those they prefer. As a result, it is difficult to conclude that the participants’ responses to this question fully reflect their communication preferences. Consequently, this pilot questionnaire needed modification for the expanded demographic study to improve clarity and accuracy.

In terms of the evaluation of the quality of communication, ineffective communication was evident in interactions between deaf and hard-of-hearing students and their teachers. According to Table 3.9, when asked how they would evaluate the overall quality of communication with their teachers—who were identified as the most supportive and reliable persons by deaf and hard-of-hearing students—34% of the 15 students claimed that they were not satisfied at all, 40% found it difficult to give a precise answer, and only 26% stated that they were satisfied with the overall quality of communication. The most common explanation for participants’ dissatisfaction was teachers’ failure to fully understand the participants’ needs. In other words, the deaf and hard-of-hearing participants might have struggled to communicate their true concerns to their instructors.

Table 3.9 Quality of the communications of the pilot study participants

	Strongly disagree	Disagree	Neither...nor	Agree	Strongly Agree
I am satisfied with the overall communication.	2	3	6	2	2
I feel safe having discussions about my learning difficulties.	1	4	6	3	1
He/She/They will listen to what I have to express during the conversation.	1	2	7	2	3
He/She/They know exactly what I want or how I feel when I express my difficulties to them.	2	6	4	2	1
He/She/They will answer my questions and give suggestions to me.	3	1	7	3	1

Given that the most frequently used language in teacher-student communication was sign language, the absence of standardized CSL use and professional teacher training may be accountable for the language barriers noted. As reviewed by the literature, the absence of uniformity of CSL usage in deaf classrooms, according to Johnson (2004a), is one circumstance that concerns the educational system. Although the country has been attempting to standardize the usage of "Deaf Sign Language" since 1959, Signed Chinese or Sign-Supported Chinese remains the best way to describe the sign language used in deaf schools (Wang, 2018). In this case, it is hard to define the sign language used by deaf and hard-of-hearing students and their teachers as CSL or

Signed Chinese, and this question needs to be further discussed in the following studies in this thesis. On the other hand, previous studies also highlight the lack of professional deaf education teachers in China. Liu (2013) reports in a questionnaire survey of 90 instructors from six deaf schools across China that, although having qualified educational backgrounds, they have not received adequate training in special education or subject areas. Given these circumstances, a follow-up study with instructors is required to completely understand the communication breakdown between the teachers and their students.

3.2.3.3 Learning English in China

The following section delves into the English language learning experiences of the deaf and hard-of-hearing participants. This section consists of four parts: participants' motivations, hearing loss and English learning experiences, difficulty levels in learning language skills, and possible reasons that might be responsible for the difficulties.

Adapted from Ye's (2021) Learning Motivation Questionnaire in the context of ELL-NESC, deaf and hard-of-hearing participants were asked to say why they wanted to learn English. The most common intrinsic motivation shared by the participants was their curiosity and eagerness to learn about the world. Meanwhile, the Gaokao (College Entrance Examinations in China) was the main extrinsic stimulation that pushed the participants to learn English. Other than passing this exam and getting into

university, the participants also expressed their own and their parents' expectations of a bright future. This finding accords with Xu and Case's (2015) conclusions that the level of instrumental motivations rises when hearing Chinese additional language learners enter high school. Instrumental motivations, as defined by Kyriacou and Zhu (2008), are "life career aspects", such as "to enter into college". That is to say, at least in this aspect, deaf and hard-of-hearing students have similar expectations and needs to their hearing peers.

Both intrinsic and extrinsic motivations were observed in the participants' answers. Nevertheless, the findings of this study contradict Ye's claim that Chinese junior pupils are more internally driven than extrinsically motivated (Ye, 2021). As shown in Table 3.10, the participants appeared to be more extrinsically driven. In general, among the 15 participants, around 27% demonstrated intrinsic motivations for learning an additional language, whereas 87% were motivated by extrinsic motivations, and 13% pointed out that they had no idea why they needed to learn English. However, given that the design of the question was imprecise, this finding needs to be further studied.

Table 3.10 Participants in the pilot study's motivations of learning English

	Intrinsic Motivations for Learning English	Extrinsic Motivations for Learning English	Other specified answers
1	I hope I can study abroad; I am interested in traveling abroad		

2	.	English is required in the Gaokao	
3		English is required in the Gaokao	
4	I hope I can study abroad; I am interested in traveling abroad	It is one of the compulsory courses in my curriculum; English is required in the Gaokao	
5		English is required in the Gaokao	
6		English is required in the Gaokao	
7		English is required in the Gaokao	
8			I don't know why I need to study English.
9		I learn English because my parents think it is necessary; To be more competitive in the future.	
10	I am interested in traveling abroad	To be more competitive in the future; English is required in the Gaokao	
11		English is required in the Gaokao	
12		To be more competitive in the future;	
13		To be more competitive in the future; English is required in the Gaokao	
14			I don't know why I need to learn English
15	I enjoy watching English films without translation subtitles	It is one of the compulsory courses in my curriculum	

The results of this pilot demographic questionnaire also provided evidence for correlations between hearing loss levels and experiences in learning English. Students with less severe hearing loss had fewer difficulties. In this pilot questionnaire, I designed a 6-point Likert scale question, with answers ranging from very easy to very

difficult, for the participants to self-report their perceived difficulty level of learning English skills. To quantify difficulty levels, values were assigned as follows: -2 for "very easy", -1 for "easy", 0 for "normal", 1 for "a little bit difficult", 2 for "difficult" and 3 for "very difficult". By summing these values, it was possible to get a general sense of how students felt about learning English as an additional language. The smaller the total value, the less difficulty the student was likely to experience.

As shown in Table 3.11, the average difficulty value of the participants with hearing loss levels lower than moderate in both ears was significantly smaller than for those with more severe hearing loss. In other words, the degree of hearing loss greatly influenced the English learning experiences of the participants, causing more difficulties, particularly for those with severe and profound deafness.

Table 3.11 Values of difficulty in learning English and degrees of hearing loss in the pilot study

Student number	Total value of learning difficulty	Left ear hearing loss level	Right ear hearing loss level
1	9	Profound hearing loss	Profound hearing loss
2	8	Moderate hearing loss	Mild hearing loss
3	18	Moderate severe hearing loss	Moderate severe hearing loss
4	-3	Moderate hearing loss	Mild hearing loss
5	15	Moderate severe hearing loss	Moderate severe hearing loss
6	19	Profound hearing loss	Severe hearing loss
7	0	Moderate hearing loss	Mild hearing loss
8	2	Profound hearing loss	Profound hearing loss
9	-5	Mild hearing loss	Mild hearing loss
10	0	Moderate hearing loss	Moderate hearing loss

Student number	Total value of learning difficulty	Left ear hearing loss level	Right ear hearing loss level
11	10	Moderate hearing loss	Moderate hearing loss
12	0	Mild hearing loss	Mild hearing loss
13	-8	Moderate hearing loss	Mild hearing loss
14	1	Mild hearing loss	Normal hearing
15	13	Moderate severe hearing loss	Moderate severe hearing loss

However, there were some exceptions. For example, Student No. 8, who had profound hearing loss in both ears, reported lower difficulty levels than Student No. 2, whose hearing loss was significantly less severe than Student No. 8. This suggests that hearing loss might not be the only factor contributing to the personal differences in learning English among the participants. Other factors, such as learning attitudes, strategies, and individual resilience, might also play a role.

Table 3.12 depicts students' perceptions of the difficulty levels in learning literacy skills in English. As shown in the table, a value of -2 represents "extremely easy". -1 represents "easy", 0 represents "normal", 1 represents "a little bit challenging", 2 represents "difficult" and 3 represents "very difficult". When the total values in each column were added together, the values for English vocabulary and grammar were much lower, indicating that the participants agreed they had fewer difficulties with these two language abilities. In contrast, improving reading and writing abilities was more challenging.

Table 3.12 Participants' perceptions of the difficulty levels in learning English literacy skills in the pilot study

	grammar	vocabulary recognition	vocabulary spelling	reading comprehension	writing skills
1	0	0	0	0	0
2	-1	0	0	1	2
3	2	0	1	3	3
4	-1	0	-1	0	0
5	0	0	0	3	3
6	1	1	2	3	3
7	0	0	0	0	0
8	-2	-1	0	1	0
9	-1	-1	-1	1	-1
10	0	0	0	0	0
11	0	0	0	0	1
12	0	0	0	0	0
13	-1	-1	-1	-1	-1
14	1	-1	-1	2	0
15	1	0	1	1	1
In sum	-1	-3	0	14	11

According to Table 3.13, up to 13 out of 15 participants claimed that they were under pressure to learn English, and nine deaf and hard-of-hearing students believed they were experiencing negative emotions, such as depression and anxiety. Although there is no clear evidence that learning English caused these negative sentiments, it is plausible to argue that the existing English language learning experiences for deaf and hard-of-hearing students in this pilot study was unpleasant.

Table 3.13 English learning difficulties in the pilot study: pressure and negative emotions

	Never	Sometimes	Always
Pressure	2	7	6
Negative emotions	6	6	3

According to Falkowska (2016), restricted access to relevant material and limited access to barrier-free communication are two factors that contribute to deaf and hard-of-hearing students' challenges in language acquisition. A similar result was observed from the participants of this pilot questionnaire. As presented in Table 3.14, the participants reported a lack of valuable information learning English in China, and 11 out of 15 students felt that their hearing loss made it more difficult for them to interact with others.

Table 3.14 English learning difficulties in the pilot study: lack of information and communication failure

	Never	Sometimes	Always
Lack of useful information	0	13	2
Communication failure caused by hearing loss	4	9	2

Resources available to participants outside of class were also scarce. When asked if there was anyone else who could support them with English learning, nine participants answered that there was no one, while six reported that they could seek help from someone else. According to these six students, those who could help them with English language learning were mainly parents and friends. Although two

students suggested that they had personal tutors and one student claimed that one of their parents was an English teacher, most of these support people did not have qualifications in English language education (Table 3.15).

Table 3.15 English learning difficulties in the pilot study: lack of available resources outside the classroom

	No	Yes
People can help with English learning outside of school	9	6
Other resources to learn English outside of class	8	7

Seven participants discussed other means of learning English, such as viewing English TV episodes or movies and reading English literature. Although having alternative learning materials is beneficial, it must be acknowledged that this pilot questionnaire was not designed to provide evidence to support the effectiveness of those learning materials and activities.

3.2.4 Discussion of the pilot study results

Deafness affects deaf learners' additional language acquisition in a variety of ways. In terms of demographic characteristics, communication practices, and English learning experiences, the study results paint a vivid image of Chinese deaf and hard-of-hearing English learners. According to the findings of this study, the unique characteristics of deaf and hard-of-hearing pupils are intimately related to their familial and linguistic backgrounds. Additionally, heterogeneity is observed in the various communication methods employed by deaf and hard-of-hearing students. Being deaf and hard-of-hearing, they engage in multi-modal interactions both visually and orally. This

outcome indicates the capacity to deliver information materials in a variety of formats. Furthermore, these students' additional language learning experiences are hindered by information deprivation, which makes the process even more painful. The causes of unpleasant learning experiences are not only related to deafness but also to unsuccessful communication between deaf and hard-of-hearing students and their instructors, as well as a scarcity of useful resources and guidance.

3.2.4.1 The formation of a language classroom in a deaf school

This pilot study shows the complexity of forming an English classroom in a Chinese deaf school. Students at Wuhan No. 1 Deaf School showed great diversity in hearing loss degrees, linguistic abilities, educational backgrounds, and English learning experiences. Such heterogeneity might be related to the school policy. According to this school's High School Enrollment Brochure (Wuhan No. 1 Deaf School, 2024 Fall), students from all over China with hearing impairments who had attended special education schools, deaf schools, or general education schools were eligible to apply if they had completed their 9-year compulsory education and had no intellectual disabilities. In other words, deaf and hard-of-hearing students at this school originally came from different backgrounds, bringing diversity into the classrooms.

This diversity further influenced other aspects of the class, such as students not fully settling with Deaf identities, and their varying sign language and spoken language skills. In essence, the cultural and linguistic contexts of this language classroom were

also heterogeneous.

As a result, questions need to be raised about the classroom communication environment and instructors' tactics for managing such variability in the classroom. As participants reported in the Quality of Communication Questionnaire, the current quality of communication was not satisfactory. It turned out that the communications with their teachers could not always fully meet the participants' needs. Additionally, since this questionnaire focused only on the perspectives of deaf and hard-of-hearing students, a follow-up study with the students' teachers should be conducted to gain an integrated understanding of an English classroom with Chinese deaf and hard-of-hearing students.

3.2.4.2 Languages used by deaf and hard-of-hearing students'

Languages used by deaf and hard-of-hearing students appear to be multi-modal. These students' language preferences are impacted by their individual experiences and social environments (Alothman, 2021). According to the data gathered from this pilot study, the participants had a strong preference for employing visual-based communication modes, such as CSL. Even participants with minor hearing loss who had learned to communicate verbally used sign language, lip reading, and/or writing when interacting with others. This phenomenon might demonstrate the impact of social settings. When most participants communicated via sign language, the minority group tended to join in. However, there was no proof that the participants' sign language

was standardized CSL or Signed Chinese. One student, for example, who had profound hearing loss in both ears, still needed to rely on gestures and body language, rather than sign language, to communicate. This finding indicates that even though sign language was the most frequently used communication method among the participants, their proficiency in sign language varied.

The results concerning the students' language use also point to the viability of a multi-modal additional language classroom. Visual preference was observed by the participants. As a result, it is logical to suppose that various types of visual resources might assist their language development.

3.2.4.3 Quality of communication

Although deaf and hard-of-hearing students' multi-modal language use may inspire language teaching techniques and serve as proof that students can obtain information from a variety of sources, it also highlights the difficulties these students face in everyday communication. Currently, the findings of this study are unable to pinpoint the exact causes of these difficulties; however, the results of this pilot questionnaire suggest that the participants did not consistently agree that those who are supposed to be supportive are effective communicators.

When the participants faced problems in everyday life activities and English learning, they preferred to seek support from their friends and teachers rather than their parents,

according to the study. However, their evaluations of the quality of communication indicated dissatisfaction. One of the biggest issues raised by the participants was that their communication partners did not completely comprehend their demands. Since sign language is the main mode of communication, a lack of standardized CSL usage might be a factor. However, since this study solely relied on the responses of deaf and hard-of-hearing students, it is also crucial to hear the instructors' thoughts on the quality of communication with their students, as well as their perspectives on the probable causes of communication failure.

3.2.4.4 Difficulties in learning English

Learning English in a non-English-speaking country was not a pleasant experience for the participants, with 87 percent reporting that they were under pressure to learn English and 60 percent reporting negative emotions. As indicated by the results of this pilot study, poor language learning experiences might be due to various factors, including external pressures, deafness-related language difficulties, and a lack of readily available and useful resources.

The study found that deaf and hard-of-hearing students' reasons for learning English as an additional language were more extrinsic. "English is necessary for the Gaokao" was the most prevalent reason given by participants, followed by "To be more competitive in the future" and "English is a compulsory subject required by my school". As very few of them mentioned learning for personal happiness, there is a

tendency that the outside world has placed significant pressure on these students in numerous ways.

It must be acknowledged that deafness made learning an additional language difficult for the participants. Participants with severe hearing loss reported higher difficulty levels in learning English. Moreover, the participants reported limited access to English learning resources, especially outside the classroom.

As a result, the findings of the pilot study highlight the critical need for producing English learning materials tailored to the needs of Chinese deaf and hard-of-hearing students, as well as advocating for a more barrier-free communication environment in classrooms.

3.2.5 Summary of the pilot study

In summary, this pilot study revealed the distinct characteristics of a small group of Chinese high school deaf and hard-of-hearing English learners in a deaf school system. Students develop different self-identifications and employ multiple methods of communication due to their varying experiences with deafness, language acquisition, family history, and educational background. The study's findings illustrate how these elements play a role in the participants' English as an additional language acquisition. Their language preferences in communication, as well as their difficulty levels in acquiring language abilities, might be influenced by demographic factors. According

to the findings, the deaf and hard-of-hearing students preferred visual-based interactions and used multi-modal methods to improve the quality of communication. However, the overall quality of communication between students and teachers was poor. The students in this study tended to express negative feelings about their English language learning experiences due to communication obstacles and a lack of access to resources. Since this study focused on the demographics and personal experiences of the students, a follow-up study with instructors is required to understand the current state of English instruction for such students.

3.3 Summary

This chapter began with an overview of the overarching design of the research, which aims to investigate the English learning experiences of deaf and hard-of-hearing students in China. Adopting an exploratory approach, this thesis employs a mixed-method design, comprising four studies. The first study was a pilot demographic questionnaire involving 15 deaf and hard-of-hearing students. Serving as the foundation of the thesis, the results of the pilot study informed the design of the subsequent studies. The second study is a semi-structured interview study with the English teachers of deaf and hard-of-hearing students. This study aims to explore findings from the pilot study from a different perspective and to further delve into the unique needs of these students in English classrooms in China. The third study is an expanded demographic questionnaire with a larger group of deaf and hard-of-hearing students. The fourth study is an experimental study that tests the language preferences

of deaf and hard-of-hearing students when working on a multi-modal reading interface, and their acceptance level of using information technology as a learning support tool. These studies are interconnected, collecting both qualitative and quantitative data to address the research gaps identified in Chapter 1 (refer to Section 1.1). The second part of this chapter provides a detailed discussion of the design and findings of the pilot study. It is important to note that, being a pilot study, it had certain limitations. For example, as mentioned in Section 3.2.4.2, some questions in the questionnaire were conflicting and phrased confusingly. Moreover, the pilot questionnaire employed a measurement scale to assess quality of communication that was not designed for the educational context. Additionally, with only 15 participants, the results of this pilot questionnaire were not easily to generalize. Consequently, modifications were made to the original version of the expanded demographic questionnaire. For a detailed introduction to the expanded demographic questionnaire, refer to Chapter 4.

In conclusion, this chapter has laid the groundwork for understanding the methodological approach of this thesis. The pilot study, despite its limitations, has provided valuable insights that have shaped the design of the subsequent studies. The mixed-method approach, combining both qualitative and quantitative data, has provided a holistic understanding of the Chinese deaf and hard-of-hearing students' English learning experiences. The following chapters will delve deeper into each of these studies, discussing their design, implementation, and findings in detail.

Chapter 4 The Heterogeneous Backgrounds of Deaf and Hard-of-hearing English Learners in China: An Expanded Demographic Survey

4.1 Introduction

This chapter primarily reports the data and results of the expanded demographic survey. It begins with a review of the pilot demographic survey and then explains the necessity of conducting this expanded survey. This chapter also reviews studies focusing on the changing demographics of deaf and hard-of-hearing students worldwide. In the third part of this chapter, the data are analyzed from four perspectives: the demographic information of the deaf and hard-of-hearing participants, their multi-modal communication preferences, the participants' perceived quality of communication with their teachers, and their experiences of learning English.

4.1.1 Findings of the pilot demographic survey

To gain a basic understanding of the demographic features of deaf and hard-of-hearing English language learners in China, I conducted a pilot demographic survey with 15 high school students with hearing impairments. The participants were asked to provide information about their demographics, preferred modes of communication, as well as their experiences and expectations related to English learning.

The findings illustrate considerable diversity in the students' characteristics, while also indicating a shared preference for multi-modal communication and a common

struggle with English reading comprehension. According to the pilot study (refer to Chapter 3), deaf and hard-of-hearing students employ various multi-modal communication techniques, such as sign language, spoken language, lip reading, finger-spelling, writing, and typing.

Sign language was the dominant mode of communication used by deaf and hard-of-hearing students in the pilot study, with 12 out of 15 participants indicating its frequent use. Other frequently employed modalities include spoken language (three out of 15, 20%), speech reading/lip reading (four out of 15, 27%), and writing (four out of 15, 27%). Among the 15 participants, their habits of using the communication methods varied: seven relied solely on sign language, one used both sign language and spoken language, two used a combination of sign language, spoken language, body language/gestures, and speech reading, one used sign language, writing, and typing, one used only body language/gestures, one used only speech reading, and one used only writing.

It is important to note that in the Chinese system, handwriting and typing require distinct skills. Handwriting necessitates proficiency in the formation and structure of Chinese characters, whereas typing necessitates mastery of the Chinese pronunciation and spelling system, Pinyin. Typing can be used as a means of communication through online platforms, such as WeChat. However, the survey results indicated that

only two out of 15 students utilized typing as an aid in communication, potentially due to limited access to cell phones or computers while at school.

The results of the pilot study also revealed that deaf and hard-of-hearing students were not satisfied with the quality of communication with their most reliable communication partners (refer to Section 3.2.3.2). Specifically, as reported by the participants, eight out of 15 disagreed with the statement that their communication partners were able to understand their needs when they sought help. In terms of learning English, most participants expressed having difficulties in reading comprehension. However, given that the sample size of the pilot study was quite limited, I found it necessary to conduct the demographic survey with a larger sample of participants.

4.1.2 Research focus of this study

This study is an expanded version of the pilot demographic study. Consequently, the research focus of this study aligns with the original pilot study and primarily addresses four aspects of deaf and hard-of-hearing participants: their demographic information, their communication preferences, their perceived quality of communication with their teachers, and their experiences of learning English in China. Specifically, the research questions are:

1. What are the demographic characteristics of Chinese deaf and hard-of-hearing English learners?
2. How do the deaf and hard-of-hearing participants communicate with their teachers?

3. How would deaf and hard-of-hearing participants evaluate the quality of communication with their teachers?

4. What experiences do deaf and hard-of-hearing participants have when they learn English in China?

4.2 Review of demographic studies and individual differences in SLA among deaf and hard-of-hearing students

This literature review explores the multifaceted aspects of demographic studies on deaf and hard-of-hearing individuals, emphasizing the importance of understanding heterogeneity among this population as additional language learners. It begins by introducing the topic and contextualizing its significance, particularly in the realm of deaf education. The review then delves into the theoretical perspectives on demographic studies with deaf and hard-of-hearing populations, examining medical, social, and cultural viewpoints, each contributing unique insights into addressing auditory limitations and fostering social inclusion. The current state of research is analyzed, highlighting the findings from global demographic studies and identifying a significant gap in the literature concerning the deaf and hard-of-hearing population in China. This gap is crucial as it hinders the development and evaluation of tailored educational recommendations.

4.2.1 Theoretical perspectives on d/Deaf and hard-of-hearing populations

Demographic studies on d/Deaf and hard-of-hearing students are not new. According to Mitchell (2017, p. 93), such studies are essential for deaf education because they

focus on “methods of inquiry that help to answer one of the most basic concerns for deaf education, namely: Who are the children and youth for whom schools and programs are responsible?” Mitchell (2017) also highlights that, since not all deaf and hard-of-hearing children receive school education, the fundamental demographic findings for deaf education may differ from those for other societal concerns, such as public health, social security benefits, and telecommunication services.

The demographics of deaf and hard-of-hearing students are concerned with two issues: “demography” and “epidemiology” (Mitchell, 2017). According to Mitchell (2017), demography focuses on identifying who is a member of a population and how characteristics, such as deafness, impact fundamental aspects of life. The concept of demography also extends to analyzing the importance of having access to opportunities in society, such as stable employment, fluency in the dominant language, wealth, and higher education (Mitchell, 2017). Epidemiology is concerned with the distribution and causes of diseases or health conditions, including deafness, and their effects on individual longevity, fertility, and cognitive or physical function (Mitchell, 2017). As highlighted by Mitchell (2017), understanding the causes of deafness is necessary and valuable as epidemiology helps with facilitating better services and support for deaf and hard-of-hearing individuals; however, to broadly examine population dynamics without viewing deafness solely as a disease or health condition is the purview of demography.

Three perspectives—medical, social, and cultural—have influenced the demographic information of deaf and hard-of-hearing students (Mitchell, 2022; Young & Temple, 2014). Mitchell (2017) highlights that all three perspectives acknowledge that hearing loss affects how individuals live, learn, and engage in social activities; however, each perspective emphasizes unique aspects of the experiences of being deaf and hard-of-hearing. Therefore, this study explores all three perspectives to gain a nuanced demographic framework of deaf and hard-of-hearing students learning English in China.

4.2.1.1 The medical perspective

According to Mitchell (2017), the medical perspective focuses on how deaf and hard-of-hearing individuals perceive sound, their degree of deafness, and the biophysical impairments affecting their hearing, whether these impairments are caused by conductive, sensorineural, or neural hearing losses. This perspective views deaf and hard-of-hearing individuals as patients, or seekers of solutions, seeking to meet their communication needs (NASEM, 2016, p. 26). It also emphasizes the necessity of providing hearing healthcare services and support (Mitchell, 2022).

Normally, several aspects are considered from the medical perspective, including the age of onset, causes, and severity of hearing loss (Mitchell, 2017). To differentiate between deaf and hard-of-hearing individuals, various scales of hearing acuity or loss are used to measure individuals' levels of deafness (Mitchell, 2022). Prescribed actions are then based on individual cases (NASEM, 2016). As highlighted by

Mitchell (2022), the medical perspective focuses on providing treatment or assistance to individuals with hearing impairments, especially those who face challenges, difficulties, or barriers in spoken language communication. This perspective often emphasizes the goal of achieving the most normal hearing possible, framing the importance of hearing in normative terms (Mitchell, 2017; Mitchell, 2022).

The categorization of degrees of hearing loss has been reviewed in previous chapters (refer to Section 1.1). Usually, individuals are classified as deaf if they have severe-to-profound levels of hearing loss in the "better ear" when one ear hears differently from the other and they are largely unable to hear speech accurately (e.g., Butcher et al., 2019; Haile et al., 2019; Mitchell, 2022). Individuals with lighter degrees of hearing loss may be referred to as hard-of-hearing (NASEM, 2016). As introduced by Mitchell (2022), after hearing screening, the next step is to offer assistance, such as hearing aids, cochlear implants, and other hearing augmentation devices. The criteria for choosing hearing aids and/or cochlear implants have been discussed in Chapter 2 (refer to 2.1.2.1.2). Generally, deaf and hard-of-hearing individuals receive different treatments based on their individual situations (Mitchell, 2017; Mitchell, 2022). Additionally, some of them do not have any hearing assistance due to various reasons, such as financial issues (Mitchell, 2022; Wu et al., 2015). According to Mitchell (2022), given that speech perception is different from sound perception, even with hearing aids, it is not guaranteed that such individuals will experience hearing the same way as those with normal hearing. Thus, from the medical perspective, it is

reasonable to assume that deaf and hard-of-hearing individuals are naturally diverse in terms of their degrees of hearing loss, causes of deafness, and experiences with hearing treatment or assistance.

4.2.1.2 The social perspective

The social perspective discusses what it means to be deaf or hard-of-hearing within the context of social and built environments. Being different from the medical perspective, the social perspective is "reacting against any stigma of deafness" (Mitchell, 2017, p. 96). As highlighted by Mitchell (2022),

> an important distinction between the medical/psycho-audiological and the social perspectives is that from the social perspective overcoming barriers to participation, access, communication, and so forth is necessarily a joint venture. (p. 11)

For example, according to Antia and Kreimeyer (2015), factors such as deafness, age, quality of communication with parents, and the school environment interactively influence the development of social competence in deaf and hard-of-hearing children.

According to Mitchell (2017), the social perspective emphasizes how assumed or taken-for-granted social structures can exclude or burden individuals with any degree of deafness, potentially resulting in disability or discrimination. Mitchell (2017; 2022) notes that having access to information is one of the most basic, taken-for-granted situations for deaf and hard-of-hearing individuals. However, as reviewed in Chapter 2 (refer to Section 2.1.1), deaf and hard-of-hearing children are more likely to

experience language deprivation in their early stages due to a lack of accessible linguistic communication (Levine et al., 2016). According to Scott and Dostal (2019), language deprivation further leads to negative outcomes in the overall development of deaf and hard-of-hearing children. Mitchell (2017) emphasizes that children with early-onset deafness may experience a range of developmental delays if they lack accessible linguistic communication in their environment, resulting in a poor person-environment fit from an early age. Additionally, Antia and Kreimeyer (2015) note that in the school setting, "hearing loss has the potential to isolate children and prevent them from engaging in the types of social interactions that most children experience" (p. 2).

Given that the social perspective emphasizes the negative social consequences of deafness in the absence of change, this perspective focuses less on whether individuals identify themselves as hard-of-hearing or deaf (or Deaf, as discussed later) (Mitchell, 2017). Instead, it examines whether the fit between the person and their environment makes their deafness a disabling condition and how social practices and built environments can be adjusted or mutually adapted to promote inclusion (Mitchell, 2022). As mentioned by Mitchell (2017), "deaf education can intentionally facilitate an accessible social and physical environment that positively incorporates how life is lived differently with deafness" (p. 97). This point of view is also supported by Falkowska (2016), who argues that it is necessary to adopt multi-modal

instructions to create a barrier-free communication environment in classrooms for deaf and hard-of-hearing students.

Chapter 2 (refer to Section 2.1.2.1.3) has shown that in addition to spoken and sign languages, deaf and hard-of-hearing individuals use various communication modes to convey meaning, including speech reading, writing, and typing. Recognizing that deaf and hard-of-hearing individuals have diverse communication preferences, it is valuable, from a social perspective, to study their personalized experiences with communication habits and language preferences. This understanding can then be used to facilitate multi-modal methods, making linguistic communications more accessible to deaf and hard-of-hearing individuals.

4.2.1.3 Cultural perspectives

Cultural perspectives emphasize how shared experiences among deaf and hard-of-hearing individuals, especially the use of sign language, form the foundation for a collective identity, solidarity, and community (Mitchell, 2017). According to Mitchell (2022), by incorporating visual and tactile means for structuring community life so that auditory perception is neither necessary nor taken for granted, communities develop a way of life that persists across generations. The deaf community can be intergenerationally enculturated through families/kinship, schools/education, and other societal institutions (Mitchell, 2022). In other words, unlike the medical and social perspectives, deafness is not viewed as a biophysical or psycho-audiological

function or as a functional (dis)ability within the social and built environment. Instead, it is regarded as an identity of being Deaf (with a capital "D") (Mitchell, 2017; 2022).

Usually, national sign languages are used as the dominant languages within the Deaf community (Ladd and Lane, 2013). According to Mitchell (2017), Deaf identity can be naturally achieved when children are born to Deaf parents and can be intentionally cultivated through Deaf schools and other sign language-based instructional and family service programs. However, it has to be admitted that Deaf identity is not guaranteed and is potentially unstable among deaf and hard-of-hearing children (Mitchell, 2017). In this case, Mitchell (2017) indicates that "the cultural identity facet of the cultural perspective is unlikely to be a routine component of demographics for deaf education" (p. 98).

As mentioned in Chapter 1 (refer to Section 1.1), the participants in this thesis did not necessarily acquire a Deaf identity. However, based on Mitchell's (2022) statement, knowing the languages used by deaf and hard-of-hearing individuals is critical for cultural understanding when conducting demographic studies with this specific group. Therefore, regardless of whether the participants have achieved Deaf identities, this study focuses on the languages that deaf and hard-of-hearing participants prefer to use in different communication circumstances.

4.2.2 Deaf and hard-of-hearing students as multilingual learners

Chapter 2 has discussed the multilingual or plurilingual language repertoire of deaf and hard-of-hearing students and suggests that these language learners are multilingual learners with multi-competence (refer to Section 2.1.2.2.2). According to Cannon and Marx (2023), the research community uses the term "deaf multilingual learners" to describe individuals who are learning English but whose families do not speak or sign the languages of the wider community. Howerton-Fox and Falk (2019) emphasize that deaf and hard-of-hearing multilingual learners are deserving of continued research attention because they represent a form of linguistic diversity that has not been adequately addressed. This point of view is further developed by Snodden and Weber (2021) and Swanwick et al. (2021), who emphasize the necessity of studying the multilingual/plurilingual characteristics of deaf and hard-of-hearing students, especially in the context of language classrooms. The following paragraphs explore the current state of research, particularly demographic studies, involving deaf and hard-of-hearing multilingual learners worldwide. Then, based on previous studies, this section discusses the importance of studying the characteristics of deaf and hard-of-hearing multilingual learners.

4.2.2.1 Demographic context of deaf and hard-of-hearing multilingual learners in English-speaking countries

As introduced by Howerton-Fox and Falk (2019), the number of deaf and hard-of-hearing multilingual learners in the United States has grown by at least 150% over the past three decades. According to the Gallaudet Research Institute's Annual Survey, up

to 35% of deaf and hard-of-hearing children in U.S. schools are multilingual learners (GRI, 2013). Researchers believe this number is still increasing due to recent changes in migration patterns (Cannon and Marx, 2023). Despite the recognized necessity of conducting studies on this group, there remains a lack of focused research (Howerton-Fox and Falk, 2019).

Cannon and Marx (2023) conducted a scoping review to analyze the research methodologies of 33 original research papers focusing on deaf and hard-of-hearing multilingual learners from primary school through the completion of mandatory formal education. Their results indicated that, among these 33 research papers, 12 studies examined the characteristics of deaf and hard-of-hearing multilingual learners, with research questions focusing on life experiences, language proficiency, and background characteristics (Cannon and Marx, 2023).

For example, in a report by Swanwick et al. (2021), the authors identify challenges in collecting demographic data on deaf and hard-of-hearing children from Roma families in England. Despite the increasing number of these children from such families in UK educational settings and the need for educators to gain a clearer understanding of these children's linguistic and cultural backgrounds, there remains a lack of ethnographic records due to the families' invisibility (Swanwick et al., 2021).

As indicated by Wang et al. (2016), demographic characteristics are crucial for deaf and hard-of-hearing multilingual children in the development of their language abilities and multicultural perspectives. Wang et al. (2016) conducted case studies with two adult Asian deaf and hard-of-hearing multilingual learners to explore their language and literacy histories and how they use different languages in various cultural communities with diverse conversational partners. The participants in this study were proficient in CSL, ASL, Signed Chinese, and the reading and writing of Chinese and English scripts. This study demonstrates individual differences in language learning experiences and personal backgrounds, indicating that early language access, family involvement, and cultural context play significant roles in multilingual development. These findings highlight the importance of considering demographic characteristics when developing educational strategies and support systems for deaf and hard-of-hearing multilingual learners.

In summary, while there has been significant growth in the population of deaf and hard-of-hearing multilingual learners, particularly in English-speaking countries, there remains a substantial gap in research focused on their unique demographic characteristics and learning experiences. Studies, such as those by Wang et al. (2016) and Swanwick et al. (2021), underscore the need for more ethnographic and detailed research to better understand and support this diverse group of learners.

Notably, according to Cannon and Marx (2023), in English-speaking countries, deaf and hard-of-hearing multilingual learners are

> often recent immigrants transitioning to a new country, language(s), and cultures. Some have families who utilize multiple languages, including heritage languages, i.e., a language used by the family based on their cultural background but not by the majority of the broader community, while others have migrated to a new country and are learning a second language (e.g., English, American Sign Language). (p. 2)

In other words, in English-speaking countries, deaf and hard-of-hearing multilingual learners are acquiring the languages (English or the national sign language) that are predominant in the society or the local Deaf community. However, for deaf and hard-of-hearing multilingual learners learning English in non-English-speaking countries, the situation is different.

4.2.2.2 Demographic context of deaf and hard-of-hearing multilingual learners in non-English-speaking countries

Learning English in a non-English-speaking country is a different experience from learning it in an English-speaking country. According to Domagała-Zyśk et al. (2021), deaf and hard-of-hearing individuals learning English in the USA, Canada, the UK, or Australia are immersed in the language and can access it almost everywhere. However, for those in countries where English is not used daily, their only opportunity to access the language is in the classroom. As the authors state,

> You neither learn it ‘out of the corner of your ear’—because you cannot hear it well in spontaneous, incidental situations—nor ‘out of the corner of your

> eye'—because it is not evident in everyday situations in your local area. (Domagała-Zyśk et al., 2021, p. xv)

Therefore, as highlighted by Csizér and Kontra (2020), deaf and hard-of-hearing students face distinct challenges when they learn English in non-English-speaking countries.

One of the most common challenges faced by deaf and hard-of-hearing English learners in non-English speaking countries is the lack of access to the language (Csizér and Kontra, 2020) and suitable materials (Domagała-Zyśk et al., 2021). In a mixed-method study with 54 deaf and hard-of-hearing college-level students from the Czech Republic and Hungary, Csizér and Kontra (2020) explored the characteristics and challenges faced by these students. The authors found that lacking a solid first language can pose significant challenges for deaf and hard-of-hearing students when learning an additional language. Additionally, since this group of students is more reliant on their teachers, they are more likely to be demotivated by non-professional teachers and poor instruction. As they state,

> While good teachers and good teaching as described by the interviewees can exert a long-lasting positive impact, a bad teacher and ineffective methods can demotivate a language learner way into adulthood. (Csizér and Kontra, 2020, p. 245)

From a social perspective, the social and educational expectations placed on deaf and hard-of-hearing students are often insufficient to motivate them to learn an additional language. Therefore, Csizér and Kontra (2020) conclude that

> there is much more to know about deaf and severely hard-of-hearing foreign language learners than meets the eye, and that the differences between them and their hearing peers are more fundamental than having different levels of hearing ability. (p. 245)

Researchers also highlight the heterogeneous nature of deaf and hard-of-hearing English language learners in non-English-speaking countries. According to Sedláčková (2021), deaf and hard-of-hearing individuals vary widely in several aspects, including the degree and onset of hearing loss, means of communication, educational experiences, first language development, and affective factors. Sedláčková (2021) calls for careful study and consideration of this group's heterogeneity, emphasizing the importance of approaching each learner individually.

In Wang et al.'s case study (2016), even though the two participants had immigrated to the USA by the time the study was conducted, they had learned English while still in China and Singapore. The stories of these two deaf and hard-of-hearing participants highlight significant individual differences in terms of motivation, learning habits, and the support and learning materials they received. Despite the small sample sizes in both Csizér and Kontra (2020) and Wang et al. (2016), the studies underscore the need for further research into the characteristics of deaf and hard-of-hearing

multilingual learners, particularly those learning English in non-English-speaking countries.

Building on this, Csizér and Kontra (2020) underline that due to their unique language backgrounds and learning experiences, DHH-ELLs-NESC have distinctively different needs, necessities, and expectations. Therefore, they call for effective learning environments that utilize sign languages, as well as tailored learning and teaching strategies and materials to better support these students. This reinforces Sedláčková's (2021) argument for individualized approaches, highlighting the critical need for educational practices that address the diverse characteristics and requirements of deaf and hard-of-hearing learners.

In summary, previous studies suggest that conducting demographic studies with deaf and hard-of-hearing multilingual learners is important for researchers, educators and policymakers to get a better understanding of this group of students. As stated by Domagała-Zyśk et al. (2021),

> a lack of fundamental knowledge about the functioning of this group of learners, as well as a dearth of appropriately adapted teaching materials contribute to a disadvantage in the language education market. (p. xv)

4.2.3 Areas of individual differences among DHH-ELLs-NESC

It is well-documented that deaf and hard-of-hearing students exhibit considerable heterogeneity (Domagała-Zyśk et al., 2021). Accordingly, Sedláčková (2021)

emphasizes the necessity of approaching each student individually. To summarize, it is essential to consider the individual differences in SLA (as discussed by Li et al., 2022b) that apply to deaf and hard-of-hearing learners. Additionally, these differences may be influenced or heightened by factors such as the type and degree of hearing loss, prior language development, preferred communication methods, and educational background (Sedláčková, 2021). The following paragraphs focus on areas of individual difference that might influence deaf and hard-of-hearing students' language learning experiences in the context of ELL-NESC. Please note that some of the main points have been discussed in previous chapters (refer to Chapters 1 and 2). The purpose of these paragraphs is to synthesize these individual difference areas to highlight the necessity for individualized educational strategies that cater to the diverse needs of these learners, ensuring a more effective and inclusive learning environment.

4.2.3.1 Hearing loss

The World Health Organization (WHO, 2021) categorizes degrees of hearing loss into six levels, ranging from mild hearing loss to complete hearing loss. A person can be considered hard-of-hearing with a loss in decibels ranging from 25–70 dB, practically deaf with a loss of 70–90 dB, and profoundly deaf when the loss exceeds 90 dB. Chapter 1 provides a detailed introduction to this classification and describes individuals' hearing experiences at different levels of hearing loss (refer to Section 1.1).

Hearing loss can also be categorized according to the time of its development as either congenital or acquired (Sedláčková, 2016). In this classification, individuals who experience a profound loss of hearing at birth or before the basic development of speech, that is, before the age of two or three, are considered prelingually deaf. Conversely, those who experience hearing loss after speech development are categorized as postlingually deaf (Sedláčková, 2021).

To some extent, hearing loss can be compensated for by technical hearing devices, typically hearing aids and/or cochlear implants. In Chapter 2, there is a detailed discussion of the differences between these two devices (refer to Section 2.1.2.1.2). It is important to note that there is no one-size-fits-all solution. As has been discussed in Chapter 2, deaf and hard-of-hearing people are given different treatments based on their situations. Besides, researchers (Marschark, 2015; Mitchell, 2022; Sedláčková, 2021) emphasize that technical hearing devices cannot turn deaf and hard-of-hearing individuals into people with normal hearing, nor can they be considered an ultimate solution to the challenges of language and literacy development. In other words, deaf and hard-of-hearing people are naturally heterogeneous because they have different experiences with hearing loss and technical hearing devices.

Moreover, Sedláčková (2021) highlights that the heterogeneity of deaf and hard-of-hearing people is based less on the type and severity of one's hearing loss and more on one's means of communication and life experiences. It is well evidenced that a

supportive family environment and early intervention have substantial influences on the skills and abilities essential for language learning (as discussed by Csizér and Kontra, 2020; Wang et al., 2016). Therefore, Sedláčková (2021) states that "the hearing loss itself, in terms of anatomic or physiological structures and functions, says very little about the particular individual's abilities and preferences" (p. 83). Based on this point of view, which is also supported by Mitchell (2022), a study of the demographic characteristics of deaf and hard-of-hearing individuals must also consider their individual preferences and life experiences.

4.2.3.2 First language development

Researchers agree that first language (L1) development is a crucial factor influencing subsequent language learning. Initial experiences with L1 usage led to neural attunement, which significantly impacts SLA (e.g., Mayberry and Kluender, 2018). However, for deaf and hard-of-hearing individuals, developing a first language often presents a complex challenge (Sedláčková, 2021).

Research often treats sign languages as the first language of deaf and hard-of-hearing individuals (see, e.g., Hall, 2017; Hall et al., 2019). However, only deaf children born to deaf parents naturally acquire a sign language as their L1, representing a relatively small group (Marschark et al., 2016). In contrast, many deaf and hard-of-hearing children born to hearing parents may not experience the same process of first language development as their hearing counterparts (Scott and Dostal, 2019). Chapter 2 has reviewed studies on the risk of language deprivation faced by deaf and hard-of-

hearing children due to hearing loss and limited access to languages and communication (Levine et al., 2016). To briefly emphasize,

> Delayed access to language, in spoken or signed form, will lead to negative consequences (especially in the field of complex grammar) that cannot be overcome, no matter how long and intensely a child or adolescent is exposed to first language input later. (Knoors, 2015, p. 21)

Sedláčková (2021) explains that language is a fundamental tool for thinking and understanding both the world and oneself. Language skills are also crucial for socialization, as they facilitate the acquisition of behaviors, knowledge, and the values and culture of one's society (Rydell, 2018). Consequently, varying experiences in first language development result in individual differences in other personal abilities among deaf and hard-of-hearing children.

4.2.3.3 Preferences on languages and means of communication

As discussed in Chapter 2, deaf and hard-of-hearing individuals typically use various means of communication to convey meaning, including sign languages, spoken languages, signed languages, lip/speech reading, writing, typing, speech-to-text technology, and other methods (refer to Section 2.1.2.1). The languages used by deaf and hard-of-hearing individuals are related to their deaf experiences (pre-lingual or post-lingual) (Sedláčková, 2016), self-identification (being Deaf with a capital D) (Mitchell, 2022), and family backgrounds (Scott and Dostal, 2019). Their choice of communication method also depends on the other interaction partners (Sedláčková, 2021). To avoid repetition, refer to Chapter 2 for a more detailed literature review of

studies focusing on the diverse linguistic backgrounds and multilingual repertoires of deaf and hard-of-hearing individuals.

4.2.3.4 Educational differences

In addition to their first language experiences shaped by their family environment, deaf and hard-of-hearing individuals also vary in their educational backgrounds (Mitchell, 2017). Some learners may have been educated in special education schools, while others have attended general education schools. Educational methods also differ; some learners have been taught using the oral method, which emphasizes mastering a spoken language in both its spoken and written forms. Others have been in school environments that primarily support communication through sign language. Additionally, some learners have been educated under the concept of total communication, which utilizes all available expressive and receptive means, including spoken language, visualization, sign language, finger-spelling, speech, reading and writing, gestures, and mime (Sedláčková, 2021). Furthermore, there is the bilingual approach, which recognizes sign languages and spoken languages as having equal status. This method emphasizes the acquisition of a sign language as a natural and fully accessible language for initial communication and socialization, followed by the learning of a spoken language, especially in its written form. Refer to Chapter 2 for a detailed discussion on the bimodal bilingual educational approach (see Section 2.1.2.2.1).

To sum up, all the previously mentioned factors impact the development of language in a deaf or hard-of-hearing individual, making the situation complex. As highlighted by Mitchell (2017), conducting demographic studies with such individuals is not simply a matter of deafness and hearing loss; rather, it involves the complex issue of their personal experiences in various aspects.

4.2.4 Demographic characteristics of deaf and hard-of-hearing students are changing

The previous paragraphs have reviewed the necessity of conducting demographic studies with deaf and hard-of-hearing students. First, as highlighted by Swanwick (2016), there is a lack of demographic data regarding deaf and hard-of-hearing multilingual learners, especially in non-English-speaking countries. Second, such learners are heterogeneous in various aspects, adding more complexity to their language development. Additionally, researchers have found that the demographics of these people are ever-changing, as discussed by Mitchell (2022).

Specifically, as seen in Mitchell and Karchmer (2006) and Mitchell (2022), significant changes have been observed in the demographics of deaf and hard-of-hearing students receiving special education services in the United States. Since students' profiles of ethnicity, intervention, and educational setting are more varied and scattered, not only do certain past conclusions no longer hold, but the nature of student engagement in curriculum, instruction, and evaluation has also altered (Mitchell, 2016).

Chinese deaf and hard-of-hearing students have also experienced demographic changes influenced by medical and technological improvements. In 1999, on the advice of the Central Government, China began the Universal Newborn Hearing Screening (UNHS) project. As part of the UNHS, pre-screenings for hearing aids and cochlear implants are performed on newborns from low-income households through hospital-based programs. By 2010, UNHS had been implemented in 20 of China's 32 provinces. In major cities, 95 percent of infants have been screened. In more remote areas, newborns with high-risk factors for hearing loss are directed to screening facilities within one month of birth. As a result, over 10,000 deaf individuals in China have received cochlear implants since 1995, with 85 percent of the beneficiaries being youngsters under the age of seven (Liang and Mason, 2013). Such progress has further led to changes in the educational sector. Both the formation of classrooms and students' educational needs and expectations have evolved, impacting curriculum design and instructional strategies. According to Silverstri and Hartman (2022), hearing assistive technologies, including hearing aids and cochlear implants, have significantly improved deaf and hard-of-hearing students' access to auditory information in classroom settings. Additionally, by optimizing classroom acoustics, such as managing background noise, hearing assistive technologies benefit both deaf and hard-of-hearing students and hearing students by mitigating listening and concentration fatigue, thus making inclusive education more attainable (Silverstri and Hartman, 2022; White, 2018)

The future for deaf and hard-of-hearing children and deaf education appears promising; however, in reality, with an estimated 19,000 newborns born with severe-to-profound hearing loss, cochlear implantation is currently less than 5% of the pediatric candidate population (Liang and Mason, 2013). For most deaf and hard-of-hearing children who have not had the opportunity to receive cochlear implants or hearing aids, CSL could be the primary mode of communication.

According to Johnson (2004a), one challenge to the education system is the lack of standardization in CSL use in deaf classrooms. Despite efforts since 1959 to standardize the use of "Deaf Sign Language" (Yang, 2002), Signed Chinese or Sign-Supported Chinese remains the most commonly used form of sign language in deaf classrooms (Wang, 2018; Yan, 2012; Yang, 2015). Unlike CSL, the word order in Signed Chinese mirrors that of spoken Mandarin (refer to Section 2.1.2.1.3). Consequently, the use of two different kinds of sign language complicates the communication environment in deaf classrooms. Data collected from 9,583 deaf and hard-of-hearing students across 18 provinces in mainland China illustrates this complexity (Liu, 2013). Specifically, Liu (2013) found that 76.9% of deaf and hard-of-hearing students and 77.3% of teachers were aware of the differences between the sign languages—Signed Chinese or CSL—used among themselves. This variation in language use adds more complexity to language classrooms for deaf and hard-of-hearing students.

As a result, considering the "old" factors (degree of hearing loss, types of hearing loss, family backgrounds, etc.) and "new" features (advancements in hearing assistive technology, multi-modal language use, etc.), the population of deaf and hard-of-hearing students has become more heterogeneous. When deaf and hard-of-hearing students from diverse family backgrounds with different experiences are placed into one classroom, a demographic study becomes essential. This study should consider factors such as the use of technical hearing supports, acceptance of Deaf culture, and communication preferences to demonstrate the unique characteristics of Chinese deaf and hard-of-hearing students and their English language learning experiences.

4.3 Methodology

Previous research on the diversity among deaf and hard-of-hearing multilingual learners has highlighted the varied backgrounds and experiences that impact their learning needs and preferences. It has also underscored the importance of identifying individual preferences to enhance teaching and learning experiences. Inspired by previous studies, I conducted a demographic study with high school and college-level deaf and hard-of-hearing English learners in China. This study is an expanded version of the pilot study reported in Chapter 3. Based on the pilot demographic survey, I modified several questions in the questionnaire and expanded the sample size of the participants.

4.3.1 Participants of this study

A total of 106 participants, including 51 university students and 53 high school students, were invited to take part in this study. However, after data exclusion (refer to Section 6.3.2.3 in Chapter 6 for detailed explanation on this issue), the valid sample size was reduced to 83, consisting of 39 university students and 44 high school students. Since the initial pilot study participants had already graduated, and due to a shortage of Grade 10 students in Wuhan No. 1 Deaf School, I reached out to other deaf high schools. Only one deaf school in Nanjing agreed to participate in the study. Consequently, the 44 high school participants were recruited from this school, which uses the same textbook as Wuhan No. 1 Deaf School. The 39 university students were from University A. The School of Special Education at University A offers English courses specifically designed for deaf and hard-of-hearing students, using the "New Concept English" series as their textbooks.

4.3.2 Design of the questionnaire

The questionnaire was designed based on the pilot demographic questionnaire in Chapter 3 (provided in Appendix II), with modifications to better suit the educational context. It consisted of three parts, focusing on participants' demographic information, communication habits and preferences, and experiences of learning English. The following paragraphs provide a brief introduction to the design of the questions in each part. Additionally, the full questionnaire is provided in Appendix III.

To ensure participants fully understood the questions, the questionnaire was written in both English and Chinese. It was distributed through the Jisc. Online Survey platform. For ethical considerations, participants were required to agree to the consent form before answering the questions. The consent form was attached to the questionnaire on the platform. The participants needed to read each statement carefully and choose "Yes" if they agreed to participate. If a participant chose "No" for any of the questions in the consent form, the questionnaire would immediately skip to the final page, and no personal data would be collected.

4.3.2.1 Demographic information

This part collected participants' data, including their age, gender, and educational level. Regarding hearing loss, the participants were asked to provide information about the degree of their hearing loss in each ear, their self-identification as being Deaf, hard-of-hearing, or hearing impaired, and their family history of hearing loss. The participants also needed to answer questions about their experiences with technical hearing devices, including the age of intervention, the types of hearing devices they used, and the estimated hours of device usage. Concerning language backgrounds, participants were asked if they were prelingually deaf (lost their hearing before the age of three) or postlingually deaf. If the participants were postlingually deaf, there were further questions to determine whether they had acquired some level of speaking skills or literacy skills in a spoken language.

4.3.2.2 Communication preferences and habits

This part of the questionnaire asked participants about their individual preferences and habits regarding language use when communicating with different people. Several modifications were made to the questions in this section of the expanded demographic questionnaire, based on the pilot version.

4.3.2.2.1 Participants' preferences and habits on the language(s) used in communications

In the original pilot version, there were questions asking participants whom they would prefer to communicate with when they encountered difficulties in everyday activities and learning, and what language(s) they would use when communicating with this person. To ensure clarity, these questions were modified. The ranking question, "How often would you communicate with this group of people and try to seek help from them when you have difficulties in everyday activities/English learning?" was changed to a Likert scale question: "When you have difficulties in learning English, you will seek help from whom?" ranging from never to always.

Additionally, instead of asking, "How do you communicate with the person who ranks first in the last question? Please tick any that apply", the expanded demographic questionnaire now asks, "How do you communicate with your teacher/deaf friends/other hearing people?" Originally, the question about participants' language use in communication was a multiple-choice question where participants chose any language modalities that fit their situation. In the expanded version, this became a 5-

point Likert scale question, where the participants reported the frequency of each language modality used in communication, ranging from never to always. This modification was made because, in the pilot study, the original question only asked participants to identify the language modalities they would use but did not capture the frequency of their use. For example, one participant selected CSL, spoken language, and lip reading; however, this response did not indicate how often the participant used each modality or which one was their primary mode of communication. Therefore, in the expanded questionnaire, participants were asked to indicate the frequency of their use of each communication mode, resulting in more detailed data. Additionally, the original questionnaire only focused on the communication methods currently in use, without considering the modalities that deaf and hard-of-hearing participants might prefer (as discussed in Section 3.2.3.2). To address the limitations identified in the pilot demographic study, the revised questionnaire distinguished between two questions: “How do you communicate with XXX?” (“你如何和 XX 交流?”) and “What is/are your preferred way(s) to communicate with XXX? Please select all that apply.” (“你更喜欢用什么方式与 XXX 交流?可多选。”). This modification not only corrected that oversight but also allowed for an investigation into whether the participants’ current communication methods and those used by their partners aligned with the participants’ expectations and needs.

4.3.2.2.2 Measurement of communication quality

The second modification made in this part of the questionnaire was the scale used to evaluate the quality of communication between deaf and hard-of-hearing participants

and their teachers. Originally, the pilot demographic study used the Quality of Communication Questionnaire designed by the University of Washington School of Medicine. However, since this measurement was intended to evaluate the quality of end-of-life communications, it was thought to be unsuitable for this study. Therefore, to better fit into the educational context of this study, the Student Communication Satisfaction Scale (SCSS) designed by Goodboy, Martin, and Bolkan (2008) was adopted.

The SCSS uses a 7-point Likert-type format, ranging from (1) strongly disagree to (7) strongly agree, with 24 items. However, considering that this demographic study might have taken longer to complete than expected, the short SCSS, with eight items taken from the original form, as recommended by the authors (Goodboy et al., 2008), was used. The validity and reliability of the short version have been tested by the researchers (e.g. Boztepe, 2017).

4.3.2.3 Experiences of learning English

This section of the questionnaire addresses participants' experiences of learning English in China. It begins with several questions about whether the participants had learned English before experiencing hearing loss and how many years they have studied English. They were also asked to give their reasons for learning English. The primary focus of this section was on the participants' perceived difficulty levels in learning English literacy skills, including grammar, vocabulary recognition, vocabulary spelling, reading comprehension, and writing. Additionally, there was a

ranking question asking students to rank the literacy skills they believed they had mastered the best. Finally, the participants were asked if they had access to English learning resources outside the classroom.

4.4 Data and results

The questionnaire data was analyzed using SPSS. To address the research questions, the data analysis specifically focused on the demographic characteristics of the deaf and hard-of-hearing participants, their multi-modal communication preferences, their evaluation of communication with their teachers, and their experiences of learning English in China.

4.4.1 Demographic information of the participants

The following paragraphs report data about the participants' demographic information, including gender, self-identification, degrees of hearing loss in each ear, language background, and experiences with technical hearing devices such as hearing aids and cochlear implants.

Ultimately, the data analysis included a total of 83 samples, comprising 44 samples from the high school group and 39 from the university group. As demonstrated in Table 4.1, in the university group, there were 17 male, and 19 female students, and three participants opted not to disclose their gender. In the high school group of 44 participants, there were 13 males, 28 females, and three who chose not to disclose their gender.

Table 4.1 Gender of the participants in the expanded demographic study

Categories		High School (Total: 44)	University (Total:39)
Gender	Male	13	17
	Female	28	19
	Prefer not to say	3	3

An overview of the participants' demographics is presented in the following Table 4.2. The participants exhibited considerable heterogeneity in aspects related to hearing loss, including differences in self-identification, degrees of hearing loss, language backgrounds, and experiences with technical hearing devices.

Table 4.2 Self-identification, degrees of hearing loss, language backgrounds, and experiences with technical hearing devices of the participants in the expanded demographic study

Categories		High School (Total: 44)		University (Total:39)	
Self-identification	Deaf	28		23	
	Hard-of-Hearing	2		0	
	Hearing Impaired	14		16	
		High School (Total: 44)		University (Total:39)	
Degree of hearing loss		Left Ear	Right Ear	Left Ear	Right Ear
Normal hearing		1	1	0	0
Mild hearing loss (26 to 40 dB HL)		1	1	0	1
Moderate hearing loss (41 to 55 dB HL)		4	6	3	3
Moderate severe hearing loss (56 to 70 dB HL)		7	6	2	0
Severe hearing loss (71 to 90 dB HL)		12	12	13	15
Profound hearing loss (91+ dB HL)		19	18	21	20
Language background		High School (Total: 44)		University (Total:39)	
Before I acquired language.		19		18	
After I acquired language: I could speak before my hearing loss.		8		9	
After I acquired language: I could read and		17		12	

write before my hearing loss.						
Experience with technical hearing devices			High School (Total: 44)		University (Total:39)	
Don’t have technical hearing devices			13	29.5%	12	30.8%
Have technical hearing devices	Number of students		31	70.5%	27	69.2%
	Estimated wearing hours		Mean	SD	Mean	SD
			13.70	4.489	10.23	3.829
	Only hearing aids (HA)	Left ear	3	6.8%	2	5.0%
		Right ear	2	4.5%	3	7.5%
		Both ears	15	34.1%	16	40.0%
	Only cochlear implants (CI)	Left ear	3	6.8%	1	2.5%
		Right ear	4	9.1%	2	5.1%
		Both ears	2	4.5%	1	2.5%
	HA is in the left ear, while CI is in the right ear		2	4.5%	2	5.0%
	HA is in the right ear, while CI is in the left ear		0	0	0	0

Regarding self-identification, 23 out of 39 (59%) identified as Deaf, while 16 out of 39 (41%) identified as hearing impaired. Similarly to university students, 28 out of 44 (63.6%) identified as Deaf, while 14 out of 44 (31.8%) identified as hearing impaired, and two out of 44 (4.5%) identified as hard-of-hearing[16]. At least 60% of university students and 60.3% of high school participants acknowledged sign language as their first language.

The degree of hearing loss in the university group ranged from moderate to profound in the left ear and mild to profound in the right ear. Specifically, in the left ear, 53.8%

[16] As discussed in Chapter 3, the terms “deaf”, “hard-of-hearing”, and “hearing impaired” carry different implications in English. While both “deaf” and “hearing impaired” denote individuals with varying degrees of hearing loss, the term "impaired" suggests a disability and a sense of being different from others. The term “hard-of-hearing” usually refers to having a “hearing loss from mild to severe range” (Marschark and Spencer, 2009, p. xiii). In Chinese, “hard-of-hearing” is translated as “听力困难”, which means having difficulties in hearing, while “hearing impaired” is translated as “(重度)听力障碍”, which indicates a severe to profound level of hearing disabilities. Currently, there are no official documents in China discussing the difference between “hard-of-hearing” and “hearing impaired”. However, according to the translations, the main difference between the two terms relates to the severity level of hearing loss.

had profound loss, 33.3% severe, 5.1% moderate to severe, and 7.7% moderate. In the right ear, 51.3% had profound loss, 38.5% severe, 7.7% moderate, and 2.6% mild. Although the university group displayed heterogeneity in hearing loss, the high school group's data indicated an even more complex picture. In the high school group, degrees of hearing loss in both ears spanned from normal to profound. In the left ear, 43.2% had profound loss, 27.3% severe, 15.9% moderate to severe, 9.1% moderate, 2.3% mild, and 2.3% had normal hearing. In the right ear, there were 40.9% with profound loss, 27.3% severe, 13.6% moderate to severe, 13.6% moderate, 2.3% mild, and 2.3% with normal hearing.

Both groups showed that most participants had severe-to-profound hearing loss in both ears, but individual differences existed. For instance, "ydljdz089"[17] had profound hearing loss in the left ear but mild loss in the right ear. The high school group displayed even more diversity, ranging from normal hearing to profound loss. For example, "gzydlj002" had profound hearing loss in the right ear but normal hearing in the left. In a similar vein, despite "gzydlj006" having moderate severe hearing loss in her left ear, she had normal hearing in the right. Not only that, "gzydlj044", having only mild hearing loss in both ears, attended a deaf school and was identified as hearing impaired.

[17] Please refer to Chapter 6 for the coding of the participants.

Differences in the levels of hearing loss resulted in diverse experiences with technical hearing devices among participants. Approximately 70% of both university and high school group participants reported wearing such devices. High school participants reported an estimated average of 13.70 hours of device usage, while university participants reported 10.23 hours.

The types of hearing devices varied among students. Specifically, in the university group, 21 out of 39 students used hearing aids, with 16 using them in both ears, two only in the left ear, and three only in the right ear. Additionally, four university students utilized cochlear implants, with one using them in both ears, one only in the left ear, and two only in the right ear. Two students had a hearing aid in the left ear and a cochlear implant in the right ear. In the high school group, 20 out of 44 students wore hearing aids, with 15 using them in both ears and three only in the left ear. Nine high school participants utilized cochlear implants, with two in both ears, three only in the left ear, and four only in the right ear. One high school student used a hearing aid in the left ear and a cochlear implant in the right ear.

Regarding language background, the chart illustrates that 18 university students and 19 high school students experienced hearing loss before acquiring a language. Among the 39 university students, nine had learned to speak, and 12 had, to some extent, acquired literacy skills in Chinese. In the high school group, eight were able to speak, and 17 had learned how to read and write in Chinese. In essence, 22 university

students and 25 high school students fell into the post-lingual deafness category, while 18 university students and 19 high school students were prelingually deaf. It should be noted that this finding contradicts participants' self-identifications, as most deaf and hard-of-hearing students identified as Deaf. According to the World Federation of the Deaf (2016), being Deaf involves sign language as the first language. The fact that many Deaf and hard-of-hearing students had prior knowledge of Chinese but still identified sign language as their first language underscores the complexity of the language background for this group.

4.4.2 Multi-modal communication preferences of the participants

The deaf and hard-of-hearing students in this study exhibited varied preferences in communication modalities. Table 4.3 below presents the responses to the question: What is your preferred way to communicate with teachers/deaf and hard-of-hearing individuals/other hearing persons? (你更喜欢用什么方式跟你的英语老师/聋人/听人交流？可多选). This question asks participants about the language modalities they would like to use in communication. Given that these were multi-answer questions, the numbers represent the percentage of respondents who selected each answer option (e.g., 100% would indicate that all respondents chose that option).

Table 4.3 Language modalities that the participants would like to use in communications in the expanded demographic study.

	High school (% out of 44)			University (% out of 39)		
	teachers	deaf and hard-of-hearing partners	hearing partners	teachers	deaf and hard-of-hearing partners	hearing partners

Sign language	77.3	84.1	47.7	87.2	97.4	46.2
Spoken language	59.1	59.1	61.4	56.4	51.3	59.0
Body language and gestures	13.6	22.7	15.9	38.5	51.3	38.5
Lip-reading	34.1	36.4	29.5	35.9	43.6	33.3
Signed language	43.2	36.4	15.9	51.3	56.4	38.5
Writing	47.7	40.9	56.8	51.3	48.7	53.8
Typing	31.8	36.4	45.5	43.6	53.8	76.9

*Please note that in this question, participants were asked to pick any language modalities that align with their individual preferences.

As demonstrated by Table 4.3, multi-modal communication preferences among high school students were evident. When engaging with teachers and individuals who were deaf or hard-of-hearing, sign language emerged as the predominant choice (77.3% and 84.1%, respectively), followed by spoken language and writing. However, the prominence of sign language diminished when communicating with hearing individuals. In such cases, high school students exhibited a shift in preferred language modalities, with spoken language (61.4%) taking precedence, followed by written language (56.8%), and then sign language (47.7%). This underscores the adaptable communication choices made by high school students in this specific study.

Comparatively, in the university group, the data revealed a different pattern in communication preferences. When interacting with teachers, sign language (87.2%) was the preferred mode, followed by spoken language (56.4%), signed language

(51.3%), and writing (51.3%). When engaging with deaf and hard-of-hearing individuals, sign language (97.4%) continued to be the predominant choice, accompanied by signed language (56.4%) and typing (53.8%). Interestingly, the exclusive preference for sign language diminished when participants communicated with hearing individuals. In these instances, typing (76.9%) emerged as the favored mode, followed by speaking (59.0%) and writing (59.8%), mirroring the communication preferences observed among high school students.

Apart from examining the language modalities preferred by deaf and hard-of-hearing students, the study also employed a series of 5-point Likert scale questions, ranging from "1-never" to "5-always", to investigate the actual language modalities used by the deaf and hard-of-hearing participants when communicating with their teachers, other deaf and hard-of-hearing individuals, and hearing individuals. The participants' responses to the question: How do you communicate with your teachers/deaf and hard-of-hearing friends/other hearing people? (你如何与你的老师/聋人朋友/听人交流?) is demonstrated in the following Table 4.4.

Table 4.4 Language modalities used by the participants in the expanded demographic study

High school (total: 44)						
	Modes	Mean	SD.	Modes	Mean	SD.
With teachers	Sign language	3.61	1.333	Signed language	3.34	1.346
	Spoken language	3.52	1.470	Writing	3.68	1.308
	Body language and gestures	2.89	1.333	Typing	3.39	1.434
	Lip-reading	3.14	1.391			

High school (total: 44)						
	Modes	Mean	SD.	Modes	Mean	SD.
With deaf and hard-of-hearing partners	Sign language	3.98	1.131	Signed language	3.23	1.217
	Spoken language	3.36	1.382	Writing	3.52	1.131
	Body language and gestures	2.98	1.355	Typing	3.66	1.140
	Lip-reading	2.93	1.301			
With hearing partners	Sign language	2.50	1.455	Signed language	2.57	1.453
	Spoken language	3.70	1.357	Writing	3.43	1.246
	Body language and gestures	2.23	1.309	Typing	3.66	1.346
	Lip-reading	3.05	1.462			
University (Total: 39)						
	Modes	Mean	SD.	Modes	Mean	SD.
With teachers	Sign language	3.85	1.309	Signed language	3.51	1.233
	Spoken language	3.15	1.348	Writing	3.56	1.410
	Body language and gestures	3.15	1.309	Typing	3.56	1.392
	Lip-reading	3.03	1.367			
With deaf and hard-of-hearing partners	Sign language	4.23	1.135	Signed language	3.36	1.088
	Spoken language	3.00	1.318	Writing	3.23	1.366
	Body language and gestures	3.41	1.229	Typing	3.56	1.334
	Lip-reading	3.08	1.285			
With hearing partners	Sign language	2.21	1.080	Signed language	2.33	1.060
	Spoken language	3.03	1.386	Writing	3.62	1.350
	Body language and gestures	2.64	1.063	Typing	4.31	.950
	Lip-reading	2.72	1.276			

Specifically, in the high school group, when interacting with teachers, the most frequently used language was sign language, followed by writing and spoken language. However, in response to the question about their preferred communication modalities, participants expressed a greater willingness to use spoken language over

writing. This difference suggests that high school participants desire to speak more to their teachers, although this intention has not yet materialized.

Similarly, when communicating with deaf and hard-of-hearing individuals, the most frequently used language modality is sign language, followed by typing and writing, while the preferred sequence is sign language, spoken language, and typing. When communicating with hearing individuals, the preferred sequence of spoken language, writing, and sign language is not fully reflected in communications; the sequence of language modalities used in communications is spoken language, typing, and writing.

Similar discrepancies were observed in the university group. In interactions with teachers, although the most preferred modalities were sign language, spoken language, signed language, and writing, spoken language was not used that frequently by the participants. When engaging with deaf and hard-of-hearing individuals, the preferences were for sign language, signed language, and typing; however, in reality, they employed sign language, typing, and body language/gestures. In situations involving communication with hearing individuals, even though the most preferred modalities were typing, spoken language, and writing, university deaf and hard-of-hearing participants tended to use writing more frequently than speaking.

To enhance clarity, Table 4.5 illustrates the disparities between participants' most preferred language modalities and the language modalities most frequently used by them.

Table 4.5 Disparities between the most preferred language modalities and the language modalities most frequently used by the participants in the expanded demographic study

		High school			University		
		1st place	2nd place	3rd place	1st place	2nd place	3rd place
With teachers	Preferred	Sign lang.	Spoken lang.	Writing	Sign lang.	Spoken lang.	Writing, Signed lang.
	Used	Sign lang.	Writing	Spoken lang.	Sign lang.	Writing, Typing	Signed lang.
With deaf and hard-of-hearing partners	Preferred	Sign lang.	Spoken lang.	Writing	Sign lang.	Signed lang.	Typing
	Used	Sign lang.	Typing	Writing	Sign lang.	Typing	Body lang. and gestures
With hearing partners	Preferred	Spoken lang.	Writing	Sign lang.	Typing	Spoken lang.	Writing
	Used	Spoken lang.	Typing	Writing	Typing	Writing	Spoken lang.

*Note: please be aware that due to the limited spaces, “lang.” in this chart is the abbreviation of “language”.

In conclusion, the data from this study reveals that deaf and hard-of-hearing students employed a variety of communication modalities when interacting with different groups. While sign language emerged as the predominant choice when communicating with teachers and other hearing-impaired individuals, it was not the exclusive option. Alongside sign language, participants frequently utilized spoken language, writing, typing, and signed language. This adaptability suggests that the

students in this study had acquired essential literacy skills, enabling them to write and type in Chinese. Additionally, given that most participants were using technical hearing devices, their ability to speak also implies a certain level of understanding of the sound system in spoken language.

The findings from the present study indicated that the deaf and hard-of-hearing participants purposefully employed multi-modal languages to facilitate communication in varied situations. For instance, while sign language played a central role in their interactions with teachers and other hearing-impaired individuals, the participants adapted their communication language when faced with hearing individuals who might be unfamiliar with sign language. This discovery underscores the practicality of incorporating multi-modal resources in educational settings to address the diverse linguistic requirements of students.

4.4.3 Quality of communication

Tables 4.6 and 4.7 present the data on student-teacher quality of communication as evaluated by high school and university participants using the short version of the SCSS. As introduced in the methodology section (refer to Section 4.3.2.2.2), the short version of the SCSS uses a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In this scale, Items 2 and 3 are negatively worded, so a higher mean score indicates a lower level of dissatisfaction. The reliability of the scale was tested, yielding a Cronbach's Alpha of 0.840 for the high school group and 0.917 for the university group.

Table 4.6 SCSS with the university participants in the expanded demographic study

University (Valid: 39)	Mean	Std. Deviation	Skewness	
			Statistics	Std. Error
1. My communication with this person feels satisfying	5.05	1.276	-.981	0.378
*2. I dislike talking with this person	5.44	1.373	-.875	0.378
*3. I am not satisfied after talking to my teacher	5.00	1.504	-.342	0.378
4. Talking with my teacher leaves me feeling like I accomplished something	4.62	1.115	-.246	0.378
5. My teacher fulfils my expectations when I talk to him/her	4.56	1.165	-.847	0.378
6. My conversations with my teacher are worthwhile	5.03	1.267	-.787	0.378
7. When I talk to my teacher, the conversations are rewarding	5.21	1.361	-.723	0.378
8. My teacher makes an effort to satisfy the concerns I have	4.92	1.365	-.706	0.378

As indicated by Table 4.6, university participants generally expressed satisfaction with their communication with their teachers. For instance, participants felt that their communication was satisfying (Mean = 5.05) and rewarding (Mean = 5.21). The negatively worded items, “I dislike talking with this person” (Mean = 5.44) and “I am not satisfied after talking to my teacher” (Mean = 5.00), also have high mean scores, indicating low levels of negative evaluation. Standard deviations range from 1.115 to 1.504, showing some variability in responses. Additionally, the skewness values were negative, suggesting that responses were generally skewed toward higher (positive) values.

Table 4.7 SCSS with the high school participants in the expanded demographic study

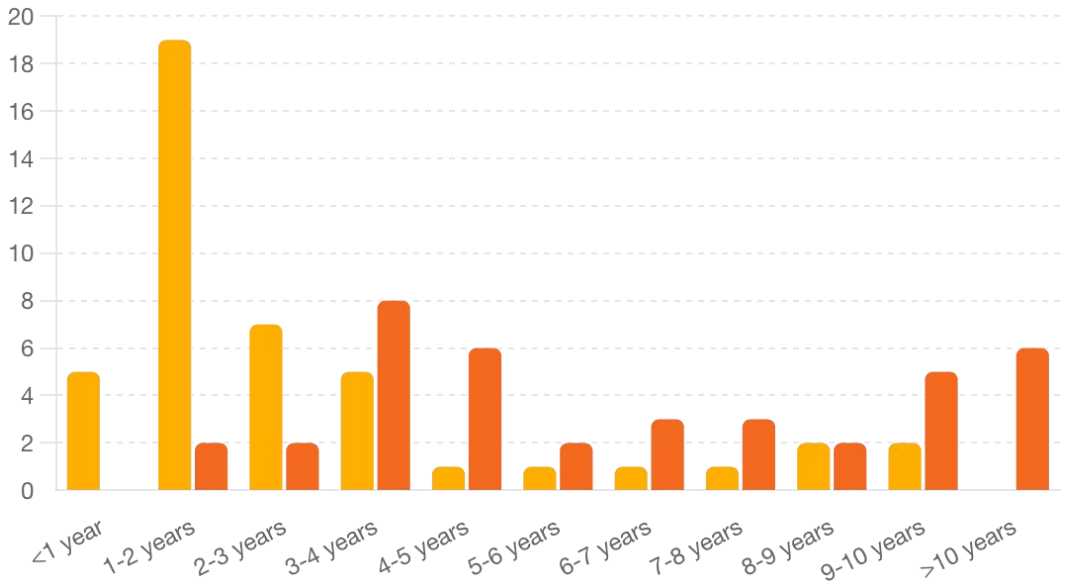
High school (Valid: 44)	Mean	Std. Deviation	Skewness	
			Statistics	Std. Error
1. My communication with this person feels satisfying	5.48	1.320	-.266	0.357
*2. I dislike talking with this person	5.18	1.821	-.767	0.357
*3. I am not satisfied after talking to my teacher	5.41	1.647	-.732	0.357
4. Talking with my teacher leaves me feeling like I accomplished something	4.73	1.744	-.304	0.357
5. My teacher fulfils my expectations when I talk to him/her	5.00	1.431	-.399	0.357
6. My conversations with my teacher are worthwhile	5.00	1.555	-.233	0.357
7. When I talk to my teacher, the conversations are rewarding	5.36	1.542	-.689	0.357
8. My teacher makes an effort to satisfy the concerns I have	4.95	1.584	-.400	0.357

Similar results were found with high school participants (refer to Table 4.7). With a mean score of 5.48 for Item 1 and a mean score of 5.36 for Item 7, high school participants evaluated their communication with teachers as being satisfying and rewarding. Mean scores for Items 4, 5, 6, and 8 were also high, indicating that high school participants generally agreed that their communication with teachers was worthwhile and met their expectations. The standard deviations ranged from 1.320 to 1.821, indicating some variability in responses, while the skewness values were negative, suggesting that responses were generally skewed toward higher (more positive) values. Comparing the data from university and high school participants, it emerged that high school participants demonstrated slightly higher satisfaction levels in their communication with teachers compared to university participants.

4.4.4 Experiences of Learning English

The participants in this study possessed diverse experiences in learning English, with their total years of English learning spanning from less than one year to over 10 years. The figure below (Figure 4.1) illustrates the distribution of participants based on the duration of their English learning. In the chart, the X-axis represents the years of learning English, the Y-axis represents the number of participants, the lighter color histogram represents the high school group, and the darker color histogram represents the university group.

Figure 4.1 Distribution of English learning experience of high school and university participants in the expanded demographic study



As indicated by Figure 4.1, the university group exhibited even greater diversity in English learning experience compared to the high school group. This phenomenon was attributed to the admission process of universities. University A participating in this survey admitted deaf and hard-of-hearing high school graduates nationwide. As

noted by Johnson (2004a), deaf schools across China can independently decide whether to offer English courses based on their teaching resources. Therefore, given the varying circumstances regarding the provision of English courses in deaf schools throughout China, there was a significant disparity in the English learning backgrounds of the university deaf and hard-of-hearing students. Most high school participants in this study had learned English for 1-2 years, with individual differences also existing in the group.

In alignment with the findings from the pilot demographic study, deaf and hard-of-hearing students expressed the view that English writing and reading comprehension posed greater challenges compared to vocabulary and grammar. Using a 6-point Likert scale, ranging from "1-very easy" to "5-very difficult and I need extra support from my teacher", the participants evaluated their perceived difficulty levels in learning English literacy skills. Table 4.8 illustrates that the mean perceived difficulty of English reading comprehension in the university group was 4.26, while the mean perceived difficulty in the high school group was 3.66. This outcome suggests that university participants faced even greater challenges in English reading comprehension compared to their counterparts in high school.

Table 4.8 Participants' perceived difficulty level in learning English literacy skills in the expanded demographic study

	High school		University	
English literacy skills	Mean	SD	Mean	SD
English grammar	3.39	1.205	4.08	1.244
English vocabulary recognition	3.02	1.171	3.21	1.174
English vocabulary spelling	2.73	1.169	3.33	1.325
English reading comprehension	3.66	1.380	4.26	1.371
English writing skills	3.82	1.419	4.49	1.295

As suggested by previous studies (e.g., Perfetti and Stafura, 2014; Perfetti. 2017), reading comprehension relies, to a considerable extent, on knowledge of words. To investigate whether the participants' perceived difficulty with reading comprehension is correlated with their perceived difficulty level of learning vocabulary, I conducted a correlation analysis based on their responses to the question: How do you feel about learning English reading comprehension/vocabulary spelling/vocabulary recognition? (在学习英语阅读理解/英语单词拼写/英语词汇时，你的感受是？)

Table 4.9 Correlation analysis between the participants' perceived difficulty level of English reading comprehension and vocabulary

		High school	University
English vocabulary recognition	Pearson Correlation	.566**	.686**
	Sig. (2-tailed)	<.001	<.001
English vocabulary spelling	Pearson Correlation	.547**	.647**
	Sig. (2-tailed)	<.001	<.001

The correlation analysis in Table 4.9 reveals a significant positive relationship between participants' perceived difficulty with English reading comprehension and their perceived difficulty with vocabulary recognition and spelling. For high school participants, the Pearson correlation coefficient between reading comprehension and vocabulary recognition was 0.566 ($p < 0.001$), and between reading comprehension and vocabulary spelling was 0.547 ($p < 0.001$).

For university participants, the correlation between reading comprehension and vocabulary recognition was even stronger, with a Pearson correlation coefficient of 0.686 ($p < 0.001$). The correlation between reading comprehension and vocabulary spelling was 0.647 ($p < 0.001$). These results suggest that the university participants who found vocabulary recognition and spelling more difficult also tended to find reading comprehension more challenging. Overall, these significant correlations underscore the importance of vocabulary knowledge in the development of reading comprehension skills.

In summary, the participants exhibited considerable diversity in their demographic information, communication preferences, and English learning experiences. Regarding learning English as an additional language in China, they perceived more challenges in writing and reading comprehension. The correlation analysis indicates that, for the university group, vocabulary recognition and spelling have a stronger

relationship with their perceived difficulty in reading comprehension. In the high school group, although the relationship is not as robust as in the university group, vocabulary still plays a significant role in English reading comprehension.

4.5 Discussion

Compared to the pilot study, this expanded demographic study further demonstrates the heterogeneity of the deaf and hard-of-hearing participants at both high school and university levels. The participants in this study showed significant variations in their levels of hearing loss, language backgrounds, and experiences with technical hearing devices. This result suggests that educational settings, at least the schools of the participants, do not treat the severity of deafness as a criterion for student placement. Upon reviewing the student recruitment policies of these schools, it was found that both the high school and the university required students to submit their hearing test reports for registration. However, none of the schools mentioned that these reports are considered in student placement decisions.

Second, the results of this study further prove that deaf and hard-of-hearing participants are multilingual and flexible in using different language modalities in various communication situations. The differences between the languages used by the hard-of-hearing participants and the languages they would prefer to use suggest that their language abilities, especially spoken language abilities, may be underestimated. For example, participants in this study demonstrated a willingness to speak to their teachers and hearing people. However, when they communicate, the most frequently

used language modalities remain sign language, writing, and typing. Although this study does not focus on how the language abilities of deaf and hard-of-hearing individuals are underestimated, it would be interesting to explore this issue further in future research.

Third, the participants in this study reported higher satisfaction with the quality of communication with their teachers compared to the pilot study. One possible reason for this improvement could be the increased use of technical hearing devices among the participants. As demonstrated by data of this study, comparing to the participants in the pilot demographic study, nearly 60% deaf and hard-of-hearing participants in this study used technical hearing devices, which made acoustic information more accessible to them. Given that this study was not centered on investigating factors that could be influential to the quality of communication between deaf and hard-of-hearing students and their teachers, it would be beneficial to conduct further studies to delve into this topic in the future.

Finally, in terms of English language learning, the participants exhibited diverse backgrounds. However, both high school and university participants reported difficulties in English reading comprehension. Additionally, their perceived difficulty in reading comprehension was closely linked to challenges in English vocabulary, highlighting the crucial role that vocabulary plays in reading comprehension.

In summary, the results of this study provided a framework of the demographic characteristics and language preferences of Chinese deaf and hard-of-hearing English learners. This finding raises questions about teachers' attitudes and teaching practices in response to this heterogeneity. To explore this further, a semi-structured interview study was conducted with a group of English teachers of deaf and hard-of-hearing students in China (refer to Chapter 5).

Chapter 5 Teaching English to Deaf and Hard-of-hearing Students: Semi-structured Interviews With Teachers

This chapter reports on the data and findings of a series of semi-structured interviews with four English teachers of deaf and hard-of-hearing students in China. As shown in previous chapters (see Chapters 3 and 4), deaf and hard-of-hearing students vary significantly in terms of their degrees of hearing loss, language backgrounds, experiences with technical hearing devices, multi-modal multilingual preferences, and experiences of English language learning. This heterogeneity raises a question about how teachers address and respond to their students' diverse characteristics and needs in learning English in a non-English-speaking country.

This chapter begins with a summary of the findings from the demographic studies (refer to Section 5.1.1) and introduces the training backgrounds of teachers of deaf and hard-of-hearing students in China. The second part of this chapter examines theories of teachers' beliefs and attitudes, along with previous studies on how teacher training backgrounds influence their attitudes and responses to students' diverse needs. The methodology section provides information on the respondents and the design of the semi-structured interviews, followed by a detailed report of the research data. The conclusion section discusses the possible reasons for the mismatch between the teachers' responses and the children's diverse needs and calls for a more systematic teacher training program for subject teachers in deaf education in China.

5.1 Introduction

This section outlines the rationale and focus of the study. It begins with a brief overview of the findings from demographic studies involving deaf and hard-of-hearing students. The second part provides an overview of the current training backgrounds of teachers who teach English to deaf and hard-of-hearing students in China. The final part of the section discusses the objectives of the study.

5.1.1 Results from the demographic studies

Results of the demographic studies demonstrate heterogeneous characteristics of the deaf and hard-of-hearing participants, indicating that this group of students has diverse needs in language classrooms (refer to Chapters 3 and 4 for a detailed discussion of the two demographic studies). These studies reveal that the participants use multi-modal means of communication flexibly when interacting with different individuals. In terms of learning English as an additional language, the participants enter the classroom with varied English learning backgrounds, indicating that their knowledge of the language may not be on par with their classmates. Additionally, the participants reported that English reading comprehension is the most challenging aspect of learning, suggesting they might need extra help in this area.

Conducting semi-structured interviews with the English teachers of deaf and hard-of-hearing students is crucial for several reasons. First, these interviews provide insights into how teachers perceive and address the diverse needs of their students, offering a

different perspective from that of the students themselves (refer to Section 3.1.2). Understanding the strategies and approaches that teachers use to accommodate varying levels of language proficiency and different communication preferences is essential for identifying gaps in current teaching practices and determining where additional support and resources may be needed. These insights complement the responses from the demographic questionnaires, ensuring a comprehensive understanding of the educational environment and informing targeted interventions to improve the learning experiences of deaf and hard-of-hearing students.

Furthermore, the demographic studies highlighted that deaf and hard-of-hearing students employ a range of communication methods, including sign language, lip reading, and written communication. Thereby raises a question in terms of how teachers manage and integrate these different communication modalities in their teaching practices. By conducting semi-structured interviews, it is possible to explore the extent to which teachers are trained and prepared to manage diversity in the communication and learning needs of their students.

In conclusion, the demographic studies underscore the necessity of understanding the complex and varied needs of deaf and hard-of-hearing students in English language classrooms. Conducting semi-structured interviews with their teachers is a vital tool for uncovering the methods and practices currently in use. Additionally, identifying gaps in teacher training may contribute to the development of more effective

educational strategies and support systems.

5.1.2 Teacher training for teachers with deaf and hard-of-hearing students

The purpose of teacher preparation programs is to foster the development of the knowledge and abilities that teachers require to cooperate with specialists, families, and society to educate a varied population of students (Cannon and Luckner, 2016). As defined by Cannon and Luckner (2016), such attitudes, knowledge and abilities require teachers of deaf and hard-of-hearing students, especially those students who are multilingual learners, to be aware of their students' cultural differences, personal needs and language backgrounds, and to be able to conduct effective instruction, accordingly. Johnson (2004b; 2013) mentions that the competencies that teachers of deaf and hard-of-hearing students should demonstrate are not limited to speech and language abilities but also address curricula and pedagogical skills. In other words, in the context of this study, English teachers of Chinese deaf and hard-of-hearing students need to be competent in language skills to communicate with this group of students, as well as have knowledge of SLA in the context of ELL-NESC and pedagogical skills.

Based on the statistical data provided by the Ministry of Education of the People's Republic of China (2022), by the end of 2021, the total number of full-time teachers in special education schools was 66,169. Among these, 1,566 teachers held master's degrees, and 36,180 had bachelor's degrees. Furthermore, 52,043 out of the 66,169

teachers had received training in special education (Ministry of Education of the People's Republic of China, 2022). Chapter 1 reviewed the professional standards for special education teachers (refer to Section 1.2.2.2). Specifically, teachers working in special education settings, including deaf schools, are expected to demonstrate competence in three key areas: theoretical knowledge and moral standards, professional knowledge, and professional skills (Ministry of Education, 2015). However, a doctoral study by Li (2015) has concluded that the current teacher training programs for special education majors do not meet the competency standards for qualified deaf education teachers.

According to Li (2015), the special education program in China currently treats deaf education as a subdivision within special education teacher training. Other subdivisions at the same level as deaf education include education for visually impaired students, education for students with intellectual disabilities, and education for children with autism (Ministry of Education of the People's Republic of China, 2022). In other words, under this special education program, deaf education is often integrated into the broader special education framework rather than being treated as a distinct field requiring specialized training.

Taking the Central China Normal University's (CCNU) teacher training program in special education as an example (selected because the only respondent in this study majoring in special education obtained her bachelor's degree from this university), the

program's module plan outlines three categories of courses offered to student teachers: general mandatory public courses, such as College English, which are compulsory for all college students regardless of their major; major compulsory courses, such as Theories in Special Education, required for all students majoring in special education; and major elective courses, which students majoring in special education can choose based on their areas of interest (CCNU, 2015).

According to CCNU (2015), courses related to deaf education fall under the category of major elective courses. According to the university's graduation requirements, special education majors must earn a total of 130 credits to graduate, including 25 credits from major elective courses. However, these elective courses are only available during the second and third years of the four-year bachelor's program. Of the 25 major elective courses, only four are directly related to deaf education: Sign Language (Levels 1 and 2), Psychology and Education of Children with Hearing Impairment, and Speech-Language Pathology. In other words, for teachers graduating from the special education teacher training program at CCNU, it cannot be guaranteed that all of them have received systematic training in deaf education before beginning their careers as teachers of deaf and hard-of-hearing students.

Even though CCNU is only one example of the universities offering special education training programs in China, researchers agree that this country's teacher training for deaf education can lead to generalized training that may not adequately address the

unique needs and challenges faced by deaf and hard-of-hearing students, and needs to be improved (Li, 2015; Wang, 2022). Consequently, teachers may lack specific skills and the knowledge critical for effectively educating these students, such as proficiency in sign language, understanding of deaf culture, and strategies for teaching language and literacy to students with hearing impairments (Cannon and Luckner, 2016; Li, 2015).

Additionally, Li (2015) points out that the current special education system in China suffers from rigid policies, inadequate systems, and practical difficulties. Specifically, the system's inadequacies include the lack of systematic and coherent curriculum standards, the lack of subject-specific training content, and the inadequacy of the in-service training system. In summary, according to Li (2015), teachers from special education training programs may have diverse educational backgrounds and lack subject-specific teaching knowledge before entering the profession.

5.1.3 Study objectives and research questions

Considering the results of the demographic studies and the current situation of teacher training in deaf education in China, this study aimed to explore the impact of teachers' training experiences on their teaching beliefs and attitudes, and how teachers respond to their students' heterogeneous features and diverse needs in language classrooms. There are three main research questions in this study:

1. How do the respondents of this study address their deaf and hard-of-hearing

students' heterogeneous backgrounds and diverse needs in their English classrooms?

2. How do the respondents' training backgrounds shape their attitudes, beliefs and instructions in dealing with their students' heterogeneous backgrounds and diverse needs in their English classrooms?

3. What are the respondents' expectations for potential teaching/learning materials designed specifically for deaf and hard-of-hearing students?

5.2 Review of relevant literature on teacher's knowledge, attitudes and behaviors

This literature review focuses on previous studies related to how individuals' knowledge influences their attitudes and behaviors. Grounded in the theoretical framework of the Theory of Planned Behavior (TPB) and the Integrated Behavioral Model (IBM), this semi-structured interview study posits that individuals' behaviors are partly shaped by their knowledge and attitudes. Based on this assumption, I further hypothesize that the way respondents in this study react to their deaf and hard-of-hearing students' heterogeneous characteristics and diverse needs is related to their training backgrounds. The review then examines the formation of teachers' cognition, beliefs, and attitudes. Finally, this section concludes with an analysis of previous studies on how teachers respond to students' diverse needs, particularly in language classrooms with deaf and hard-of-hearing students.

5.2.1 Theoretical framework

Previous research results demonstrate that teachers' cognition, attitudes, beliefs and

training experiences are closely interconnected and crucial in analyzing their teaching behaviors. This is in line with the theoretical framework of beliefs, attitudes, and behaviors provided by the TPB approach. This hypothesis contends that these beliefs work together with teachers' attitudes and, eventually, form the intention of performing specific teaching behaviors.

5.2.1.1 Theory of Planned Behaviors (TPB)

TPB, developed by Icek Ajzen in 1991, is a psychological theory that links beliefs and behaviors. It extends the Theory of Reasoned Action (TRA) and aims to explain how individuals form intentions to perform specific behaviors and how these intentions translate into actions (Ajzen, 1991; 2012; 2020). TPB has been widely applied in various fields to understand and predict human behaviors.

According to Bosnjak et al. (2020), up to 2020, TPB has been subject to empirical scrutiny in more than 4,200 papers referenced in the Web of Science bibliographic database, making it one of the most applied theories in the social and behavioral sciences. These studies span various disciplines, including health sciences, environmental science, business and management, and educational research (Bosnjak et al., 2020; Dunn et al., 2018; Ulker-Demirel & Ciftci, 2020; Yuriev et al., 2020).

TPB is a framework designed to predict and explain human behaviors in specific contexts (Ajzen, 2012; 2020). The immediate antecedent of behaviors in TPB is the

intention to perform the behaviors in question; the stronger the intention, the more likely the behaviors will follow (Ajzen, 2020). According to Ajzen (2012, 2020). Behavioral intentions are determined by three factors: attitude toward the behaviors, subjective norms concerning the behaviors, and perceived behavioral control.

Attitude toward the behaviors is assumed to be a function of readily accessible beliefs regarding the behaviors' likely consequences, termed behavioral beliefs. This is defined as a person's subjective probability that performing a behavior will lead to a certain outcome or provide a certain experience, such as the belief that wearing a heart monitor can detect heart arrhythmia or is inconvenient (Ajzen, 2020). Subjective norms represent the perceived social pressure to perform or refrain from a behavior, influenced by normative beliefs, which encompass the expectations of significant others and the individual's motivation to comply with these expectations (Ajzen, 2012). Perceived behavioral control pertains to an individual's perception of their ability to perform the behaviors, influenced by control beliefs regarding the presence of facilitating or impeding factors (Ajzen, 2012).

In educational contexts, TPB has been applied to explore teachers' and students' behaviors, such as technology adoption in classrooms and study habits. For instance, Sadaf and Gezer (2020) conducted a TPB-based study with 144 teachers to explore the factors that influence teachers' intentions to integrate digital literacy into their classrooms. A more detailed review of the implications of TPB in the educational

context is discussed in Section 5.2.1.3.

5.2.1.2 The Integrated Behavioral Model (IBM)

The IBM, developed by Fishbein et al. in 2000, is an extension and refinement of the TPB and the TRA (seen in: Fishbein & Ajzen, 2010). IBM integrates components from multiple behavior theories to provide a comprehensive framework for understanding and predicting behaviors. Similar to TPB, the model posits that behavioral intention is the most immediate determinant of behaviors.

IBM extends the TPB by incorporating additional factors that influence both intentions and behaviors. These factors include knowledge and skills, environmental constraints, habits, and emotional responses (Montaño & Kasprzyk, 2008). Montaño et al. (2015) emphasized that knowledge and skills are crucial as they determine whether an individual can perform specific behaviors. Environmental constraints refer to external factors that can facilitate or impede the execution of behaviors. Habit emphasizes the role of past behaviors patterns in shaping future actions, while emotional response considers the affective reactions individuals have toward the behaviors or their outcomes. By integrating these elements, IBM provides a more holistic approach to understanding behaviors, making it particularly useful in contexts where behavior change is complex and influenced by multiple factors (Montaño & Kasprzyk, 2008).

5.2.1.3 Application of the TPB and IBM theories in educational research

As mentioned in previous paragraphs, the TPB and IBM have been widely used in studies in educational contexts. Research in this area has focused on topics such as the factors that influence teachers' intentions to use technology in the classrooms (e.g., Liu & Wang, 2024; Sadaf & Gezer, 2020; Teo et al., 2016), teachers' intentions to adopt certain instructional strategies (e.g., Costan et al., 2022; Liu & Yu, 2023), and teachers' willingness and intentions to work in specific environments, such as inclusive classrooms (e.g., Alam & Zhu, 2023; Hellmich et al., 2019; Sharma & Jacobs, 2016).

Based on the TPB and IBM approaches, researchers also emphasize the importance of attitudes, knowledge, subjective norms, and perceived behavioral control from the perspective of professional development and teacher training. For example, Mintz (2020) highlights the importance of knowledge, skills, and attitudes in teacher preparation for inclusion, concluding that pre-service teachers' self-efficacy increased after receiving enhanced input on inclusion knowledge and skills. More recently, Schmitt et al. (2023) have investigated preschool teachers and found that pedagogical content knowledge significantly impacts their willingness to conduct scaffolding and diagnostic activities, indicating that pedagogical content knowledge is an essential professional competency for teachers. Additionally, Dunn et al. (2018) conducted a quantitative study with 152 teachers and found that their willingness and intentions to engage in ongoing professional training were influenced by factors such as subjective

norms and perceived control. These findings suggest that teacher professional training programs should emphasize teaching skills, subject content knowledge, and resources.

Therefore, based on the theoretical underpinnings of TPB and IBM, combined with previous research on teacher training, teacher beliefs and attitudes, and the impact of these factors on teaching, this study hypothesizes that the training background of the teachers of deaf and hard-of-hearing students plays a role in their attitudes and response to their students' heterogeneous characteristics and diverse needs. Furthermore, it is assumed that this, in turn, leads to significantly different teaching priorities and styles among the respondents.

5.2.2 Teachers' cognition, beliefs and attitudes

As suggested by the TPB and IBM approaches, the beliefs and attitudes formed through teachers' training experiences significantly shape their intentions and actions in the classroom. Based on this understanding, one of the main goals for conducting interviews with the four teachers was to explore the impact of their training experiences on their teaching beliefs and attitudes, and how these further determined their teaching behavior in response to the deaf and hard-of-hearing students' diverse needs. To achieve this, it was necessary to first address the relationship between teachers' training experiences and their cognition, beliefs and attitudes.

Teacher cognition is a concept that describes the knowledge, beliefs, attitudes, and

cognitive processes that teachers use to determine how to teach, how students learn, and how to manage the classroom (Borg, 2003). Borg (2019) elaborates on this definition by highlighting the complexity and changeability of teacher cognition. Borg (2019) emphasizes that teacher cognition involves not just what teachers know and believe but also how they implement these ideas in their instruction. This encompasses the methods and tools teachers employ to promote learning, the choices they make in response to the demands and challenges of their students, and the interactions they have with them.

Research indicates that teaching practice and student success are significantly impacted by teachers' cognition, attitudes, and beliefs. For example, in a study with 238 student teachers, Letina and Dikovic (2021) found that high-quality classroom management orientations correlated with student teachers' positive beliefs regarding research-based effective teaching behaviors, emphasizing the importance of developing future teachers' adequate attitudes toward classroom management styles and effective teaching behaviors. This perspective is also supported by Zhao et al. (2020), who mention that teachers' cognition, attitudes, and beliefs regarding a reformed instructional model greatly influence their implementation of this model in teaching practice.

The discussion on how teachers' cognition, attitudes, and beliefs shape their teaching practice also aligns with the TPB. As reviewed in Section 5.2.1.1, Montaño and

Kasprzyk (2008) suggest that attitudes are generated by expectations or beliefs concerning the outcomes of an object or action, and the evaluation of these outcomes. In other words, for example, teachers who hold strong beliefs that sign language will lead to students' academic success might have stronger intention to use this language as the primary mode of communication in the classroom.

While the perceptions, attitudes, and beliefs of teachers play a significant role in determining how students learn, it is crucial to understand that these constructs are neither rigid nor unchanging. In response to new insights, new knowledge, and continual professional growth, they may alter over time (Borg, 2019). Thus, teachers' cognition is a dynamic and evolving concept influenced by various factors, such as personal experiences, educational environments, and professional development.

Teacher training experience has been highlighted as an important factor that can influence teachers' attitudes and beliefs (Borg, 2019). Research indicates that instructors who receive high-quality training and ongoing professional development are more likely to have a comprehensive view of teaching and learning (Borg, 2019; Darling-Hammond, Hyler, & Gardner, 2017). These educators also tend to be more reflective and better equipped to make informed decisions regarding instruction and learning (Korthagen, 2004).

Teacher training experiences can impact teachers' attitudes by providing them with

new knowledge and practical skills to implement in the classroom. For instance, research by Darling-Hammond et al. (2017) has indicated that instructors were more likely to use evidence-based teaching strategies after participating in high-quality professional development programs. This suggests that teacher education programs can help instructors develop more effective instructional techniques based on methods proven to enhance student learning.

Moreover, teacher training experiences can influence instructors' attitudes by helping them gain a more sophisticated and nuanced understanding of teaching and learning. According to Korthagen (2004), effective teacher preparation programs should enable instructors to critically evaluate their practice, not just emphasize the transmission of information and skills. In this case, considering the diverse training background of Chinese teachers working in special education settings, it would be meaningful to investigate how their attitudes and beliefs could be different considering their training experiences.

Even though the literature has presented numerous discussions on knowledge, attitudes and beliefs regarding behavior and behavioral change, few are concerned with language teachers of deaf and hard-of-hearing students, even if this group exhibits diverse and complex characteristics in these areas. In this case, the semi-structured interviews in this study aim to explore the characteristics of the four English teachers with Chinese deaf and hard-of-hearing students in relation to their

beliefs and attitudes toward their students and deaf education and try to explore how such beliefs and attitudes shape their teaching behavior.

5.2.3 SLA pedagogy for students with diverse needs

Ellis (2021) identifies Complex Dynamic Systems Theory and the 'multiple turns' as the two most significant developments in SLA theory in the 21st century. According to Ellis (2021), these theories suggest that second language learners are complex and heterogeneous. Liu and Nelson (2018) state that diversity is the only constant feature of second language education. Numerous studies have investigated diversity in second language classrooms. Researchers have shown that different first language backgrounds (Gonzalez et al., 2011) and cultural backgrounds (Park, 2001) can affect the quality of instructional activities. Moreover, Liu and Nelson (2018) point out that students' preferences in learning styles and strategies could be another key aspect of diversity.

According to Gonzalez et al. (2011), many factors contributing to classroom diversity can be used to the learner's benefit, and various effective strategies can encourage collaboration and effective learning among students and teachers. Group work, for example, is one strategy that leverages students' diversities, making students themselves invaluable informants (Liu and Nelson, 2018).

However, despite the emphasis on the complex and heterogeneous characteristics of

L2 learners, teaching a diverse group of students remains challenging in SLA pedagogy. One commonly used method, differentiating instruction—or adjusting teaching to meet each student's requirements—is criticized by teachers for failing to motivate both low-performing and high-performing students and for increasing teachers' workloads (Svensson, 2017). Additionally, while current research in SLA on teaching diverse students has considered various factors, including culture, language, and gender, there is still a paucity of academic discussion on special needs students, particularly deaf and hard-of-hearing students. In addition to the diverse features of second language students, this group of students has a unique cultural and linguistic background. Consequently, language classrooms for this group of students are more diverse and complex.

In conclusion, the design of this study is built upon existing research concepts and theories, addressing practical needs due to the lack of relevant studies. First, the TPB and IBM theoretical frameworks provide robust foundations for understanding and predicting teacher behaviors, attitudes, and beliefs in educational contexts. Second, based on these theories, research demonstrates that high-quality teacher training and ongoing professional development significantly influence teachers' instructional practices, attitudes, and beliefs. However, given that teachers of deaf and hard-of-hearing students in China have very diverse training backgrounds, it is necessary to investigate the formation of their knowledge and attitudes toward their students, and how they respond to their students' diverse needs. Third, in the context of SLA, the

complex and heterogeneous characteristics of learners pose significant challenges for educators, especially when addressing the diverse needs of deaf and hard-of-hearing students. However, there remains a lack of research focused specifically on language teachers of deaf and hard-of-hearing students, highlighting the need for further investigation into their unique training backgrounds, beliefs, and instructional approaches. Therefore, this study aims to contribute to this gap by exploring how the training experiences of teachers of deaf and hard-of-hearing students shape their attitudes and teaching behaviors, ultimately influencing their effectiveness in diverse and complex classroom environments.

5.3 Methodology of the semi-structured interview study

To allow teachers to describe their English classrooms with Chinese deaf and hard-of-hearing students from their perspective, semi-structured interviews are ideal as they enable respondents to elaborate on the interview topics in an exploratory manner (Dörnyei, 2007).

5.3.1 Design of the semi-structured interviews

According to Dörnyei (2007), to promote responses of depth and breadth while keeping the interview process on track, an interview guide would be helpful. To ensure the interview guide was comprehensive and effective, a few trial runs were conducted with a small group of participants who were not part of the main study. These trials involved testing the clarity and flow of the questions, identifying any ambiguous wording, and ensuring that the questions elicited relevant and insightful

responses. Feedback from these trial participants helped refine the guide by adjusting the phrasing of questions and reorganizing the sequence to better align with the areas of interest. This iterative process ensured that the final version of the interview guide was well-structured and focused. Therefore, based on the underlying purpose of this interview, the final version of the interview guide (provided in Appendix V) covered a total of seven main areas of interest:

(1) Demographic information about the teacher

(2) Initial training and in-service training received by the teacher both informally and formally

(3) Teaching modality, including the classroom language used and the teacher's attitude toward teaching modality (i.e. the use of oral communication vs. sign language)

(4) Teacher's beliefs about deaf and hard-of-hearing students, such as specific characteristics that deaf and hard-of-hearing students have and whether it would be appropriate to put deaf and hard-of-hearing students into an inclusive classroom together with hearing students

(5) The quality of the teacher's communication with their students and how they deal with communication failure

(6) Teaching English to Chinese deaf and hard-of-hearing students, including their teaching objectives and the instructional strategies used by the respondents

(7) Experience with the current teaching material and suggestions concerning

potential teaching materials

Based on these seven themes, questions were designed to encourage respondents to provide detailed information about their experiences and behaviors, opinions, feelings, knowledge, observations, and demographic information (Patton, 2002, as cited in Dörnyei, 2007). According to Dörnyei (2007), six categories of questions are instrumental in creating a comprehensive and rounded picture of the respondents.

1. **Experience and Behavior Questions**: These questions aim to elicit detailed accounts of the respondents' daily activities, routines, and specific incidents related to their teaching practices. For example, the respondents in this study were asked to describe their English classes with Chinese deaf and hard-of-hearing students. They were encouraged to provide detailed information about the difficulties they encountered and how they managed to solve these problems.

2. **Opinion and Value Questions**: These questions explore the respondents' beliefs, opinions, and values regarding various aspects of teaching and learning. For instance, the respondents in this study were asked for their opinions on language use in classrooms and their views on the heterogeneous characteristics and diverse needs of deaf and hard-of-hearing students.

3. **Feeling Questions**: Designed to capture the emotional responses of the respondents,

these questions delve into how teachers feel about their teaching experiences, the challenges they face, and their interactions with students. This helps in understanding the emotional context behind their behaviors and decisions. For example, respondents in this study were asked if they felt well-equipped and supported by teacher preparation programs and the teaching community.

4. **Knowledge Questions**: These questions assess the respondents' knowledge about specific topics, such as best practices in deaf education, awareness of relevant educational policies, and understanding of the unique needs of deaf and hard-of-hearing students. For example, respondents in this study were asked about the initial and in-service training they had received.

5. **Sensory Questions**: These questions focus on what respondents have seen, heard, or otherwise experienced in their teaching environment. This can include observations of student behaviors, interactions with colleagues, and the physical setup of their classrooms. For example, respondents in this study were asked if they had observed their students' heterogeneous features.

6. **Background/Demographic Questions:** These questions gather essential demographic information about the respondents, such as their educational background, years of teaching experience, and any specialized training they have received. This data helps contextualize their responses and provides insight into how their

backgrounds may influence their teaching practices. For example, at the beginning of the interviews, the respondents in this study were asked to provide demographic information regarding their working environment, job duties, years of teaching, training backgrounds, etc.

By incorporating these six types of questions, the semi-structured interviews aim to provide a holistic understanding of the respondents' experiences and perspectives. This approach ensures that the data collected is rich, nuanced, and reflective of the multifaceted nature of teaching deaf and hard-of-hearing students.

The interview consisted of three parts. In the first part, the respondents were asked to introduce their educational backgrounds, professional identification, and career development (Borg, 2011; Darling-Hammond, Hyler, & Gardner, 2017; Korthagen, 2004). Specifically, the goal of this part was to investigate how the respondents' training backgrounds influence their professional identification and their attitudes toward deaf education. In the second part of the interview, the respondents were asked to discuss their choices of languages to be used in classrooms and their communication experiences with hard-of-hearing students. For every choice that the respondents made in their teaching practice—for example, using only CSL to deliver a lesson—they were asked to provide reasons so that it was possible to explore how their beliefs and attitudes were reflected in their classes. In the third part, respondents were asked to provide more detailed information about their English teaching

experiences. For example, they were asked to describe a lesson, including how they designed the lesson plan, which content or knowledge areas they specifically focused on, and the teaching strategies they employed. Additionally, respondents were encouraged to share their attitudes and expectations regarding English teaching and learning materials specifically designed for deaf and hard-of-hearing students.

Interviews were conducted through the WeChat platform, with each interview lasting around one hour. To ensure that all the respondents could express and explain their opinions without language barriers, the interviews were conducted in Chinese. The transcripts were then translated into English for analysis. The English transcripts were peer-reviewed by another native speaker of Chinese proficient in English to ensure the accuracy of the translation. Interview data was analyzed using NVivo 12.

5.3.2 The respondents of the semi-structured interviews

Four teachers from varied backgrounds were invited to participate in the interviews to provide insights from diverse perspectives. As has been mentioned in previous paragraphs (refer to Section 5.1.2), there is a lack of teacher training programs specifically for deaf education in China. When selecting the teachers, four criteria were considered: whether the teacher had a special education training background, whether the teacher had a general education training background, whether the teacher had an English language education background, and whether the teacher had a CSL training background. Their working environments and job duties were also considered

to ensure broad representation. As presented in Table 5.1, the selected respondents worked in different educational settings, including special education schools, inclusive classrooms in general educational schools, and non-profit educational agencies. They all taught English to Chinese deaf and hard-of-hearing students.

Table 5.1 Training background, working environment and job duties of the four respondents

	Respondent No.1	Respondent No.2	Respondent No.3	Respondent No.4
Special Education background	No	No	Yes	No
General education background	Yes	No	No	Yes
CSL training background	Yes	Yes	Yes	No
English education background	No	No	No	Yes
Job duties and Working environment	A special education school in northern China	A non-profit online education organization	A deaf school in central China	A general education public middle school in central China
	Mainly works with ADHD children	Mainly teaches English to deaf and high school hard-of-hearing children	Mainly teaches English to deaf and high school hard-of-hearing children	Had one deaf student in her English class
	Teaches English to middle-school deaf children			

In this study, the respondents typically held bachelor's degrees (which aligns with the

situation introduced by Qi and Li, 2020). Even though only one had graduated from a special education teacher training program, this situation aligns with Zhu and Sun (2011), who found that Chinese teachers in special education schools generally come from two primary backgrounds: special education and subject-area education (such as English language education, which often does not include training in teaching students with special education needs). The four criteria used to select the interviewed teachers ensured that the respondents had at least one professional training background in special education, general education in other subject areas, English language education, or sign language. Despite the small sample size of four respondents, their diverse training and working backgrounds provide a well-rounded perspective that reflects a broader range of experiences and practices in teaching deaf and hard-of-hearing students. This diversity allows the study to capture insights from different educational contexts, making the findings more robust. Detailed information about the respondents is presented in the following paragraphs.

Respondent No.1 was an English teacher working at a special education school in Liao Ning Province, China. She was also in charge of a non-profit project teaching English to Chinese deaf and hard-of-hearing students. Graduating from a teacher preparation program in general education of other subject areas, this respondent had basic knowledge in education and teaching. She had also received professional training in CSL; however, she lacked professional training in deaf education and teaching English.

Respondent No.2 was a postgraduate student taking her postgraduate degree in theater studies in the UK. She taught English to Chinese deaf and hard-of-hearing students in a non-profit project. She had received professional training in CSL; however, she lacked professional training in special education and teaching English.

Respondent No.3 was an English teacher working at the Wuhan No. 1 Deaf School. Majoring in special education, she had a professional knowledge in this area. When she was at college, she took courses in CSL. However, she lacked training in teaching English.

Respondent No.4 was an English teacher working at a general education middle school in Wuhan. There had been a deaf student in her classroom, and she wished to share her experiences. Majoring in English language education, she demonstrated rich experiences and knowledge in this area. However, she had received no training experiences in special education, deaf education or CSL.

5.3.3 Interview transcription and node coding

Data analysis was conducted using the qualitative software NVivo 12. When coding the transcripts, three top nodes were created: “Deaf and hard-of-hearing students”, “Teachers” and “English Teaching”. Each top node contained several sub-nodes.

Under the top node “Deaf and hard-of-hearing students”, the focus was on teachers’ discussions about their students’ specific characteristics, learning difficulties, and skills. This analysis aimed to gain insights into deaf and hard-of-hearing students from a teacher’s perspective and to compare whether the teachers’ observations aligned with the students’ self-reported learning difficulties and skills from the questionnaire survey.

The second top node “Teachers” was primarily concerned with demographic information about the English teachers, including the informal and formal training they received both before and after starting their careers, their teaching roles, and their self-identification as either an English teacher, deaf education teacher, or special education teacher. Additionally, four important sub-nodes were created under this category: teachers’ attitudes toward language modality in teaching, teachers’ attitudes and responses to student heterogeneity, teachers’ beliefs about deaf and hard-of-hearing students and inclusive education, and teachers’ evaluation of their quality of communication with students. This categorization allowed for an in-depth examination of questions such as “Who are the teachers?”, “How do they teach a diverse group of students?”, “Why do they make certain choices in language and teaching strategies?”, and “How do they evaluate their quality of communication with their students?”

The top node “English Teaching” focused on practical teaching aspects, including

lesson design, teaching strategies and language use, and teaching materials.

It is acknowledged that there may be some overlap between nodes. However, the primary goal is to explore the potential reasons for the teachers' choices. As previously mentioned, according to the IBM, teachers' behaviors can be significantly influenced by their existing knowledge and beliefs. Therefore, it is assumed that the diverse training backgrounds of the respondents may lead them to make different teaching choices based on the skills and knowledge they acquired during their training.

To test this hypothesis, the discussion of the results will start with the respondents' knowledge background and gradually demonstrate how their beliefs and backgrounds influence their teaching practices. In the following discussion, unedited excerpts from the transcribed interviews are presented in the author's translation, attempting to preserve the character of the original communication.

5.4 Results and findings

The interview data of the respondents was analyzed from three perspectives: the respondents' training experiences, their attitudes and beliefs regarding their teaching roles and deaf and hard-of-hearing students, and their attitudes and beliefs regarding their teaching subject.

5.4.1 The training experiences of the teachers

The following paragraphs discuss the respondents' initial and in-service training experiences. It was found that the four respondents attended different initial teacher training programs, resulting in having distinct knowledge and skills when they began their teaching careers. Although they received in-service professional training, the programs provided to respondents working at special education schools differed from those offered to the respondent at a general education school. Specifically, respondents at special education schools reported that their training primarily focused on theories of special education and sign language skills, resulting in a lack of emphasis on subject knowledge and pedagogical skills. However, the respondent at the general education school mentioned that the training primarily focused on English teaching pedagogy and rarely covered topics related to special education or deaf education.

As mentioned in Chapter 1, special education teachers are expected to demonstrate competence in three key areas: theoretical knowledge and moral standards, professional knowledge, and professional skills. The respondents who had no training experiences in teaching English expressed a need for support with English teaching strategies, indicating that the professional knowledge and skills outlined in the Professional Standards (issued by the Ministry of Education in 2015) were not adequately addressed by the teacher training programs they received.

5.4.1.1 Initial training and the start of their career

Among the four respondents, each had distinct initial training experiences during their college years, coming from varied professional backgrounds such as special education (R3), theater (R2), ideology and political education (R1), and English language education (R4). R3, who majored in special education, gained a broad understanding of the field but noted that her program lacked a focus on deaf education and subject-specific training.

> *There were all kinds of courses, including those for deaf and hard-of-hearing students, for students with intellectual disabilities, and for students with visual disabilities. We studied Braille and sign language. We had a full range of courses in the school. The courses were not just for deaf and hard-of-hearing students. We learned everything: for deaf education, for mental retardation education, and blind education.*
>
> *There is no specific subject content in the profession. (R3)*

In contrast, R4 was trained in English language education but did not receive any training related to special or deaf education. The respondents' initial training experiences indicate that none of the four respondents was equipped with knowledge in both deaf education and English language education. This situation aligns with Li's (2015) conclusion that the current teacher training programs for special education majors do not meet the competency standards for qualified deaf education teachers.

The lack of professional training in English language education is also highlighted by Wang (2022). Many teachers of deaf and hard-of-hearing students graduate with non-English majors and lack comprehensive professional training in deaf education, subject knowledge, and skills (Wang, 2022). These deficiencies inevitably lead to identity issues for English teachers in deaf schools, impacting their attitudes toward teaching and professional development, and highlighting the crucial role of identity in the teaching profession (Wang, 2022).

Despite not majoring in special education or deaf education, R1 and R2 demonstrated strong motivation and passion for Deaf culture and deaf and hard-of-hearing students. R1 mentioned that she self-trained in special education and worked as a volunteer in special education schools before starting her career. Similarly, R2 expressed a strong passion for Deaf culture, noting that she was pursuing a PhD in Deaf Theater in the UK. Both respondents had attended sign language training programs and had self-trained in the knowledge of special education to better meet the needs of their students.

> *It was the ..... sign language class that I attended. The first thing I did was to volunteer at an autistic children's institution. Additionally, I took some online courses on my own. Self-learning.*
> *Because I like this field, but I didn't major in special education when I entered university. I started to get involved in this field from my freshman year by*

volunteering and going to Changchun University to play with the deaf and hard-of-hearing students.

Then, I learned sign language as a hobby. Then, I found I liked it so much that I chose to work in a special education school. (R1)

Well ..... with deaf and hard-of-hearing students, there is no training. I helped myself with everything because I have been doing research on this myself, on Deaf culture, so that's kind of my own (background of knowledge). I didn't have any training. Anyway, I learned sign language, which is important.

Yes, I can. In short, I'm doing some work on deaf theater, but more on how to explore the characteristics of deaf culture in theater, and then how to empower not only the deaf community but also the hearing community. (R2)

These accounts illustrate the diverse backgrounds and self-initiated efforts of R1 and R2 to bridge the gap in their formal education and better serve their deaf and hard-of-hearing students. Numerous studies focus on self-initiated professional training of teachers (as discussed in Morris, 2019; Tiggs, 2021). Although this study does not focus specifically on this issue, the experiences of the two respondents demonstrate the role of personal motivation and self-directed learning in professional development, especially in contexts where formal training may be lacking or insufficient (Morris, 2019).

5.4.1.2 After-work training and support

Based on the responses from the interviews, the respondents faced significant challenges due to a lack of formal in-service training in both deaf education and English language teaching.

R1 and R3 became English teachers simply because their schools were in short supply of English teachers at that time. R2 was invited to teach English to deaf and hard-of-hearing students because she had a master's degree from the UK and was proficient in CSL. Given that these teachers had no prior knowledge or experience in English language education before starting their teaching careers, it might be reasonable to assume that the school would provide some training or support in terms of how to teach English to Chinese deaf and hard-of-hearing students. However, based on the responses given by the respondents, formal training and support provided by the school or related organizations still emphasized more general theories and concepts in special education and sign language abilities, and rarely covered practical teaching issues.

The interview results show that only R4 had attended formal in-service training on instructional issues. She was an English teacher working at a general education public school. According to her response, regular teacher training programs were held not only by the school but also by various levels of government agencies, ranging from the district to the provincial level. These training programs covered various topics,

including English language abilities, English teaching skills, and students' mental health and counseling. However, R4 admitted that was not effectively prepared when she suddenly had one hard-of-hearing student in her classroom.

In her interview, R4 mentioned that, without background knowledge of deaf education and the characteristics of deaf and hard-of-hearing students, she found it difficult to identify the deaf student among the more than 50 students in her class. She said she noticed that this deaf student was quiet during classroom activities and initially thought that, as a new member of the class, he was simply shy about talking to his new classmates. It was not until she spoke to him and noticed his hearing aid that R4 realized he was deaf.

> *Actually, if the class head teacher hadn't said anything, you wouldn't have been able to tell that this child was deaf. When I got close to him, I noticed that he was wearing a hearing aid, and I consulted the class head teacher, and I found it out. (R4)*

The interview data of the other three respondents also indicated that the school had failed to provide adequate support for them, leaving them to rely on themselves when they encountered difficulties in teaching English. R1, R2, and R3 explained where they could get informal training and support. In addition to working out difficulties on

their own, other available resources included friends, the Internet, and their former teachers.

For example, both R1 and R2 reported that they had a group of teachers and sign language interpreters with whom they could discuss sign language translation issues. This collaboration helped them use accurate sign language to explain English grammar principles to the students.

> *She's my sign language teacher, Mrs. Du. And we also have a small group of friends with whom we learned sign language together. For example, XXX (teacher's name) asked me before about how to explain the simple past tense and perfect tenses more clearly in sign language (CSL). Besides, like I've mentioned before, when I was trying to teach something about 'very', 'more', 'the most', and to distinguish comparative and superlative degrees, I felt that I couldn't sign clearly in CSL, then I went to discuss this issue with the group, and with Mrs. Du. We finally decided on a clearer way of signing. (R1)*

> *I often turn to XXX (teacher's name) when I have difficulties because she is in charge of the whole project. I would ask her some (questions about sign language). If I don't know how to use sign language to express a concept concisely, I would ask her. For example, like I shared with you last time, about*

how to express the perfect tenses and past tenses in sign language, I also discussed with her. She gave me a lot of help. (R2)

Additionally, R2 mentioned that she would ask her high school English teacher for suggestions on lesson preparation. R3 also reported that she would read research papers in SLA for suggestions on English teaching strategies.

I've recently become more interested in teaching vocabulary. I've been reading some books myself. If you have any materials on this, send them to me. Or for vocabulary teaching in general schools, if you have any materials, you can them send to me. (R3)

Based on the responses of these four respondents, English teachers' knowledge backgrounds consisted of five aspects when teaching Chinese deaf and hard-of-hearing students: knowledge in special education, sign language, deaf education, English language abilities, and English teaching skills. However, the formal initial and in-service training and support that the respondents received failed to fully cover these areas. As a result, the English teachers in this study might not have been able to build the necessary professional competencies and skills needed to teach English to Chinese deaf and hard-of-hearing students. As emphasized by Cannon and Luckner (2016), teacher training programs are essential for shaping teachers' attitudes and beliefs toward their students' diverse cultures and needs. Therefore, the lack of

systematic initial and in-service training in deaf education and language education in the context of ELL-NESC might have left the four respondents inadequately prepared to effectively address the unique challenges of teaching their students.

5.4.2 The attitudes and beliefs of the teachers

Given that the four respondents in this study had very distinct experiences with initial and in-service training, and none had systematic training in either deaf education or English language education, it is necessary to explore how their attitudes and beliefs were shaped by their teacher training experiences. The following paragraphs discuss the respondents' attitudes and beliefs regarding their communication with their students, language use in classrooms, the heterogeneous characteristics of their students, and teaching English to Chinese deaf and hard-of-hearing students.

5.4.2.1 Beliefs and attitudes on communications with deaf and hard-of-hearing students

The respondents of this interview study agreed that they were very satisfied with the quality of communication. Three of them (R1, R2 and R3) concurred that they did not have any communication issues with their deaf and hard-of-hearing students and that when learning difficulties arose, their students were eager to turn to the teachers for assistance. Furthermore, when responding to this question, all four respondents demonstrated a high level of self-efficacy with their language and communication skills.

R3's case needs to be specifically analyzed. As the English teacher of the 15 deaf and hard-of-hearing participants in the pilot demographic study, she held different opinions regarding the quality of teacher-student communications from her students.

> *When I say, 'Bring me the book' or 'Bring me the notebook', or when I am thirsty in class, I just make a gesture to drink water, and they will go to my office directly and bring me a cup. It's like in a family. They can understand immediately what I want to do. If you communicate with students a lot, they can understand what you mean, sometimes with just a look. For example, I was at school the other day and I met a student who was walking in the playground after lunch. I made a simple sign to her, and she understood me immediately. The communication quality all depends on your way of dealing with the students. (R3)*

In this dialogue, R3 described how she managed to use simple signs and gestures to give instructions to her students and how her students responded positively. According to her, frequent interactions had developed a communicative understanding that allowed deaf and hard-of-hearing students to respond swiftly to her requirements. R3 was quite confident in her everyday interactions and modes of communication with her students. This confidence was also evident in her description of classroom teaching as she assumed that most students successfully comprehended the lessons

because they turned in their homework.

However, the results from the pilot demographic study with her 15 deaf and hard-of-hearing students presented a different perspective on this respondent's opinion. The pilot questionnaire survey revealed that students provided negative feedback regarding the effectiveness of their everyday interactions with this teacher. Of the 15 students who participated, five did not find it helpful to talk to the teacher about their English learning difficulties, eight did not think the teacher was good at understanding their needs and challenges, and four did not believe the teacher provided helpful advice when dealing with their issues (refer to Section 3.2.4.3 for a detailed discussion on the 15 students' evaluation of the quality of communication with their teacher). In other words, there appears to be a disparity between the teacher's self-perception of her communication effectiveness and the students' experiences.

This finding correlates with the study by Luo et al. (2020) on Chinese English teachers' self-efficacy beliefs and their performance on the knowledge of basic language constructs. Through a mixed-method study, Luo et al. (2020) also noticed a gap between teachers' self-efficacy and their knowledge performance. According to them, the case study teachers in their research believed that since they could read and speak English, they had sufficient skills to teach the language. However, Cunningham, Zibulsky, and Callahan (2009) argue that having advanced language skills is not a sufficient condition for being a good language teacher. Luo et al. (2020) attribute this

knowledge gap to the lack of explicit teacher training in teaching English in a non-English-speaking country.

In this study, R3 received her initial training in special education, which only considers deaf education as a subdivision in the module. As discussed in Section 5.1.2, while the teacher training program that R3 attended included some courses related to deaf education—two of which focused on sign language—there is no clear evidence that these four courses provided sufficient systematic knowledge in deaf education for R3. She was initially trained as a special education teacher, rather than a deaf education teacher. In this case, referring to the findings of Luo et al. (2020), R3 saw her existing knowledge background as sufficient for quality communication with deaf and hard-of-hearing students, which might not be the case.

For the other three respondents, although it is impossible to verify their high efficacy in the quality of communication with their students in this study, their interview data demonstrated that their evaluations of their quality of communication were built on their existing knowledge, attitudes, and beliefs formed by their training experiences.

For example, with formal training in CSL, R1 and R2 believed that the quality of communication between teachers and deaf and hard-of-hearing students could be ensured by their proficiency in that form of communication.

If the teacher's sign language is not good, of course, they (students) are not satisfied with the communication. In fact, among the three students I am teaching now, there is one who is good at CSL, and he is also a boy who is very lively and cheerful. During his adolescence, he even had conflicts with other teachers. For example, if he did something and the other teachers criticized him, he was definitely not convinced. He didn't understand what the teacher was saying to him, and he couldn't understand what the teacher was explaining. Or he could read the teacher's Signed Language, but the teacher couldn't understand the CSL he was using, and the teacher didn't understand what he was saying. So, there was a misunderstanding, and then there was a fight. (R1)

If students are not satisfied with the communication, maybe it's because the teacher's sign language is not good in the first place. If the teacher has good sign language, but the student still finds it difficult to communicate, I think it might be because the teacher is intimidating. (R2)

In other words, with high proficiency in CSL, R1 and R2 highly valued the importance of sign language use in teacher-student communications. Based on this perspective, these two respondents assumed that being proficient in CSL allowed teachers and deaf and hard-of-hearing students to communicate smoothly.

However, this perspective overlooked the heterogeneous nature of deaf and hard-of-hearing students. As demonstrated by the expanded demographic survey, these participants had various language backgrounds and preferences (refer to section 4.4.2). Moreover, comparing the results of the pilot and expanded demographic surveys, it was found that the participants in the expanded demographic survey who used more language modalities in communication tended to be more satisfied with their teacher-student communication than those in the pilot demographic study (refer to Chapters 3 and 4). While various factors can lead to the difference in students' perception of the quality of communication, this study does not focus on that issue. The interview results of this study indicate that the respondents mainly referred to their knowledge to evaluate the quality of communication with their students. However, due to the lack of systematic training, this intention could be problematic.

5.4.2.2 Beliefs and attitudes on classroom language use

Differences in training experiences also led to the respondents' varying beliefs and attitudes regarding the languages to be used in their classrooms. Specifically, with formal training experiences and high proficiency in CSL, R1 and R2 both agreed that it was the only language that truly belonged to the Deaf community and that it should therefore be the main language of instruction. R3, however, did not share this view. According to R3, language is merely a means of transmitting information, and the focus of teaching should be on helping students effectively understand and acquire knowledge.

I think no matter sign language or spoken language, it's a means to communicate. As long as you can get the students to understand, it doesn't matter what means are used. If some students can hear a little bit, then you can use spoken language. If they can't hear, then use sign language. It doesn't matter whether you use sign language or spoken language, as long as you can make things clear to the students. I don't think it's worth arguing about which is the primary and which is the secondary, sign language or spoken language. (R3)

Therefore, R3 mentioned that in her classroom she used a variety of languages, including spoken Chinese, sign language, and spoken English, to help students understand teaching contents more effectively.

As an English teacher in a general education school, R4's students were predominantly hearing students. She believed that deaf and hard-of-hearing students' hearing abilities and language skills should meet the requirements of purely oral instruction when they enter the general education classroom, rather than unrealistically expecting teachers to learn and use sign language specifically for the sake of individual students.

In conjunction with the previous discussion of the professional backgrounds and training experiences of the four respondents, their very different attitudes toward sign language and spoken language in the classroom stemmed, to a large extent, from the teachers' knowledge backgrounds.

Even though the interviewed teachers disagreed on the roles of sign language and spoken language in the classroom, in practice, they used a multi-modal approach in their teaching. R2 mentioned that in her English classroom, in addition to using sign language to explain concepts, she also wrote on the board and asked students to interact with her through the online classroom chat box. Furthermore, R2 pointed out that some English grammar concepts cannot be explained in CSL, so she also used Signed Chinese and written Chinese to help her students gain a better understanding. R3 believed that the most important thing in the classroom was for the students to be able to understand the content of the lecture, so her classroom had always been multilingual and multi-modal.

The teachers' positive attitudes toward multi-modal teaching provide ideas for future research on how to improve the English language teaching environment for Chinese deaf and hard-of-hearing students. As stated by R3, promoting the efficiency of students' understanding of the teaching content is the focus of teaching and learning. Therefore, R3 highlighted that rather than being caught in a single sign-to-oral battle,

it is important to adopt a variety of modes to broaden how information is disseminated, thereby helping deaf and hard-of-hearing students better understand the content.

5.4.2.3 Beliefs and attitudes on the heterogeneity of deaf and hard-of-hearing students

The results of the demographic studies (see Chapters 3 and 4) have reflected deaf and hard-of-hearing students' high level of diversity in language and education backgrounds. Such heterogeneity was also mentioned by the three respondents who mainly worked with deaf and hard-of-hearing students (R1, R2, R3).

Of the four respondents, only R3 had graduated with an undergraduate degree in special education from Central China Normal University, majoring in special education. According to R3, students with special needs are inherently different and she used tiered assignments (Pozas et al., 2020) in her teaching practices:

> *There is a lot of diversity in special needs students. Everyone's personality, physical development, and cognitive level are definitely different. The first thing that special education stresses is individualized instruction. Special education students are all very different. (R3)*
>
> *I have to teach according to their abilities. For example, for students with good academic performance, my requirements are different, and I can give them extra homework; if they have an average performance, they can be*

pushed a little bit. Isn't there a theory that is about the nearest developmental zone for this? Within the student's ability, I push a little bit, but the requirements are different for each child. (R3)

However, lacking professional training in deaf education, she argued that deaf and hard-of-hearing students were less diverse than other students with special needs and, therefore, individualized teaching was not necessary.

You would likely get more representative answers by speaking with a teacher in intellectual disability education about student differences. However, in deaf education, we can generally overlook those differences.

For our deaf and hard-of-hearing students, although they are different, they are not as different as those students with intellectual disabilities. So, we just need to have a smaller class size, and the class teaching is still basically like that of a general education school.

In a class with students who have intellectual disabilities, there are often three teachers—one main teacher and two teaching assistants—because classroom discipline can sometimes be challenging. Some children may become suddenly agitated and run around, requiring one teacher to attend to the disruptive student while the other teachers work to calm the remaining students. In contrast, in our experiences with deaf and hard-of-hearing students, these differences are less pronounced and do not typically interfere with teaching.

R3

R1 and R2 also noted the differences in deaf and hard-of-hearing students. R1 mentioned that her school would place students into different classrooms based on their language backgrounds.

> *In terms of the students in my school, there are big differences between deaf and hard-of-hearing students. In our school, there are signers who are not aurally based at all, and there are also students who use spoken language as their main form of communication.*
> *We will take these differences into account in class placement. Aurally based students usually sit together with each other. However, because of other factors, such as students' ages, there will be some exceptions when aurally based students and visually based students are mixed together. Since those students are only minority cases, most of the students are fine with the classroom placement and daily teaching. (R1)*

However, noticing that deaf and hard-of-hearing students had diverse language needs, both R1 and R2 insisted that CSL should be the primary language used in classrooms with deaf and hard-of-hearing students. This perspective might lead to an inadequate response to their students' diverse needs. As mentioned by R1, she had noticed that two of her students were not fluent in CSL; however, she admitted, "I realized this

phenomenon, but I haven't come up with a solution yet."

Similarly, R2 said that even though one of her students was aurally based, she remained silent and continued using CSL to deliver her lessons.

> *I still don't use my voice, but I do use some body language to emphasize certain knowledge points and type them back into the chat box. I use exaggerated body language to remind the students that this point is important and to grab their attention. (R2)*

However, given that the interview data from R2 does not prove the effectiveness of the strategies she adopted, the responses of R1 and R2 indicate that their students' diverse language needs were not adequately fulfilled.

Based on the results, it is evident that there is a significant gap between the respondents' perceptions and their behavior regarding how to respond to student diversity in teaching. Likely, this gap is also related to the lack of teacher training that specifically addresses how to effectively implement individualized teaching for deaf and hard-of-hearing students.

5.4.2.4 Beliefs and attitudes on teaching English to Chinese deaf and hard-of-hearing students

As highlighted by Borg (2019, 2003), there is ample evidence of the effects of teachers' learning experiences as learners, professional development programs, and contextual factors on the development of teacher cognition, which is defined as what teachers know, believe, and think. As previously discussed, to teach English to Chinese deaf and hard-of-hearing students, teachers need to possess not only knowledge and skills in special education, deaf education, and sign language but also competency in English language and teaching pedagogy in the context of ELL-NESC (refer to Section 5.4.1). However, three of the English teachers who participated in the study (R1, R2, R3) had not attended formal professional training in teaching English as an additional language in non-English-speaking countries. R3 mentioned that she self-trained herself in this area through reading books and research papers. In conjunction with Borg's (2019) claim, as demonstrated by the interview data, the respondents' attitudes toward English instruction were specifically affected by a confluence of their test-taking-focused language learning experiences, their previous training experiences, and a dearth of teaching materials.

5.4.2.4.1 Teaching objectives

There has been no unified official document issued for the English curriculum standards for Chinese deaf and hard-of-hearing students. Although the Ministry of Education lists English as an elective course in the Experimental Plan for Compulsory

Education Curriculum for Schools for the Deaf (2007), the curriculum standards for the English language education have not been stipulated in the Curriculum Standards for Compulsory Education for Deaf Schools (2016 Edition). As a result, only the English Curriculum Standards for General High Schools (Experimental) (Ministry of Education, 2003) and the Shanghai English Curriculum Standards for High Schools for the Deaf (Shanghai Municipal Education Commission, 2009) may be referenced to discuss the overall objectives of teaching English to Chinese deaf and hard-of-hearing students.

The English Curriculum Standards for General High School (Experimental) state that the overall objective of the English curriculum for high schools is to develop students' comprehensive language application skills in terms of cultural awareness, language knowledge, language skills, and learning strategies (Ministry of Education, 2003). Similarly, the Shanghai English Curriculum Standards for High Schools for the Deaf (Trial Draft) outline the language objectives and emotional objectives as

> mastering the most basic language knowledge; strengthening some language skills (reading and writing); mastering the basic methods of learning English; developing an interest in and a habit of learning English; having awareness of using English; and encouraging teamwork among students. (p. 50)

In general, high school English language education for Chinese deaf and hard-of-hearing students should have the overall objective of developing students' language skills and learning motivation. However, the interviews revealed that respondents in

this study held different perspectives on their teaching objectives. Specifically, with certain training experiences in teaching English as an additional language (either through formal training or through self-initiated training), R3 and R4 agreed with the curriculum objectives stated in the Curriculum Standard.

> *We can't be purely test-based, because it's very difficult for students if we're purely test-based...It is difficult (for students) to understand the knowledge and to use it. Language is something that has to be understood and expressed. Language has to be input and output, and you need to get students to output as well. It's very difficult. (R3)*

However, for R1 and R2, their English classrooms were more test-oriented.

> *Our lessons will be more exam-oriented. We don't use complicated language to explain the principles behind the grammar, but let students use the simplest and most straightforward method to find out answers. They just need to know what to choose when answering test questions. (R1)*

This indicates that, due to the absence of a unified course standard for the English curriculum for Chinese deaf and hard-of-hearing students, the respondents in this study had different understandings when establishing their teaching objectives. In contrast to the situation in deaf schools, the English curriculum in general education

schools does not have such problems. The curriculum and teaching in general schools are more standardized under the guidance of the syllabus issued by the Ministry of Education. According to R4, she had many more opportunities to attend in-service training than teachers in deaf schools. Moreover, as introduced by R3, the training opportunities for teachers in special education schools are declining, and the training rarely focuses on curriculum development or subject-teaching issues. This reality helps explain the respondents' differences in their understanding of their teaching objectives.

5.4.2.4.2 Teaching pedagogy

The study found that the four English teachers who participated in the interviews made their choices of teaching strategies concerning their teaching objectives, their learning experiences as English language learners, and their training experiences.

The respondents mentioned that their teaching strategies were based on their teaching objectives. As was said by R1, since her classes were more test-oriented, she would prefer to teach her students to use the most straightforward way to find answers, rather than spend time using complicated language to explain the principles behind each grammatical structure. This opinion was supported by R2, who also stated the importance of teaching test-taking skills in her English classes.

Students just need to use some more advanced sentences to get a high score

(in writing). Students just have to memorize those sentences and then use them according to the topic, and that's enough. So writing for the Gaokao is a very strategic, test-based thing. (R2)

Apart from test-taking skills, R2 also demonstrated how her personal knowledge background affected her teaching strategies.

I studied drama education as an undergraduate. We used drama to teach subjects like literature, math, English, and history. The most basic principle of drama education is learning by doing. I haven't taught reading classes yet, but my plan is to send the articles to the students before the reading classes and have them translate the articles themselves. During the class, the students would take turns and use sign language to act out the story of the reading. In this way, students will first be asked to translate on their own. I will certainly pick out the key sentences to teach, but some very basic sentence translations will not take up class time. Second, if the students can tell the story in sign language, they have already understood it. (R2)

However, even though she intended to integrate teaching pedagogy from her drama education major into her English reading classes, the main strategy for her to teach English was still translation. Grammar translation was widely used by the two teachers who agreed that their English classes were more test-oriented. When asked

about how she taught reading classes, R1 replied that she would use CSL to translate the reading passage for the students. Moreover, for both R1 and R2, one of the main concerns in teaching English was how to use CSL to accurately translate English. As discussed earlier, they would only address this translation issue in their teaching communities and seldom seek help in other topics, such as teaching pedagogy (refer to Section 5.4.1.2). This intention was closely linked to their sign language training experiences.

The quest for accuracy in sign language interpretation has, in turn, influenced their teaching pedagogy. According to R1, she would use her first class to help students distinguish between Chinese, sign language, and English. She believed that through this approach, students would understand that the three languages are different, thus encouraging them to think directly in English. This concept of thinking in English was also emphasized by R2, who mentioned that she preferred to use CSL to explain English principles directly so that her students did not need to translate English into Chinese and then into CSL for comprehension.

R2 introduced how she used CSL to teach English grammar.

> *In fact, I don't think it (using CSL to teach English) has much to do with grammar or syntax order, but rather with the way sign language is expressed. Like I told you before about the present perfect tense. In Chinese, we would*

say 'already'. For example, '我（I am）已经(already)结婚(marry)了(-ied)', but the sign language expression is 'married' plus the action of shaking your hand to express 'finished', which means something has been done. In this way, 'married' plus the handshake can directly express the meaning of the present perfect tense in English. Then, I don't need to tell students 'married' plus the handshake means '我（I am）已经(already)结婚(marry)了(-ied)' in Chinese, and then relate the meaning of 'already' to the English present perfect tense 'I have got married'. (R2)

The other two teachers (R3 and R4) exhibited a more diverse style of teaching. In their interviews, they stated that the goal of teaching English should be to build language usage abilities as opposed to placing an excessive focus on exam preparation strategies. R3 expressed her disagreement with only teaching vocabulary or grammatical structures. She gave a more detailed answer to the question of how to teach an English lesson than R1 and R2.

There are many general methods (used to teach a lesson), such as heuristic teaching, and then there is the situational approach, where you create a situation. For example, suppose students went on a trip to XX places last week and did XX things, and I ask them to describe them. Then, we go through some writing exercises, such as writing a diary. And then relate the knowledge to the students' real life. Teaching should be integrated with the students' lives.

(R3)

Similarly, R4 mentioned that she would integrate different strategies when designing lesson plans for English grammar, reading, writing, and speaking skills. She also highlighted that adopting integrated teaching strategies was required by her school, which was not the case for the deaf schools where R1 and R2 worked at.

5.4.2.4.3 Teaching material

As introduced by the respondents, there are currently no English textbooks specifically designed for deaf and hard-of-hearing students. As a result, they either choose to use the same materials as general education schools (R1 and R3) or create their teaching materials (R2). The textbook used by the teachers in this interview is the "Go for It" series, written by People's Education Press (PEP). According to the interview, although the respondents agreed that the PEP textbook was the best choice available, it was still not suitable for their students. R1 mentioned that this textbook had too many listening and speaking activities, which were not accessible to all deaf and hard-of-hearing students.

> *There is a problem because the general education school textbooks definitely focus more on listening and speaking, but we can hardly do any of these activities. Even though it's not that all deaf and hard-of-hearing students are unable to do those activities, those students using sign language are not able*

to join at all. (R1)

R3 agreed with this opinion by stating that she had to make some modifications so that students could engage in the listening and speaking activities.

The PEP version of the textbook is actually not suitable for our children. In terms of listening, speaking, reading, and writing abilities, listening and speaking make up a large proportion of the textbook. The listening part is handled differently by each person. For example, some of our teachers do not teach the listening part. But I still teach it every time, just in a different form. So it depends on how you handle it. (R3)

Regardless of the type of teaching materials currently used by the respondents, they agreed that the materials should be appropriate to the needs of deaf and hard-of-hearing students and that they should avoid designing teaching methods and activities that are incomprehensible to these students. R2 pointed out that she usually searched for teaching resources on the Internet, but since these resources were designed for hearing students, some of the concepts mentioned were simply incomprehensible to her students. For example, R2 noted that some teaching materials used phonological knowledge to teach vocabulary and grammar.

For example, there are materials that talk about language rules could be

understood by taking advantage of their pronunciation, such as the vowels "a", "e", "I", "o", "u", but it's hard to teach deaf students these concepts because they don't have the experiences of hearing these sounds. (R2)

According to R2, although this method may be effective for hearing students, it was not suitable for deaf and hard-of-hearing students because it was difficult for them to build a systematic understanding of phonological knowledge in the same way as hearing students.

Therefore, in the absence of uniform teaching resources, teachers made their trade-offs in terms of teaching content based on their teaching experiences. Compared to R3, R1 had fewer years of teaching experience. In this case, she chose to simply discard the design of teaching activities that were not suitable for deaf and hard-of-hearing students rather than adjusting them, as R3 did.

Even though the respondents agreed that the current textbooks were not suitable for deaf and hard-of-hearing students, they had diverse views on the issue of whether it would be beneficial to have textbooks specially designed for deaf and hard-of-hearing students. R4 found it challenging to provide a definitive response since she was inexperienced with deaf education, although she had a favorable opinion of the current PEP textbook. R1 supported the idea of having more teaching activities appropriate for such children despite her reservations about utilizing a new textbook.

R2 mentioned that she had previously read an English textbook written by Italians and believed that textbooks designed exclusively for deaf and hard-of-hearing students would be useful. In her opinion, that textbook was excellent because it provided information via illustrations and sign language rather than just Italian translations. Despite her positive outlook, R3 did not think that using textbooks specifically for deaf and hard-of-hearing students was beneficial. According to R3, while such textbooks better catered to the needs of deaf and hard-of-hearing students, the difficulty levels of those textbooks were much lower than general education textbooks and may not have provided the same level of challenge.

> *This poses a bridging problem. For example, if you use the textbook for deaf education in primary school, suppose that it is two levels lower in difficulty than the PEP version, then when the students reach junior high school and there is no textbook for deaf education, how would you manage to teach your students by using another textbook which difficulty level is far beyond their capacity? This is the problem. In our teaching practice, we have also had many teachers report this problem. For example, some students, including those from the third and fourth-tier cities below, use the textbook deaf education in primary school, but when they move to junior high school, they find it difficult to use the PEP version textbook because it is much more difficult than the deaf textbook in primary school. If the textbook does not connect well with the junior high school, the students will have difficulties*

when they reach a high level, so I am not in favor of using this. (R3)

Moreover, R3 mentioned that even though the PEP textbook was not suitable for deaf and hard-of-hearing students, it was still the best current choice because it met the standards of the Gaokao. She suggested that the development of an English textbook for deaf and hard-of-hearing students must consider two crucial factors. First, the textbooks should comprise an entire teaching system that covers grades from elementary through secondary school. Second, the textbooks' level of difficulty should correspond to that of the Gaokao.

R3 emphasized that deaf and hard-of-hearing students may have some difficulty developing their logical thinking abilities due to language impairment caused by hearing loss, but their figurative thinking abilities are on par with or even superior to those of hearing students. Therefore, she did not agree that reducing the difficulty of content is a necessary means of developing textbooks for deaf schools. On the contrary, she believed that this approach of only reducing the difficulty of the materials without changing the difficulty of the tests could lead to challenges in teaching and learning.

To sum up, according to the teachers who took part in the interviews, given the existing circumstances, it would not be feasible to create a collection of English textbooks exclusively for Chinese deaf and hard-of-hearing students. However, they

expressed many expectations regarding potential instructional resources. According to the respondents, more teaching activities suited for deaf and hard-of-hearing students could be included in the design of these resources, and the teaching material could be presented using a range of illustrations, sign language, Chinese, and English. To assist teachers in their instruction, the teaching resources could be utilized as a complement to the current PEP textbooks.

5.5 Discussion

This study provides evidence supporting the assumption that teachers' training backgrounds significantly impacts their knowledge base and, consequently, their teaching practices. The findings from the interviews reveal that the knowledge base of the respondents varied greatly, influenced by their diverse training experiences. Specifically, the English teachers (R1, R2, and R3) demonstrated a better understanding of special education theory and sign language compared to the English teacher in the general education school (R4). However, R1, R2, and R3 lacked formal professional training in English language education and pedagogical skills. Darling-Hammond (2000) argues that teachers who lack effective training struggle to build a robust knowledge base due to their homogeneous cognitive and cultural perceptions, which in turn hinders their ability to effectively perceive and respond to their students' needs. In accordance with this statement, the respondents, who lacked systematic training in special education, deaf education, and teaching English as an additional language to learners in non-English-speaking countries, exhibited varied attitudes and practices toward their students' heterogeneous characteristics, communication

preferences, and the teaching of their subject, relying primarily on their existing knowledge.

5.5.1 Impact of training experiences on teachers' responses to students' diverse needs

The lack of systematic training specifically focused on deaf education posed significant challenges for the teachers, limiting their ability to effectively address the diverse needs of their students. Even when teachers were aware of these needs, gaps in their training often prevented them from responding appropriately. As Korthagen (2004) suggests, the absence of comprehensive training hinders teachers' ability to reflect on and adapt their instructional practices to meet the unique demands of their students. Without ongoing professional development, teachers may increasingly rely on a fixed body of existing knowledge, leading to rigid and sometimes stereotypical approaches to teaching.

For example, R1 and R2, who were strong proponents of teaching sign language, insisted on exclusively using CSL in their classrooms, even though they were aware of their students' varied language preferences. This reliance on a single mode of communication likely stemmed from a lack of training in deaf education, which would have equipped them to better address and incorporate these diverse preferences. Similarly, R3, despite having a background in special education, believed that deaf and hard-of-hearing students were not significantly different from hearing students and thus did not require special treatment. This belief highlights the detrimental

effects of insufficient training in deaf education, leading to misunderstandings about the unique needs of these students and resulting in a one-size-fits-all approach that fails to meet those needs effectively.

5.5.2 Impact of training experiences on teachers' communication with deaf and hard-of-hearing Students

The significant variations in the teachers' knowledge base also impacted their day-to-day teaching practices, particularly in how they perceived and addressed communication difficulties with their deaf and hard-of-hearing students.

First, the respondents attributed communication difficulties to different factors based on their existing knowledge. For instance, R1 and R2, whose training primarily focused on sign language skills, believed that these difficulties stemmed from the teacher's inadequate sign language proficiency. In contrast, R3, with a background in special education, attributed communication challenges to the teacher-student relationship rather than linguistic factors.

Second, the teachers' training experiences influenced their sense of self-efficacy in managing communication with their students. R1 and R2, who were trained in sign language, believed that their proficiency in this area helped mitigate communication barriers. On the other hand, R3, who was trained in special education, felt that her background provided her with a deep understanding of her students, allowing her to communicate effectively. However, questionnaire results indicated that R3's students

were dissatisfied with the quality of communication, suggesting that her skills in communicating with deaf and hard-of-hearing students were insufficient, likely due to the absence of specialized training in deaf education.

5.5.3 Impact of training experiences on teachers' practices in teaching English to Chinese deaf and hard-of-hearing students

Without formal training in English language education and in the absence of standardized curriculum guidelines, the respondents relied heavily on their own knowledge and past experiences when teaching English to Chinese deaf and hard-of-hearing students. This deficiency in specialized training and guidance contributed to inconsistencies in teaching practices across different classrooms.

For example, R1 and R2, who believed that English education should be more test-oriented, primarily focused on teaching test-taking skills, often at the expense of developing comprehensive language abilities. This approach, while potentially effective in raising test scores, did not adequately prepare students for real-world communication.

In contrast, R3 and R4, who had some background in teaching English as an additional language to learners in non-English-speaking countries, adopted a more holistic approach to language education. They emphasized developing students' overall language abilities, recognizing that language learning involves more than just passing exams. They implemented a series of strategies designed to engage students

in meaningful language use, aiming to equip them with the necessary skills for effective communication in various contexts.

In summary, the findings from this semi-structured interview study highlight the close relationship between teachers' training experiences, their perceptions of student diversity, their attitudes toward students' differentiated needs, and their English teaching practices. It is clear that the role of an English teacher for deaf and hard-of-hearing students encompasses multiple identities: special education teacher, deaf education teacher, and language teacher teaching English in a non-English-speaking country. When any one of these areas is underdeveloped, teachers may struggle to adequately respond to the diverse needs of their students.

These findings underscore the need for a more systematic teacher preparation program that fully integrates training in special education, deaf education, subject-area education, and pedagogical strategies. Additionally, respondents expressed a desire for teaching and learning materials that complement the current textbooks. In response to this need, the experimental study presented in Chapter 5 introduces a multi-modal reading interface that provides Chinese translations and CSL interpretation videos for vocabulary in reading passages selected from the textbooks used by deaf and hard-of-hearing students. Chapter 5 offers a detailed introduction to the reading interface and the experimental study.

Chapter 6 Exploring Language Preferences Through a Multi-modal Reading Interface for Chinese Deaf and Hard-of-hearing English Learners: An Experimental Study

6.1 Introduction

The primary aim of this experimental study is to explore the preferences of deaf and hard-of-hearing students for Chinese text translation and CSL interpretation of key words during English reading tasks. Additionally, the study seeks to explore the impact of multi-modal key word assistance on the students' performance in post-reading tasks. Specifically, it aims to investigate potential correlations between the diverse backgrounds of these students and their preferences for sign language information versus textual information. By examining these aspects, the research intends to provide valuable insights into effective instructional strategies for enhancing the learning experiences of Chinese deaf and hard-of-hearing students in English classrooms.

6.1.1 Rationale for the design of this experimental study

As has been mentioned in Chapter 3, the studies in this thesis are interconnected (refer to Section 3.1). The design of this experimental study is based on findings from the demographic questionnaires with the deaf and hard-of-hearing students and the semi-structured interviews with English teachers. The following paragraphs briefly introduce how findings from the other two studies in this thesis inspired the design of this one.

6.1.1.1 Addressing deaf and hard-of-hearing students' multi-modal multilingual preferences

Even though the demographic questionnaires have shown that deaf and hard-of-hearing students have diverse needs in various respects, including their language preferences (refer to Chapter 3 and Chapter 4), results from the semi-structured interviews with the teachers failed to demonstrate effective teaching practices in response to the students' needs (refer to Chapter 5).

In Chapter 5, it was noted that three out of four respondents primarily worked with deaf and hard-of-hearing students. Of these three teachers, two reported that their English classes were exclusively taught in sign language. Despite acknowledging the varying levels of sign language proficiency among students and the potential benefits of oral instruction, these instructors maintained their commitment to sign language as the primary mode of instruction. According to these two respondents, their preference for teaching in CSL stems from their belief that only CSL truly belonged to the Deaf community. However, according to the results from the expanded demographic survey, both CSL and spoken Chinese are among the two most preferred ways for deaf and hard-of-hearing students when communicating with their teachers. That is to say, the teachers' insistence on using a single language mode may not effectively meet the diverse needs of deaf and hard-of-hearing students.

In other words, there is a mismatch between teachers' choices and deaf and hard-of-hearing students' preferences for the languages used in English classrooms. It should be noted that the semi-structured interview results should not be overstated by claiming that most English teachers prefer to use only CSL or only spoken Chinese in their classrooms. As demonstrated by the respondents, this is not entirely accurate as the interviewed teachers also discussed how they used multi-modal methods as instructional assistance, such as PowerPoint slides (refer to Chapter 5).

However, given that the mismatch still exists, these findings suggest the potential benefits of developing multi-modal teaching and learning assistance, especially for inclusive classrooms. The semi-structured interview study included an English teacher who primarily worked at a general education school with hearing students but had one deaf student in her class. According to this teacher, it would be impractical for her to use CSL in her classroom; however, she also noticed that this student had difficulties with classroom communications. In such cases, developing multi-modal tools could bridge the gap between teachers' instructional methods and the unique language preferences of deaf and hard-of-hearing students, enhancing their engagement and comprehension in English classrooms.

6.1.1.2 Addressing vocabulary and reading

The students in the demographic studies ranked reading as one of the most difficult skills to learn (refer to Chapters 3 and 4). Chapter 2 has reviewed previous studies focusing on deaf and hard-of-hearing students' reading comprehension difficulties

regarding their vocabulary knowledge (refer to Section 2.2.2). The correlation between vocabulary and reading comprehension was also observed in the expanded demographic survey in Chapter 4. To be more specific, the Pearson correlation analysis indicated a positive correlation between participants' perceived difficulty with English reading comprehension and their perceived difficulty with vocabulary recognition ($r=0.566$, $p<0.001$) and spelling ($r=0.547$, $p < 0.001$) (refer to Section 4.4.4).

Based on the findings of the previous studies, the semi-structured interview study also asked the respondents if they had noticed their students' difficulties in learning English, and how they taught vocabulary and reading classes. According to the respondents' answers, only R4 mentioned that students' difficulties in reading comprehension could be related to their vocabulary knowledge.

> *Difficulties in reading comprehension and writing are determined by the situation of each student. For example, if a student is not able to identify the meaning of the words, he/she will definitely have a problem with reading. (R4)*

For the other three respondents (R1, R2 and R3), none of them highlighted the importance of vocabulary in reading comprehension or classroom instruction. R2 and R3 mentioned that they would cover some vocabulary knowledge in their classes; however, the respondents generally agreed that it was the students' responsibility to

learn, or memorize, new words. R2 and R3 believed that it was impractical and boring to specifically teach vocabulary during class time.

> *The reason I do not spend a lot of class time on vocabulary is because I feel that memorizing vocabulary is something that students should do by themselves after class, rather than me forcing them to in class. I will teach some vocabulary knowledge in class. For example, when I give an example using a certain word, I will tell the students what the verb, noun and adjective forms of the word are, but I cannot teach every word that way. (R2)*

> *I think that if I make a student learn only words and phrases for a 45-minute class, that would be very boring. If the knowledge is put in a context, a sentence, or a short piece of text, it is much better to learn that way. (R3)*

In other words, the respondents did not demonstrate adequate teaching strategies in teaching vocabulary. However, it is evident from the research literature and the demographic studies in this thesis that vocabulary plays an important role in deaf and hard-of-hearing students' reading experiences. Therefore, it would be advantageous to consider providing additional support for vocabulary acquisition to students, especially during their reading experiences.

6.1.1.3 Addressing the teachers' expectations on potential learning materials

Respondents from the semi-structured interviews expressed a shared expectation for the development of teaching and learning materials specifically tailored for deaf and hard-of-hearing students. As outlined in Chapter 5, R1 and R2 emphasized the importance of incorporating sign language instructions into these materials and designing activities that are accessible to the students. R3 highlighted the need for teaching materials to align with the difficulty level of the Gaokao, emphasizing that they should not be simplified compared to the current textbooks. In response to these expectations, this study opted to provide assistance on existing textbooks rather than develop entirely new materials.

6.1.2 The use of generic textbooks

The current textbook used by the high school deaf and hard-of-hearing students in this study is the "Go for It" series, and that used by the university students is the "New Concept English" series. It is pertinent to highlight that these textbooks utilized by the instructors and students are not specifically designed for this group of students and, therefore, do not fit their unique needs.

Based on a mixed-methods study involving 12 teachers and 266 deaf and hard-of-hearing students from five deaf and special education schools across different cities in China, Zhang (2013) emphasized the need for specialized teaching materials in English education for students in Chinese deaf schools. He argues that while general education materials are rich in content, they do not adequately address the specific

needs of deaf and hard-of-hearing students. He recommends that English textbooks for deaf and hard-of-hearing students should include visual aids, such as images, to enhance comprehension, and provides an example of an English textbook designed for deaf and head-of-hearing students at the high school level by following his suggestions. However, the example that Zhang (2013) presents in his thesis does not effectively demonstrate the use of visual aids. The only visual element found in his example is an image of a red smiley face to the left of a section title, (e.g.,

, cited in Zhang, 2013, p. 99). Hurst and Hill (2023) suggest incorporating more meaningful visual elements and fewer purely decorative ones in English coursebooks. Given that the red smiley face does not contribute to explaining the section title's meaning, it is difficult to conclude that Zhang's (2013) example textbook enhances learning comprehension as he suggests.

Researchers also suggest adapting existing general education materials to meet the specific needs of deaf and hard-of-hearing students. Liao (2021) proposes several strategies for this adaptation, including content replacement, increased emphasis on reading and writing, adjustments to the proportion and content of illustrations, and the development of supplementary exercise books. Liao (2021) argues that the general school materials currently used in deaf schools do not align with the language use and visual thinking of deaf and hard-of-hearing students. However, her article does not address how to integrate sign language elements into teaching materials or how to design activities that cater to the preferences of deaf and hard-of-hearing students.

Consequently, while there is recognition of the unique needs of this population in the discourse on developing appropriate English language materials for such students in China, the practical application remains lacking.

As previously discussed in Section 6.1.1.3, instead of creating a new textbook, this study offered additional multi-modal support for the existing textbooks—specifically "Go for It" and "New Concept English"—that were already being used by the deaf and hard-of-hearing participants.

6.1.2.1 "Go for It" for high school deaf schools

"Go for It" is a series of textbooks published by People's Education Press after being reviewed by the Ministry of Education in 2013. The book is primarily designed for middle school students (from Grade 7 to Grade 9) in general education settings. However, as introduced by the interviewed teachers, deaf and hard-of-hearing students are using these textbooks from Grade 7 to Grade 12 (i.e. throughout middle and high school) before taking the Gaokao.

The "Go for It" series comprises five books for students and five books for teachers. The student books are designed to encompass a wide range of learning activities, focusing on listening, speaking, reading, grammar, vocabulary, and writing. Notably, listening and speaking exercises hold a significant share of the content.

The Teacher's Book serves as a comprehensive guide for instructors using the Student's Book. It provides a detailed outline of the syllabus and objectives for each chapter, offering thorough instructions for teaching methods and the activities presented in the Student's Book. Under ideal circumstances, teachers can gain a systematic understanding of the Student's Book design by referring to the Teacher's Book. This allows them to address questions about the teaching objectives of specific activities, the anticipated teaching challenges, and the implementation steps in the teaching process, for example. The Teacher's Book thus serves as a valuable resource for educators, aiding in effective lesson planning and execution.

6.1.2.2 The "New Concept English" course for university deaf and hard-of-hearing students

Being different from "Go for It", the "New Concept English" caters to a broader audience, ranging from middle school students to adults. The textbook series holds a prominent position in English language education in China, renowned for its widespread popularity and enduring influence (Yang and Coxhead, 2022). Originally published as Longman's "New Concept English" in London in 1967, the series underwent a specific revision for Chinese learners in 1997, led by Qishen He, solidifying its adaptability and relevance to the local context (Alexander and He, 1997). Widely acknowledged as a classic, the series has left an indelible mark on Chinese secondary school and university students (Song, 2019).

The series comprises four books of different proficiency levels, ranging from beginning to advanced. For the present study, Book 2 (Practice and Progress) was selected under the guidance of the English teachers to align with the teaching progress. In contrast to the instructional approach employed in the "Go for It" series, the "New Concept English" curriculum adopts a distinctive structure, wherein each lesson in the Student's Book revolves around a single reading text. The components of these lessons encompass the reading text itself, an elucidation of newly introduced vocabulary derived from the text, a Chinese translation of the text, grammatical elucidations, and an array of practice questions designed to facilitate comprehension of the text, acquisition of new words, and mastery of sentence structures. To enhance students' proficiency in English listening skills, the textbook integrates audio-recorded materials corresponding to the texts. The Teacher's Book recommends that instructors advise students to engage with these audio recordings before reading the texts.

Unlike the "Go for It" series, the listening training component is not deemed obligatory in the teaching activities of the "New Concept English" series. Essentially, even in the absence of listening to the recordings, students with hearing impairments can successfully comprehend and fulfill the learning tasks delineated in the textbook through the reading activities, thereby attaining the stipulated learning objectives. However, according to Yang and Coxhead (2022), "New Concept English" demands

a substantial vocabulary foundation to effectively engage with the reading texts, which poses a huge challenge for deaf and hard-of-hearing students.

6.1.3 Research questions

Hence, the prior research and current practical realities in English classrooms catering to deaf and hard-of-hearing students in China underscore the importance of the development of dedicated learning materials tailored to this demographic. Acknowledging the existing gap, and in response to teachers' expressed needs, the present study designed a multi-modal reading interface based on the current textbooks being used by the hard-of-hearing students. This interface incorporated highlighted key words[18] accompanied by both Chinese text translations and sign language interpretation videos in a reading passage. By integrating these features into the reading interface, the students gained access to English texts with multi-modal support for key words, allowing them the flexibility to choose their preferred information modality.

The research questions of this study include:

1. What are the preferences of deaf and hard-of-hearing students for Chinese text translation versus CSL interpretation of key words during English reading tasks?
2. What effects do multi-modal resources have on deaf and hard-of-hearing students' post-reading performances on vocabulary and reading comprehension exercises in an English reading class?

[18] In the context of this study, the term "key words" refers to the new vocabulary listed in the word list of the textbooks, which students are required to learn and understand to engage with the reading passages.

3. Based on the TAM framework, what are the perceived usefulness, ease-of-use and overall attitude of deaf and hard-of-hearing students toward the use of the designed multi-modal reading interface, Chinese text translations and CSL interpretation videos of key words in English reading passages?

6.2 Review of relevant literature on multi-modal instruction, input enhancement and the Technology Acceptance Model (TAM)

This section delves into the pertinent literature surrounding multi-modal instruction, input enhancement, and the TAM. Multi-modal instruction, which incorporates various forms of media and sensory inputs, has been increasingly recognized for its effectiveness in enhancing learning experiences, particularly for diverse learner groups such as deaf and hard-of-hearing students. Input enhancement strategies aim to make key linguistic features more salient, thereby facilitating better comprehension and retention. Additionally, the TAM provides a framework for understanding how users come to accept and use technology, which is crucial when considering the implementation of technological aids in educational settings. By examining these three areas, this review aims to establish a multifaceted understanding of how multi-modal approaches and technological tools can be effectively integrated to support the learning needs of deaf and hard-of-hearing students in ELL-NESC contexts.

6.2.1 Multi-modal instruction in classrooms of deaf and hard-of-hearing students

The question of which language should be used as the primary information transmission modality in the classroom of deaf and hard-of-hearing students has been

the subject of much research in the past. For instance, Hall et al. (2019) harshly condemned Geers et al. (2017) for asserting that sign language was detrimental to the development of deaf children. By arguing that “language, not (just) speech” is what deaf children require, Hall et al. (2017) contended that deaf and hard-of-hearing children's developmental needs depend on their exposure to sign languages and that inadequate exposure to them may cause deaf and hard-of-hearing children (at least some) to partially or somewhat delay their mastering of a first language.

Notably, even though proponents of oral languages and those of sign languages are at odds over this matter, their core objectives touch on a crucial topic for field policy and practice: how to give deaf and hard-of-hearing children early, meaningful, and ready linguistic access (Mayer and Trezek, 2023). In other words, meaningful linguistic access is a major issue that must be addressed in the classroom of deaf and hard-of-hearing students.

Empirical research has been conducted to determine whether multi-modal resources could be a solution to this fundamental problem. According to Marschark et al. (2006), attempts have been made to give deaf and hard-of-hearing students alternative or numerous modes of communication in the classroom using technology to enhance interaction and instruction.

For instance, a study by Gentry et al. (2004) evaluates the relative efficacy of print, sign, and images in helping deaf children understand reading-related information. In their study, four alternative formats of CD-ROM-generated stories were delivered to deaf children using personal computers: print only, print plus images, print plus sign language, and print plus pictures plus sign. The results of the study, which examined deaf children's reading comprehension, indicated that stories on CD-ROM that included several reading cues—such as print, images, and sign language—might be an enjoyable and engaging addition to regular reading practices.

Birinci and Sariçoban (2021) conducted a study to use visual materials and sign language to teach English vocabulary to Turkish deaf and hard-of-hearing students in a state special education vocational high school. As they stated in their research, the experimental group with visual materials and sign language instructions on vocabulary performed better in both immediate tests and delayed post-tests compared to the control group, who learned the same vocabulary via sign language only. Consequently, the authors suggested that

> vocabulary teaching should be enriched with the use of visuals as much as possible in teaching deaf learners of EFL since this method can be used effectively for deaf learners who have poor linguistic memory but better visual memory in foreign language learning and other subjects as well (p. 643).

To some extent, the topics discussed in these studies remain primarily those centered on the question of which modality of information might improve the learning

efficiency of deaf and hard-of-hearing students, and they somehow weaken the subjective role that deaf and hard-of-hearing students have in learning processes. In other words, there remain questions related to deaf and hard-of-hearing students' preferences for different modalities. For example, although Birinci and Sariçoban (2021) found visual materials beneficial for vocabulary instruction, their study did not explore the students' perspectives regarding what visual materials they preferred.

Thus, rather than only concentrating on just how multi-modal information enhances Chinese deaf and hard-of-hearing students' English reading experiences, this study allows the students to select the modality that best suits their distinctive language needs, thus advancing the investigation of the connection between the modality preferences and demographic characteristics of the students. More specifically, the multi-modal resources provided to the students in this study consisted of two types, namely a Chinese text translation and a CSL interpretation of highlighted key words. During reading, the participants were allowed to choose and switch between the two modalities freely. Thus, through analyzing the participants' mouth clicks on the two choices and their demographic features, the findings of this study would help to answer the research question about the impacts that deaf and hard-of-hearing students' diverse preferences for communication modes have on their options of the modality of key word translation.

6.2.2 Input enhancement

Input enhancement has been recognized as a valuable technique in language instruction, aiming to draw learners' attention to specific language features in the input they receive (Kim, 2006). Based on Schmidt's (2001) noticing hypothesis, which serves as a theoretical rationale for the use of input enhancement, this technique involves the manipulation of input through formatting techniques, such as bolding, italicizing or underlining, to make certain elements more noticeable to learners, thus facilitating their acquisition.

Recent studies have continued to support the efficacy of input enhancement. For example, Szudarski and Carter (2014) explored the effectiveness of input flood and input enhancement in English language learners' acquisition of collocations in the context of ELL-NESC. Their study found that input enhancement (in the form of underlining) combined with input flood resulted in improved collocation competence, particularly at the levels of form recall and recognition. Similarly, Vu and Peters (2022) found that incorporating textual input enhancement into reading activities led to significantly greater vocabulary acquisition compared to reading alone.

In the context of deaf and hard-of-hearing students, input enhancement has been employed to support language development and additional language learning. For example, Berent et al. (2009) have argued that using an essay coding strategy as a means of visual input enhancement, where students' essays are coded for grammatical

instruction purposes, effectively facilitates the acquisition of English grammatical knowledge among deaf and hard-of-hearing college students. Similarly, Fahimnia and Haghani Mobarake (2014) integrated supportive colored pictures as visual input enhancement alongside reading texts, concluding that this strategy enhanced the comprehensibility of the reading material in students' course books. Kang and Scott (2021) have also suggested that visual enhancement could be beneficial in supporting deaf and hard-of-hearing students in additional language acquisition.

Research on using textual input enhancement in reading texts to support deaf and hard-of-hearing students' vocabulary learning and reading experiences in the ELL-NESC context, however, is still limited. To address this research gap, the designed reading interface in this study incorporates key words that are underlined and colored to ensure that deaf and hard-of-hearing participants can easily notice them. Even though the aim of this study is not to explore the effectiveness of textual input enhancement in aiding English vocabulary acquisition and reading comprehension among Chinese deaf and hard-of-hearing students, it is assumed that this approach would be beneficial in improve their overall performances on the vocabulary and reading comprehension post-reading tasks by drawing their attention to critical terms and concepts in the text.

6.2.3 The TAM

To achieve the goal of providing CSL interpretation videos and Chinese text translations for key words in reading texts, this study designed an online reading

interface for deaf and hard-of-hearing students to use on computers. To evaluate the participants' acceptance of this tool, a usage analysis was conducted. This analysis assessed the users' perceived usefulness, ease-of-use, and overall attitude toward the tool, using the measurements outlined in the TAM.

The TAM was initially introduced by Davis in 1989, aiming to understand users' acceptance of information technology based on their perceptions. Davis (1989) explored the interplay between cognition, affect, and technologies, revealing that user acceptance was influenced by these factors. According to Granić and Marangunić (2019), TAM outlines three key factors explaining user motivation: perceived usefulness, perceived ease-of-use, and attitude toward usage. Perceived usefulness denotes users' belief in how employing a specific information system can enhance their performance; perceived ease-of-use assesses how easily individuals can use a given information system; attitude plays a pivotal role in determining whether users will adopt or reject the system (Chang and Hsu, 2011; Granić and Marangunić, 2019).

Applying TAM for studying technology acceptance in educational settings is not a new topic. As stated by Granić and Marangunić, "TAM is the most common ground theory in e-learning acceptance literature" (2019, p. 2575). Researchers have also conducted studies on TAM's applicability to different learning technologies, such as mobile learning (Almaiah et al., 2016), Moodle (Chen et al., 2012), digital games (Ghani et al., 2019) and more.

In addition, in the area of additional language learning, TAM is also widely used to measure students' acceptance of technological learning materials. For example, Chang and Hsu (2011) adopted a mobile-assisted synchronously collaborative translation-annotation system for an English reading comprehension class and used TAM to assess the perceived usefulness, perceived ease-of-use, and users' perceived satisfaction of this system and administered it with 85 junior year university students in a non-English-speaking country. According to the results of the study, the participants were generally positive toward the use of the collaborative translation-annotation system.

In light of the aforementioned studies, it is clear that the state of current research on TAM application in the educational domain is not in its infancy. However, there is still a lack of research on testing the intention to use certain technologies in the educational domain with users of special educational needs. Even though information and communication technologies have been proven to be beneficial to students with hearing impairment by providing equal access to knowledge and learning resources (Drigas and Ioannidou, 2013), few studies have addressed the users' acceptance of the technology. One recent study on the use of communication technology in classrooms with deaf and hard-of-hearing students has been carried out by Yang et al. (2022). In this study, the authors used a mixed-method approach to explore user interactions with a holographic sign language interpreter in a mixed reality (MR) classroom for

deaf and hard-of-hearing students and reported the participants' preferences for and acceptability of the technology. This study found that despite the technological advances of the holographic sign language interpreter in an MR format, the students who participated in the survey were skeptical about generalizing the technology to real classrooms. Therefore, the users' acceptance of the technology should not be ignored when the objective of utilizing the technology is to promote learning.

Consequently, inspired by previous studies, this study not only aims to test the deaf and hard-of-hearing participants' preferences about having multi-modal key word assistance in English reading but also emphasizes the students' experiences and intentions regarding the use of the learning material.

6.3 Methodology

This experimental study consisted of two parts: the development of the reading interface and the experiment with it.

6.3.1 The development of the reading interface

The development of this reading interface involved collaboration with English teachers from the two groups. These teachers were tasked with selecting two reading passages from their textbooks that had not been covered in class. Additionally, they were required to identify and highlight key words in these passages. The teachers were also responsible for providing post-reading questions and answers that complemented the selected texts.

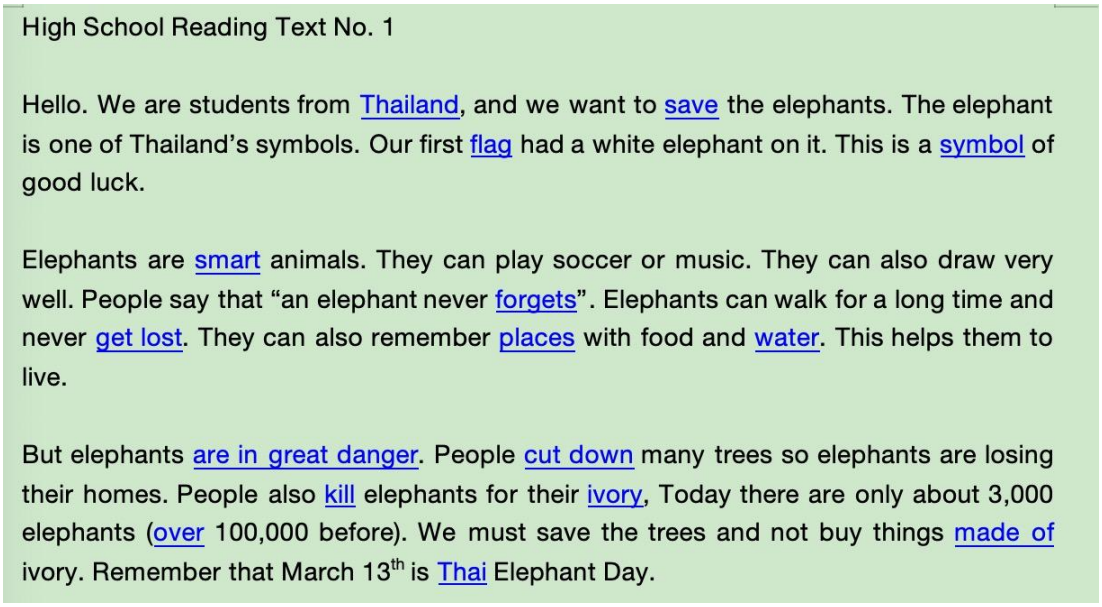
6.3.1.1 The reading passages and post-reading tasks

Two reading passages were chosen from the "Go for It" textbook for high school deaf and hard-of-hearing students, and two were chosen from the "New Concept English" for the university students. Several key considerations guided the selection process. First, both articles were unfamiliar to the students at the time of selection, ensuring that the key words in the texts had not been previously learned. Second, it would have been better if the two reading passages could have had a similar number of key words.

6.3.1.1.1 Reading passages for the high school group

The teachers chose two reading passages from Section B in Units 5 and 12 of the second book of Grade 7 in the "Go for It" series. The reading text in Unit 5 comprised 138 words and included 16 key words, while the reading text in Unit 12 contained 198 words and introduced 20 key words. Figures 6.1 and 6.2 are the two reading passages with highlighted key words.

Figure 6.1 High school Reading Passage 1



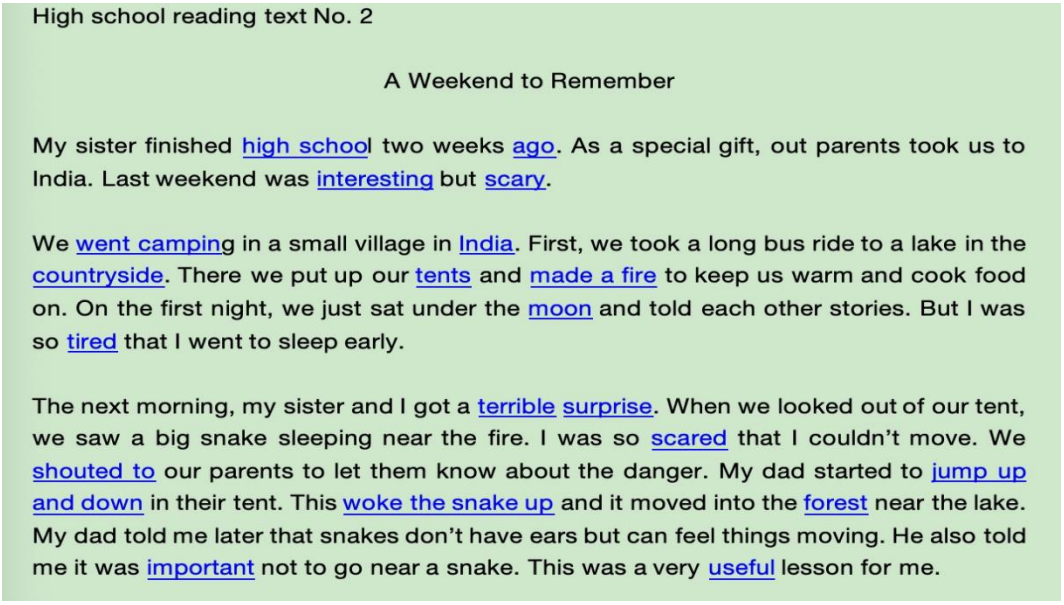
High School Reading Text No. 1

Hello. We are students from Thailand, and we want to save the elephants. The elephant is one of Thailand's symbols. Our first flag had a white elephant on it. This is a symbol of good luck.

Elephants are smart animals. They can play soccer or music. They can also draw very well. People say that "an elephant never forgets". Elephants can walk for a long time and never get lost. They can also remember places with food and water. This helps them to live.

But elephants are in great danger. People cut down many trees so elephants are losing their homes. People also kill elephants for their ivory, Today there are only about 3,000 elephants (over 100,000 before). We must save the trees and not buy things made of ivory. Remember that March 13th is Thai Elephant Day.

Figure 6.2 High school Reading Passage 2



High school reading text No. 2

A Weekend to Remember

My sister finished high school two weeks ago. As a special gift, out parents took us to India. Last weekend was interesting but scary.

We went camping in a small village in India. First, we took a long bus ride to a lake in the countryside. There we put up our tents and made a fire to keep us warm and cook food on. On the first night, we just sat under the moon and told each other stories. But I was so tired that I went to sleep early.

The next morning, my sister and I got a terrible surprise. When we looked out of our tent, we saw a big snake sleeping near the fire. I was so scared that I couldn't move. We shouted to our parents to let them know about the danger. My dad started to jump up and down in their tent. This woke the snake up and it moved into the forest near the lake. My dad told me later that snakes don't have ears but can feel things moving. He also told me it was important not to go near a snake. This was a very useful lesson for me.

Both texts were accompanied by reading comprehension questions, including multiple-choice questions, fill-in-the-blank exercises based on the article, and sorting questions aligned with the order of the story's development. Since the textbooks did

not include word exercises, the study adopted a word assessment method commonly used by teachers, involving matching a word with its corresponding Chinese meaning.

Due to the time required for the reading interface development, the experiment took place when the students were in the middle of Unit 5. While the teaching schedule had not yet covered the reading article in Section B, it should be acknowledged that some students might have encountered some of the new words in advance, a point that will be addressed in the data analysis.

6.3.1.1.2 Reading passages for the university group

The teachers selected two reading texts from Units 8 and 13 of the "New Concept English 2". The first passage consisted of 196 words and included 16 key words, while the second passage contained 182 words and 15 key words. Figures 6.3 and 6.4 are the two reading passages with highlighted key words.

Figure 6.3 University Reading Passage 1

University Reading Passage 1

Trapped in a mine

Six men have been trapped in a mine for seventeen hours. If they are not brought to the surface soon, they may lose their lives. However, rescue operations are proving difficult. If explosives are used, vibrations will cause the roof of the mine to collapse. Rescue workers are therefore drilling a hole on the north side of the mine. They intend to bring the men up in a special capsule. If there had not been a hard layer of rock beneath the soil, they would have completed the job in a few hours. As it is, they have been drilling for sixteen hours and they still have a long way to go. Meanwhile, a microphone, which was lowered into the mine two hours ago, has enabled the men to keep in touch with their closest relatives. Though they are running out of food and drink, the men are cheerful and confident that they will get out soon. They have been told that rescue operations are progressing smoothly. If they knew how difficult it was to drill through the hard rock, they would lose heart.

Figure 6.4 University Reading Passage 2

University Reading Passage 2

A noble gift

One of the most famous monuments in the world, the Statue of Liberty, was presented to the United States of America in the nineteenth century by the people of France. The great statue, which was designed by the sculptor Auguste Bartholdi, took ten years to complete. The actual figure was made of copper supported by a metal framework which had been especially constructed by Eiffel. Before it could be transported to the United States, a site had to be found for it and a pedestal had to be built. The site chosen was an island at the entrance of New York Harbour. By 1884, a statue which was 151 feet tall had been erected in Paris. The following year, it was taken to pieces and sent to America. By the end of October 1886, the statue had been put together again and it was officially presented to the American people by Bartholdi. Ever since then, the great monument has been a symbol of liberty for the millions of people who have passed through New York Harbour to make their homes in America.

"New Concept English" includes post-reading exercises that cover reading comprehension, grammar, and vocabulary multiple-choice questions. However, since this study did not focus on English grammar, grammar exercises were excluded from the post-reading activities.

Unlike the high school group, the reading texts had not been covered in class before the survey. As a result, both the texts and the vocabulary were unfamiliar to the university deaf and hard-of-hearing participants when the experiment was conducted.

6.3.1.2 Key word translations

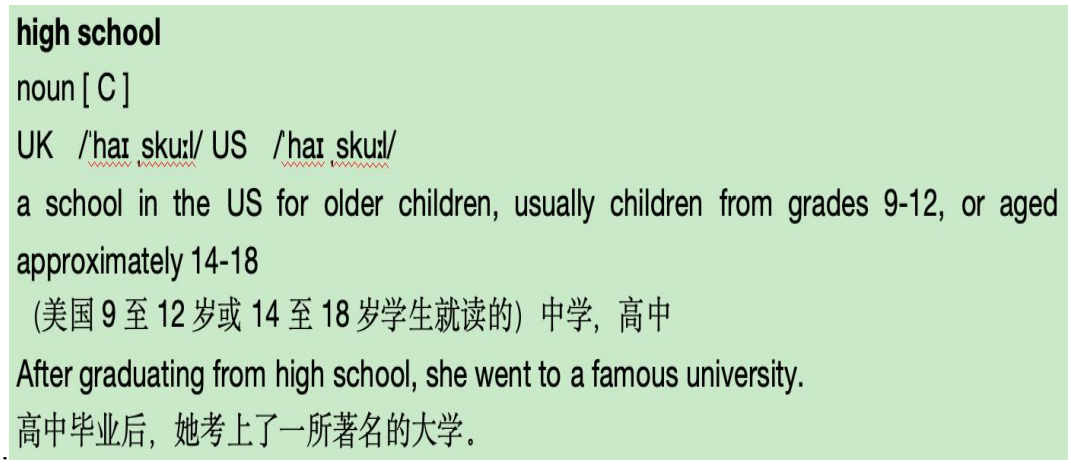
The key words in the reading passages were translated into both CSL and Chinese.

6.3.1.2.1 Chinese text translation

Upon receiving the reading passages and highlighted key words, I conducted further research by cross-referencing the highlighted key words from the Cambridge Dictionary website and the textbook word list. The Cambridge English Dictionary website (https://dictionary.cambridge.org/dictionary/english/) offers definitions and audio pronunciations for words, phrases, and idioms in both British and American English, sourced from the Cambridge Advanced Learner's Dictionary, the Cambridge Academic Content Dictionary, and the Cambridge Business English Dictionary. According to the website introduction (2024), the Cambridge English Dictionary is founded on original research from the unique Cambridge English Corpus and includes all the words from CEFR levels A1–C2 in the English Vocabulary Profile. With English meanings of key words provided by this tool, I referred to the textbook word lists for the Chinese meanings.

In cases where a word had multiple meanings, I selected the one that best aligned with the context of the text. Furthermore, for each key word, I provided example sentences with Chinese translations that matched the intended meaning in the given context. The example sentences were also provided by the Cambridge English Dictionary. According to the Cambridge English Dictionary (2024), the example sentences come from the Cambridge English Corpus, and the Chinese translations are based on the English–Mandarin Chinese Dictionary. Figure 6.5 gives an example of the textual translation of the key word "high school".

Figure 6.5 Example of the key word textual meaning, Chinese translation, example sentence and matched Chinese translation



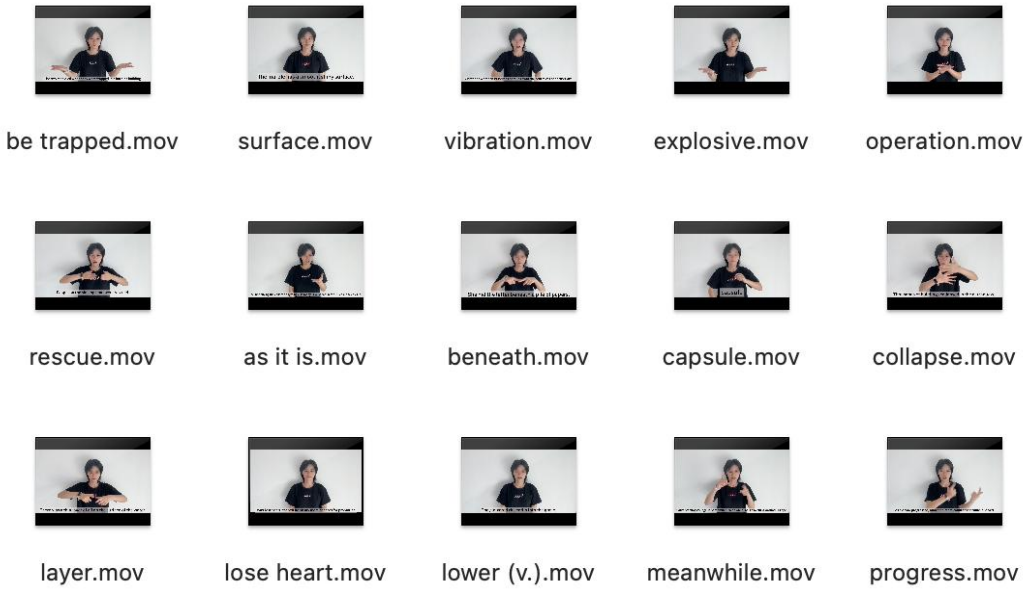
6.3.1.2.2 CSL interpretation

In the process of determining CSL interpretations for the key words, I conducted meetings with two CSL interpreters. To ensure accuracy, I referred to the Dictionary of National Standard Sign Language (《国家通用手语词典》), which was compiled by the China Disabled Persons' Federation, China Association of the Deaf, and the National Research Center for Sign Language and Braille in 2019. This authoritative resource played a crucial role in validating the CSL interpretations.

Despite the extensive coverage of the dictionary, the limitation of word size in CSL posed challenges, resulting in instances where corresponding sign language vocabulary could not be identified for certain words. In such cases, I engaged in discussions with Deaf individuals who took CSL as their first language and consulted a third qualified sign language interpreter to explore suitable sign language interpreting approaches. Following these collaborative efforts, the interpreters

produced sign language videos for each key word (as shown in Figure 6.6). This multi-step process aimed to ensure accurate and culturally appropriate CSL interpretations, considering both the linguistic nuances and the practical constraints posed by the size limitations in sign language expression.

Figure 6.6 Example of one CSL interpretation videos



6.3.1.3 The design of the reading interface

Once all the necessary materials were prepared, a coding expert was enlisted to develop the reading interface. To ensure that its design would effectively address the research questions, extensive discussions were held with the coding expert to outline the required functionalities. Several key features were identified.

1). Recording participants' behaviors, e.g. mouse clicks:

The system needed to have the capability to record participants' mouse clicks, particularly their choices on the two modalities of key word translations.

2). Time requirement for passage reading:

Participants were required to spend at least five minutes on the passage reading page before being allowed to proceed to the next step to ensure they had sufficient time to work on the key words.

3). Access to reading passage when answering questions:

Participants should be allowed to refer to the reading passage without key word assistance when working on post-reading exercises.

4). Preventing duplicate work:

A mechanism was put in place to ensure that the participants could not work on the same reading passage more than once.

5). Saving answers for grading:

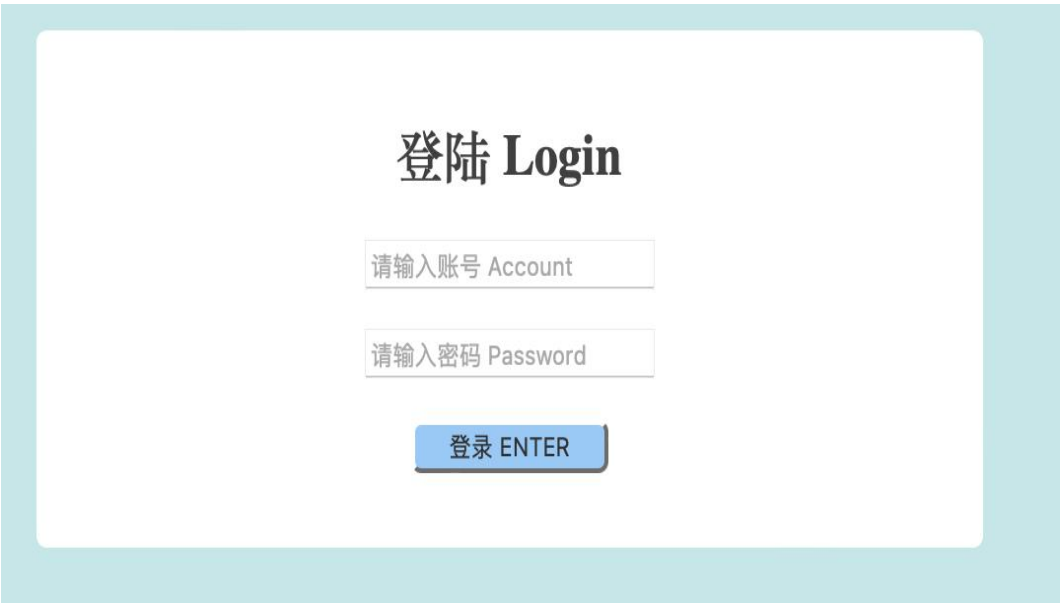
The participants' responses to the post-reading exercises needed to be saved for later grading and analysis.

After these specifications were established, the coding expert implemented the necessary features. The system underwent several rounds of piloting to identify and resolve any potential issues before the formal experiments were conducted. This thorough testing process ensured the functionality and reliability of the reading interface in line with the research objectives. For example, the layout of the interface was changed based on the suggestions of the deaf and hard-of-hearing students in the pilot rounds. The interface that was used for the experiment had an increased font size for the reading texts and the guidance function buttons, such as "Next", were made

more prominent by adding a border around them. Additionally, the answer page was divided into two columns: the left column displayed the original reading text without key word emphasis, and the right column contained the questions to be answered after the reading. In this way, the students did not need to switch back and forth between the reading text and the answer page while answering the questions.

In the reading interface, the participants were required to log in using the provided account usernames and passwords (Figure 6.7).

Figure 6.7 Reading interface login page



Upon successful login, they encountered two reading passages: one passage featured multi-modal assistance on key words (Figure 6.8), while the other did not (Figure 6.9).

Figure 6.8 Reading page with multi-modal assistance on key words

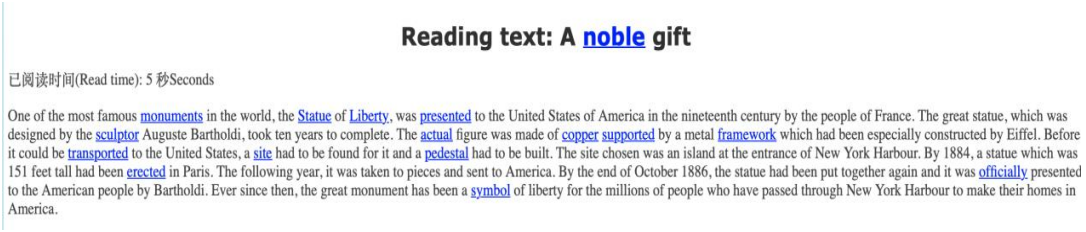
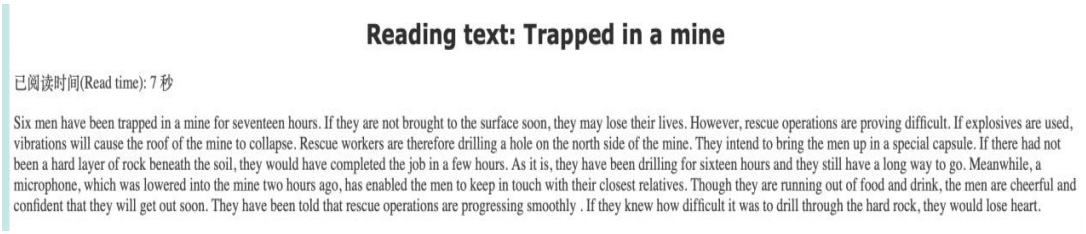
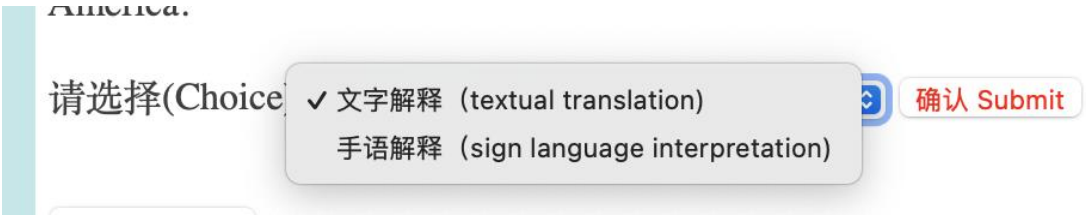


Figure 6.9 Reading page without multi-modal assistance on key words



Using the interface, the participants could engage with the highlighted key words by clicking on them (Figure 6.10). This interaction allowed students to choose between textual translation and CSL interpretation videos based on their preferences. The flexibility was designed to permit participants to switch between these modalities at any point during their reading. There were no restrictions on the maximum number of times participants could make these choices.

Figure 6.10 Choices of the given two modalities



Figures 6.11 and 6.12 illustrate how Chinese text translations and CSL interpretation videos were presented on the reading interface.

Figure 6.11 Example of Chinese text translations

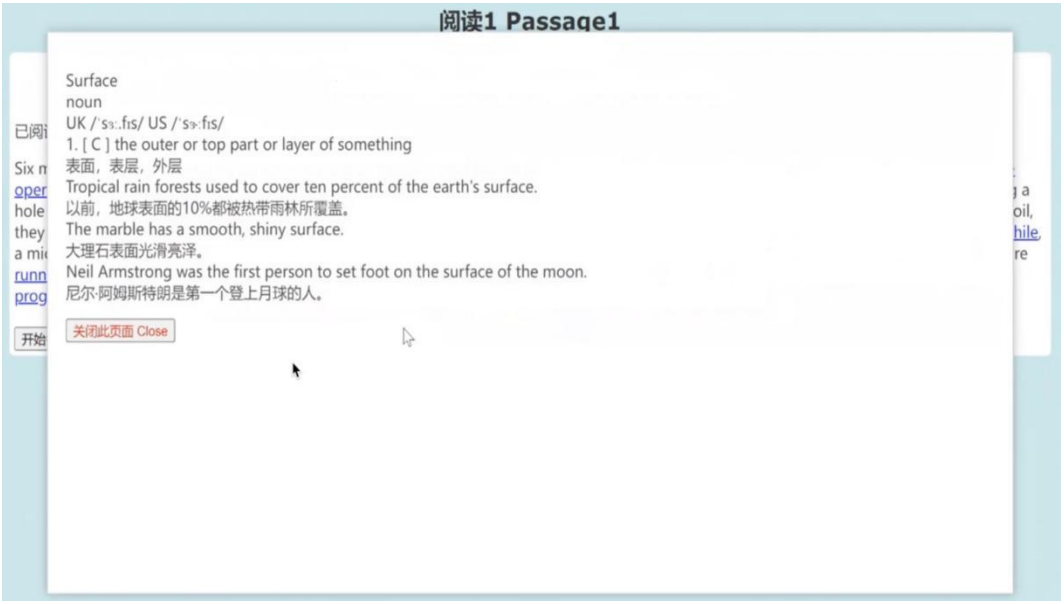


Figure 6.12 Example of CSL interpretation videos

6.3.2 The experiment with the reading interface

To explore the potential correlation between deaf and hard-of-hearing students' demographic characteristics and their preferences for Chinese text translations and CSL interpretations provided in this experimental study, the same group of students

was invited to participate in both studies. Thus, a total of 106 participants, including 51 university students and 53 high school students, were invited to take part (refer to Section 4.3.1).

6.3.2.1 Cross-design of the experiment

As mentioned in Section 6.1.3, this experimental study aimed to explore the preferences of deaf and hard-of-hearing participants for a multi-modal reading interface and the potential impact of multi-modal key word assistance on their performance in post-reading tasks. To mitigate the influence of extraneous factors on the experimental outcomes, such as the difficulty levels of the reading passages and vocabulary, as well as differences in the English proficiency of the students, a cross-design approach was adopted for this study. For each reading section, students were divided into experimental and control groups based on whether key word assistance was provided or not. If Student A was in the experimental group for the first reading, he/she was placed in the control group for the second reading.

This cross-design was implemented through a systematic assignment of privileges to the accounts, providing access to multi-modal assistance in the reading passage (i.e., being in the experimental group). Separate sets of accounts were allocated to the college and high school groups, ensuring that neither group could inadvertently access the other's reading systems. The high school group accounts were distinguishable by the prefix "gzydlj", while the college group accounts began with "ydljdz". Following these alphabetical prefixes, the accounts were numbered, with odd and even numbers

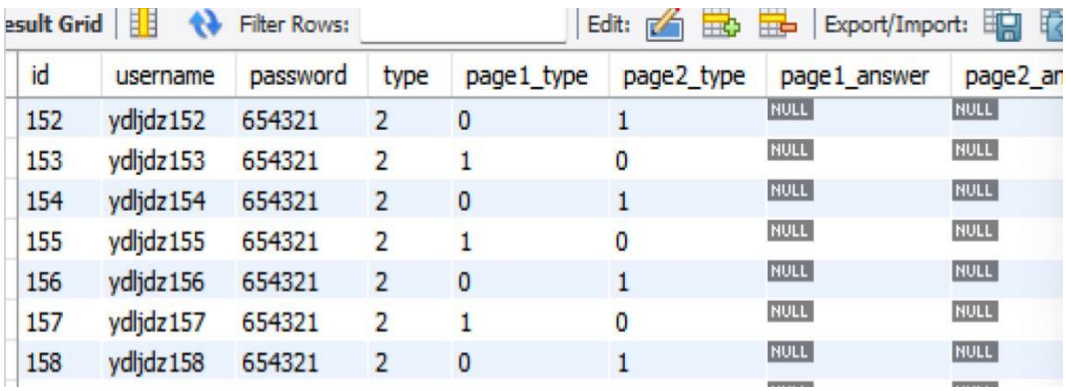
used to assign students to Group A and Group B, respectively, as illustrated in Table 6.1.

Table 6.1 The cross-design of the experiment

	High school group		University group	
	Group A	Group B	Group A	Group B
Reading Passage 1	Experimental group	Control group	Experimental group	Control group
	Control group	Experimental group	Control group	Experimental group
Reading Passage 2	Control group	Experimental group	Control group	Experimental group
	Experimental group	Control group	Experimental group	Control group

This method ensured a balanced and controlled comparison between the experimental and control conditions, facilitating a robust analysis of the impact of multi-modal assistance on English reading experiences among Chinese deaf and hard-of-hearing students. Figure 6.13 provides an example of how the system categorized the attributes of specific accounts.

Figure 6.13 Categorization of the accounts: 0 means control group, whereas 1 means experimental group



id	username	password	type	page1_type	page2_type	page1_answer	page2_ar
152	ydljdz152	654321	2	0	1	NULL	NULL
153	ydljdz153	654321	2	1	0	NULL	NULL
154	ydljdz154	654321	2	0	1	NULL	NULL
155	ydljdz155	654321	2	1	0	NULL	NULL
156	ydljdz156	654321	2	0	1	NULL	NULL
157	ydljdz157	654321	2	1	0	NULL	NULL
158	ydljdz158	654321	2	0	1	NULL	NULL

6.3.2.2 Procedure of the experiment

On the day of the experimental study, participants went to the computer laboratories of their respective schools. The high school group and the university group participated on different days. To ensure the demographic questionnaire data could be matched with the experimental study data, both the expanded demographic questionnaire survey (reported in Chapter 4) and the experimental study were conducted on the same day. Deaf and hard-of-hearing students first operated on the reading interface, then answered an exit questionnaire designed based on the TAM framework (refer to Section 6.2.3), and finally completed the expanded demographic questionnaire.

This study encompassed four sets of data: the demographic survey (reported in Chapter 4), participants' records of mouse clicks on the modalities of key words, responses to post-reading exercises, and the TAM exit questionnaire data of the reading interface and its functions. Recognizing the potential complexity of the procedure, particular emphasis was placed on ensuring participants' clarity and providing necessary support throughout. In the computer labs, the participants were accompanied by a teacher, a sign language interpreter, the coding expert and the researcher (me). It is crucial to note that the deaf and hard-of-hearing participants were allowed to receive assistance only when they had difficulties operating on the reading interface or when they were confused with the study procedure or questions

on the questionnaires. The participants were not given any guidance regarding reading comprehension or post-reading activities.

The participants were given a detailed introduction to this study when they entered the computer lab and were asked to sign the consent form to say they were willing to participate. Then, they were asked to watch a tutorial video to get familiar with the functions of the reading interface. To make sure that the participants understood how to use the functions and what they needed to do, I also gave a short set of instructions with the help of the CSL interpreter. Making sure that the participants had fully comprehended their tasks, they were given a username and a password and told that they needed to use this information to log into the interface system. The participants were also told to keep their usernames at hand because they would need them for the exit questionnaire and the expanded demographic questionnaire.

On the reading interface, the participants were required to complete the reading tasks for both passages independently. There were no time restrictions, allowing participants sufficient time to utilize the multi-modal word assistance. However, the multi-modal key word translations were only available during the reading phase. Once participants clicked “Next” to begin the post-reading questions, the key word assistance was no longer accessible, although the reading passage remained available.

After answering all the post-reading questions for the first reading passage, the participants clicked “Submit” and waited for the coding expert to confirm their answers had been uploaded to the system. Upon receiving approval, the participants proceeded to the second reading passage, following the same procedure. Once the answers for Passage 1 were submitted, the system locked the passage, preventing the participants from revisiting the article or altering their answers. This approach aimed to capture participants’ initial responses and avoid potential bias from reviewing or changing answers post-submission. Upon completing both reading tasks and submitting their answers, the coding expert verified the data collection, and the participants then worked on the exit questionnaire.

The first questions of the exit questionnaire and the expanded questionnaire asked participants for their usernames used to log into the interface. Despite being informed of this requirement, some participants entered incorrect usernames, leading to data mismatches and subsequent exclusions (refer to Section 6.3.2.3). After completing both questionnaires, the participants were rewarded with a gift and asked to leave the computer lab quietly. To mitigate fatigue, participants worked at their own pace and were allowed to take short breaks between sessions. The entire study procedure typically took about one hour to complete.

6.3.2.3 Exclusion of data from analysis

As mentioned earlier, for the data analysis, the participants’ interface usage records, post-reading answers, and responses to the expanded demographic questionnaire

needed to be matched. However, challenges arose due to typing mistakes made by some participants, leading to difficulties in identifying them. Consequently, several samples had to be excluded from the data analysis.

For example, the interface system had only one username “gzydlj018”, but two participants typed this username in the expanded demographic questionnaire when asked for their usernames. This discrepancy indicated an erroneous entry of the username in the questionnaire, making it impossible to ascertain the identity of “gzydlj018”. As a result, their data of “gzydlj018” was deleted from the interface system, along with the two questionnaire responses. Additionally, excluding two participants’ responses from the demographic questionnaire led to one interface username not being matched with any remaining demographic responses. Consequently, this unmatched username was also excluded. This situation occurred in both the high school and university groups.

Additionally, the participants who exhibited a negative attitude toward cooperation were excluded from the data analysis. For example, the participant with the username “ydljdz102” had only one mouse click record on a key word’s Chinese text translation, and most of his/her answers to the post-reading questions were incorrect (Table 6.2).

Table 6.2 Post-reading answers of the participant “ydljdz102”

ydljdz102	1	Score	2	Score	3	Score	4	Score	5	Score	6	Score
Passage 1	A	0	C	0	D	0	C	1	C	0		
Passage 2	B	0	C	0	B	0	A	0	B	0	C	0

Both the interface usage data and reading performance data for this participant were excluded from the data analysis. This decision was made because his/her negative coping attitude was not representative of his/her group and could potentially skew the overall results.

Ultimately, a total of 83 data samples were available for data analysis, comprising 39 university students and 44 high school students.

6.4 Data analysis

After the data collection, I graded the participants' answers on the post-reading exercises and coded their responses on the questionnaire surveys. All the data analysis was conducted using SPSS.

6.4.1 Participants' varied communication preferences and their options for the modality of key word translation

As presented in the expanded demographic questionnaire (reported in Chapter 4), deaf and hard-of-hearing students demonstrated very flexible language preferences in communications. Specifically, the expanded demographic study (Chapter 4) found that the high school students' preferred communication modalities were CSL, Spoken Chinese and Written Chinese, while the university participants' preferred communication modalities included CSL, Spoken Chinese, Signed Chinese and Written Chinese. The difference between CSL and Signed Chinese has been discussed

in Chapter 2 (refer to Section 2.1.2.1). Given that 77.3% of the high school participants and 87.2% of the university participants chose CSL as one of their preferred communication modalities when communicating with their teachers (refer to Section 4.4.1.2), it was assumed in this study that both high school and university students would choose CSL interpretation videos more than Chinese text translations. However, the hypothesis was not confirmed. The mouse clicks data from the students participating in the study concerning their choices between text translation and sign language videos did not show a significant correlation with their communicative language preferences.

According to Table 6.3, both high school and university participants had more mouse clicks on Chinese text translations than CSL interpretation videos. In other words, when given translation assistance on key words in reading, the deaf and hard-of-hearing participants in this study preferred to have Chinese text translations than to have CSL interpretation videos.

Table 6.3 Total number of mouse clicks on Chinese text translation and CSL interpretation videos on the interface

	Reading Passage 1		Reading Passage 2	
	Chinese text translations	CSL interpretation videos	Chinese text translation	CSL interpretation videos
High school	262	130	352	74
University	266	171	174	86

I also examined whether students with a stronger preference for either spoken language or sign language when they communicated with their teachers were more likely to make choices that aligned with their preferences. For instance, the students who favored sign language were expected to choose sign language interpretation videos over text translation. To determine the participants who had stronger preferences for sign language, I picked those who chose “rarely or never” for the question “How often do you use spoken language to communicate with your teachers” and did not choose sign language on the question of “What is your preferred way to communicate with teachers? Please tick any that applies”. To determine the participants who had stronger preferences for spoken language, I picked those who chose “rarely or never” for the question “How often do you use sign language/signed language to communicate with your teachers” and did not choose those who picked sign language and signed language for the question of “What is your preferred way to communicate with teachers? Please tick any that applies”. As a result, seven high school participants and one university participant were found to have stronger preferences for spoken language, and eight high school participants and nine university students were found to have stronger preference for sign language.

Table 6.4 Number of mouse clicks on Chinese text translation and CSL interpretation videos on the reading interface: participants who have a stronger preference for spoken language

Account	P1_text	P1_sign	P2_text	P2_sign
ydljdz094	No data	No data	9	0
gzydlj009	32	2	No data	No data

Account	P1_text	P1_sign	P2_text	P2_sign
gzydlj035	1	0	No data	No data
gzydlj025	0	10	No data	No data
gzydlj049	6	1	No data	No data
gzydlj045	1	21	No data	No data
gzydlj024	No data	No data	26	0
gzydlj043	2	0	No data	No data

As presented in Table 6.4, most high school and university participants who had a stronger preference for spoken language chose Chinese text translation more than CSL interpretation videos, except for the participant "gzydlj045". According to this participant's answers on the expanded demographic questionnaire, she was post-lingually deaf with severe hearing loss in both of her ears. She had started to wear cochlear implants in both ears for an estimated 16 hours a day from two years old. The most frequently used communication modality for her was spoken language, and she also picked it as her preferred communication modality, even when she was communicating with her deaf and hard-of-hearing friends. In other words, her demographic information could not help explain why she chose CSL interpretation videos over Chinese text translations. Given that she got 100% correct on the post-reading vocabulary questions, one possible explanation was that she was just curious about the CSL interpretation videos and was not using them to support her learning. Since "gzydlj045" was alone, the data presented in Table 6.4 demonstrates a potential correlation between deaf and hard-of-hearing participants' preferences regarding spoken language and Chinese text translations.

This potential correlation led to an assumption that the participants with stronger preferences for sign language would prefer CSL interpretation videos over Chinese text translations. However, this assumption was not proved by the data.

Table 6.5 Number of mouse clicks on Chinese text translation and CSL interpretation videos on the reading interface: participants who have a stronger preference for sign language

Account	P1_text	P1_sign	P2_text	P2_sign
ydljdz108	No data	No data	10	3
ydljdz082	No data	No data	2	0
ydljdz101	4	4	No data	No data
ydljdz091	5	18	No data	No data
ydljdz103	9	0	No data	No data
ydljdz095	9	1	No data	No data
ydljdz104	No data	No data	6	3
ydljdz096	No data	No data	3	0
ydlidz121	24	27	No data	No data
gzydlj001	8	0	No data	No data
gzydlj011	4	18	No data	No data
gzydlj016	No data	No data	24	3
gzydlj036	No data	No data	4	2
gzydlj047	2	1	No data	No data
gzydlj046	No data	No data	18	0
gzydlj015	18	5	No data	No data
gzydlj054	No data	No data	26	0

As presented in Table 6.5, even though they had a stronger preference for sign language, most of the listed participants chose Chinese text translation over the CSL interpretation except for “ydljdz091”, “ydlidz121” and “gzydlj011”. Based on their responses to the expanded demographic questionnaire, the three participants had severe-to-profound hearing loss in both ears, preferred to identify themselves as being

Deaf and did not wear any technical hearing devices. However, since most of the other participants in this group also shared these features, it was hard to say that the participants' preferences for Chinese text translations were related to their demographic characteristics. Based on this finding, it was assumed that the participants' preferences for other modalities might have influenced their choices between Chinese text translations and CSL interpretation videos.

To assess this assumption, I conducted a Pearson correlation analysis. This analysis examined the relationship between the total preference score for each of the seven language modalities (detailed in Section 4.4.2) and the participants' number of mouse clicks. Each participant's total preference score was calculated by counting the number of times they selected each language modality as their preferred method of communication with teachers, deaf and hard-of-hearing partners, and hearing partners. For instance, if a participant chose sign language for all three groups, their preference score for sign language would be 3. The correlation analysis then explored the relationship between these scores and the click-through rates on text translation and sign language interpretation videos.

As shown in Table 6.6, the correlation was not significant between participants' sign language preferences and their choices of CSL interpretation videos in the reading interface. The correlations between participants' spoken language preferences and

their choices of Chinese text translations or CSL interpretation videos were not significant either.

Table 6.6 Correlation between sign language/spoken language preferences and mouse clicks on Chinese text translations and CSL interpretation videos

High School (Total: 44)		P1 Text	P1 Sign	P2 Text	P2 Sign
PrefSignL Total	Pearson Correlation	.094	-.247	.336	-.344
	Sig. (2-tailed)	.662	.245	.148	.137
	N	24	24	20	20
PrefSpokenL Total	Pearson Correlation	.030	.128	.395	-.354
	Sig. (2-tailed)	.891	.551	.085	.126
	N	24	24	20	20
University (Total: 39)		P1 Text	P1 Sign	P2 Text	P2 Sign
PrefSignL Total	Pearson Correlation	.011	.149	.128	.022
	Sig. (2-tailed)	.962	.520	.613	.932
	N	21	21	18	18
PrefSpokenL Total	Pearson Correlation	.085	-.028	-.080	.047
	Sig. (2-tailed)	.714	.905	.753	.854
	N	21	21	18	18

The non-significant correlation findings suggest that, at least in this study, it is not reasonable to infer deaf and hard-of-hearing students' preferences for textual or sign language information based solely on their communication preferences for sign or spoken languages.

As suggested by the literature (e.g., Swanwick, 2016), the languages used by deaf and hard-of-hearing students could be multilingual and complex. Although researchers recommend providing multi-modal information to these students (as reviewed in Section 6.2.1), further studies are needed to explore the circumstances under which

different types of multi-modal materials would be beneficial, considering the demographic characteristics of the students. For example, in this study, the participants' preferences for Chinese textual information might be attributed to the simplicity of the key word translations, which may not reflect scenarios where the text is lengthy and complex. In such instances, as recommended by Oliveira et al. (2019), simplifying the textual information and providing sign language interpretation could be beneficial for deaf and hard-of-hearing individuals.

6.4.2 Key word translation and participant's performance in doing English post-reading tasks.

The findings of this study indicate that the majority of individual participants demonstrated improved performance on post-reading tasks with the aid of multi-modal key word assistance.

6.4.2.1 Participants' performances on the post-reading tasks

The high school and university participants were assigned to experimental groups based on their usernames when logging into the reading interface (refer to Section 6.3.2.1). The participants' performances on the post-reading tasks were calculated by grading their scores on the reading comprehension and vocabulary questions. Since the two textbooks ("Go for It" and "New Concept English") provided different numbers of post-reading questions, the participants' scores were analyzed on a percentage basis to ensure comparability.

As indicated in Table 6.7, the mean scores of the experimental group were generally higher than those of the control group among the participating high school and university students. This suggests that multi-modal key word translations had a positive effect on improving the participants' performance in the post-reading activities in this experiment.

Table 6.7 Participants' performances on the post-reading tasks in this study

	High school (Total: 44)				University (Total: 39)			
	Experimental		Control		Experimental		Control	
	Mean Score	SD.	Mean Score	SD.	Mean Score	SD.	Mean score	SD.
P1CompSum	84.08	15.203	76.65	23.430	54.76	38.421	33.33	29.704
P1VocabSum	94.67	13.180	87.90	22.762	77.78	26.527	74.07	24.403
P1Sum	87.92	12.826	80.70	22.241	68.57	26.511	57.78	19.268
Valid N	24		20		21		18	
P2CompSum	47.75	25.358	45.21	27.163	55.56	37.920	52.38	43.232
P2VocabSum	84.85	22.595	68.96	37.156	73.61	20.059	72.62	23.591
P2Sum	60.75	21.841	53.54	26.600	67.59	19.363	65.87	24.425
Valid N	20		24		18		21	

The analysis of the data reveals distinct patterns between the experimental and control groups in both vocabulary and reading comprehension among university and high school students across two passages (P1 and P2). For university students, in P1, the experimental group significantly outperformed the control group on reading comprehension, with an average score of 54.76 compared to 33.33, resulting in a notable 21.43-point gap. However, the difference in vocabulary scores was much less pronounced, with the experimental group scoring 77.78 and the control group 74.07, a

gap of only 3.71 points. This suggests that the intervention effectively enhanced university participants' post-reading performance in reading comprehension in P1.

In P2, the roles of the experimental and control groups were reversed, but the new experimental group did not show significant improvement in either reading comprehension or vocabulary. The experimental group scored 55.56 in reading comprehension, only 3.18 points higher than the control group's 52.38, while the vocabulary scores showed a minimal difference of 0.99 points. This indicates that the impact of the intervention was less pronounced in P2. Several factors could explain this outcome, including the increased cognitive load due to more challenging or unfamiliar content in P2, and possible learning fatigue after completing P1.

Regarding the high school group, the experimental group consistently outperformed the control group across both passages. However, due to potential prior exposure to some vocabulary in P1, the analysis focuses on P2 data. In P2, the high school experimental group showed a significant advantage in vocabulary, scoring 84.85 compared to the control group's 68.96, a 15.89-point gap. In reading comprehension, the experimental group scored 47.75, slightly higher than the control group's 45.21, with a gap of 2.54 points. These results suggest that the multi-modal keyword assistance was particularly effective in enhancing post-reading performance on vocabulary for high school students, while its impact on reading comprehension was more modest.

Overall, the findings illustrate distinct differences in how the intervention affected high school and university students. High school students showed greater improvement in vocabulary, especially in P2, whereas university students experienced a significant initial boost in reading comprehension in P1, which diminished in P2. The varying effectiveness of the intervention underscores the importance of considering several factors when developing learning materials, such as educational level, age, the difficulty of the content, and the students' ability to adapt to different learning strategies, among others. These factors significantly influence learning outcomes, making them a topic that warrants future research and attention.

The observation that the standard deviations for the mean scores of both high school and university students were relatively large is indicative of significant individual differences within the groups. This diversity is further supported by the findings of the participants' demographic survey, which highlighted varied experiences in learning English among the Chinese deaf and hard-of-hearing participants.

Given the heterogeneous nature of the participants, it becomes essential to analyze individual reading performance with and without multi-modal key word translations. However, it is important to note that, due to the timing of the experiment and the learning progress of high school participants, they were in the middle of studying Chapter 5, which was the chapter of P1. Consequently, it becomes less meaningful to

compare individual students' performance on the reading tasks of the two passages, as they might have some prior knowledge of P1 but be entirely unfamiliar with P2. In light of this and considering that both passages were new to university students, the analysis will focus solely on examining the effects of the multi-modal key word translations on the university participants' performance in the post-reading tasks.

6.4.2.2 Individual differences and the effects of multi-modal key word translations

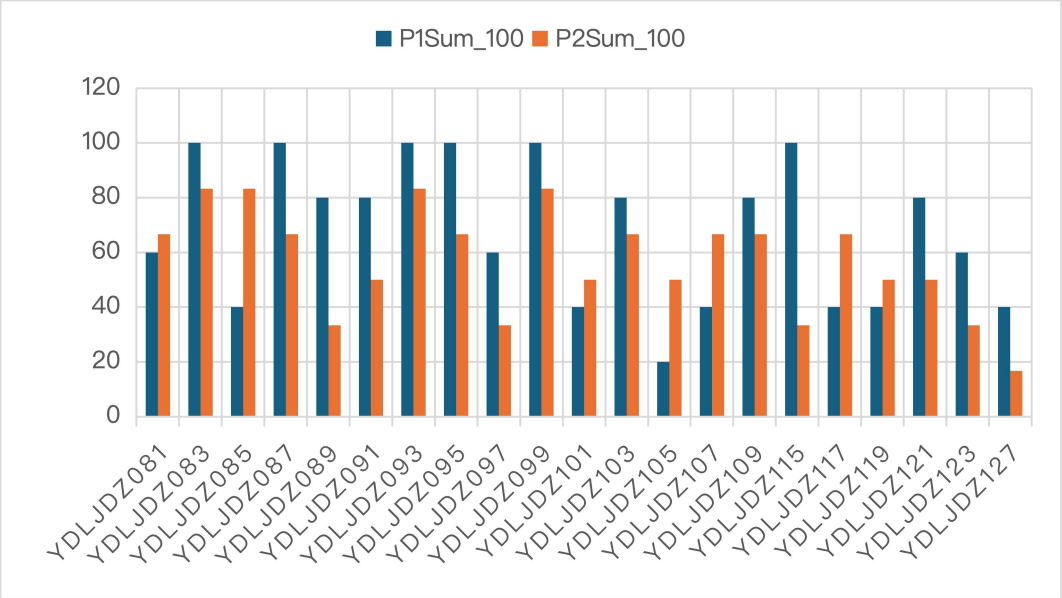
In the following two figures (Figure 6.1 and Figure 6.2), individual students' total scores on the two reading passages were compared with and without the multi-modal key word translations.

In Figure 6.14, the blue bar represents each participant's total performance on the P1 reading task, while the orange bar represents their total performance on the P2 reading task. As mentioned earlier (refer to Section 6.3.2.1), the participants who belonged to the experimental group of P1 were in the control group of P2. In other words, the students in this graph had multi-modal key word translations in P1 but no assistance in P2.

As indicated by Figure 6.14, most participants' blue bars were higher than their orange bars, suggesting that they achieved higher scores on the reading tasks with the multi-modal key word translations. However, there were also some exceptional cases. Specifically, "ydljdz081", "ydljdz085", "ydljdz101", "ydljdz105", "ydljdz107",

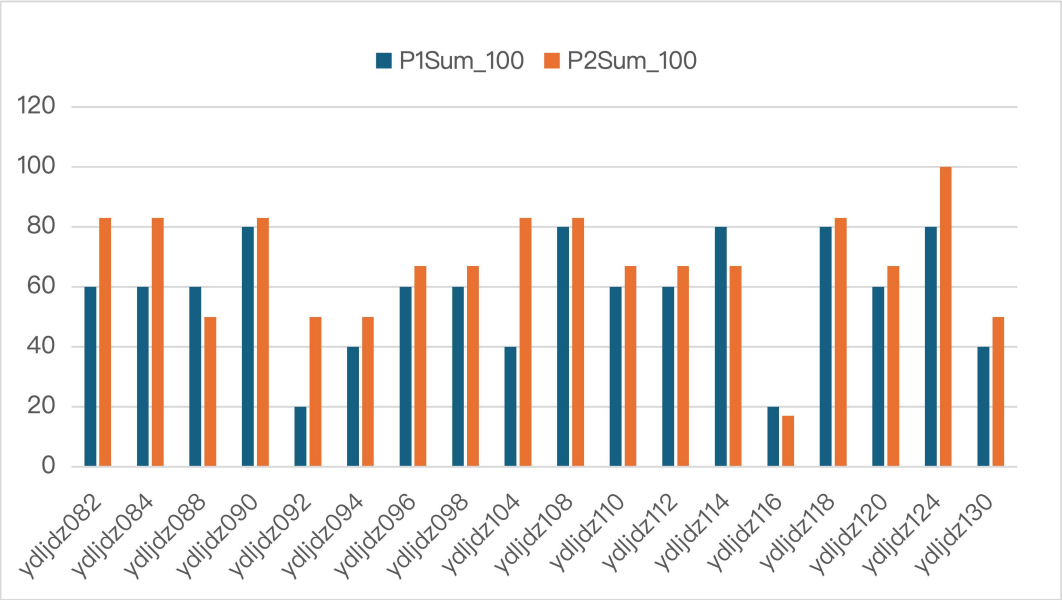
“ydljdz117”, and “ydljdz119” had higher reading task scores when they did not have multi-modal assistance. Particularly for “ydljdz085”, “ydljdz105”, “ydljdz107”, and “ydljdz117”, their reading task scores in P2 were significantly higher than the scores in P1.

Figure 6.14 Passage 1 experimental group individual differences in the post-reading tasks



In Figure 6.15, the blue bar represents the participant’s total performance on the P1 reading task, and the orange bar represents the student’s total performance on the P2 reading task. The participants who belonged to the experimental group in P1 were in the control group in P2. In other words, the group of students in this graph had multi-modal key word translation in P2, but no assistance in P1.

Figure 6.15 Passage 2 experimental group individual differences in the post-reading tasks



As seen in the Figure 6.15, most participants' orange bars were higher than their blue bars, indicating that they had higher scores on the reading tasks with the multi-modal key word translations. However, there were also some special cases. "ydljdz088", "ydljdz114", and "ydljdz116" had higher reading task scores when they did not have multi-modal assistance. Particularly for "ydljdz114", this participant's reading task scores in Passage 1 were significantly higher than the scores in P2.

A Spearman correlation analysis was conducted to investigate the potential relationship between these individual participants' mouse click data and their post-reading performances. Since there were only nine cases to be analyzed, the significance of the correlation was low, indicating that the findings could not be generalized.

Table 6.8 Spearman Correlation Analysis of interface usage data and post-reading performance for university participants not benefiting from multi-modal vocabulary assistance

		P1 Text	P1 Sign	P2 Text	P2 Sign
P1 CompSum_100	Correlation Coefficient	-.098	-.302		
	Sig. (2-tailed)	.854	.561		
	N	6	6		
P1 VocabSum_100	Correlation Coefficient	-.683	-.302		
	Sig. (2-tailed)	.135	.561		
	N	6	6		
P1 Sum_100	Correlation Coefficient	-.676	-.522		
	Sig. (2-tailed)	.140	.288		
	N	6	6		
P2 CompSum_100	Correlation Coefficient			.000	-.866
	Sig. (2-tailed)			1.000	.333
	N			3	3
P2 VocabSum_100	Correlation Coefficient			1.000	.500
	Sig. (2-tailed)			.	.667
	N			3	3
P2 Sum_100	Correlation Coefficient			1.000	.500
	Sig. (2-tailed)			.	.667
	N			3	3

As presented in Table 6.8, a negative correlation was found between interface usage data and post-reading performance, indicating that the multi-modal key word assistance did not enhance these participants' English reading experiences as expected. According to their responses in the expanded demographic questionnaire, these participants had varying degrees of hearing loss, ranging from moderate to profound in both ears. Only "ydljdz101", with profound hearing loss in both ears, did not use any hearing devices. Among the others, two wore hearing aids only in the left ear, five wore hearing aids in both ears, and one had a cochlear implant in the left ear. These participants' English learning backgrounds also varied, ranging from three to ten years of experience. Such heterogeneous backgrounds made it difficult to determine

how this negative correlation could be related to their demographic features. Previous studies have suggested that multi-modal information may distract the deaf and hard-of-hearing students' attention (Marschark et al., 2017) and increase their cognitive load (Leppink et al., 2014). However, the results of this study did not provide further evidence to explain why individual participants did not benefit from the multi-modal key word assistance in their reading experiences.

In conclusion, the findings of this study reveal that multi-modal key word translation generally had positive impacts on most participants' post-reading performance. The mean scores of both high school and university participants who received multi-modal key word translation were higher than those who did not. However, the impacts on the two groups of participants were different, and individual differences were evident. The complex demographic features of deaf and hard-of-hearing students, as discussed in previous sections, made it challenging to pinpoint the specific factors influencing the effectiveness of multi-modal key word assistance. Therefore, future studies are encouraged to delve deeper into this issue for a more comprehensive understanding.

6.4.3 Participants' acceptance toward the use of the multi-modal key word assistance

In this study, I developed a research instrument based on Ghani et al.'s (2019) research to explore users' acceptance of multi-modal key word assistance during English reading practice. The primary theoretical framework employed by both Ghani et al. (2019) and this study was the TAM, which asserts that perceived usefulness,

perceived ease-of-use, and attitude toward technology usage are interconnected factors influencing users' acceptance of multi-modal key word assistance during English reading practice.

A reliability analysis was undertaken to assess the internal consistency of the items in the questionnaire. According to Pallant (2020), a Cronbach's Alpha coefficient of 0.70 and above is indicative of reliability. Therefore, with Cronbach's Alpha reliability scores for all the constructs exceeding 0.9, the questionnaire was confirmed as a reliable measurement instrument (Table 6.9).

Table 6.9 Reliability of the TAM questionnaire

Constructs	Technology functions	Cronbach's Alpha	No. of Items
Perceived Usefulness	The reading interface	0.956	6
	The Chinese text translations	0.961	6
	The CSL interpretation videos	0.974	6
Perceived ease-of-use	The reading interface	0.936	6
	The Chinese text translations	0.970	5
	The CSL interpretation videos	0.956	5
Attitude	The reading interface	0.954	5
	The Chinese text translations	0.945	5
	The CSL interpretation videos	0.978	5

To ensure that the results of this questionnaire accurately reflected the genuine acceptance of the students of the use of multi-modal key word assistance in their English reading practice, only data from the users with valid information on the interface usage and completion of reading tasks were retained.

6.4.3.1 Perceived usefulness

Following Ghani et al.'s (2019) definition, perceived usefulness refers to a user's conviction about whether the application of technology would improve their performance. Aligning with the research of Chang and Hsu (2011) on students' cognitive acceptance of a mobile-assisted synchronously collaborative translation-annotation system for English reading comprehension in the ELL-NESC context, the measurement of perceived usefulness in this study comprised six items, as illustrated in Table 6.10.

Table 6.10 Items of perceived usefulness in the TAM questionnaire

Construct	Items
PU1	Using the XXX would enable me to accomplish English reading tasks more quickly.
PU2	Using the XXX would improve my reading performance
PU3	Using the XXX in my English reading tasks would increase my comprehension outcomes.
PU4	Using the XXX would enhance my effectiveness on the English reading tasks.
PU5	Using the XXX would make it easier to read English.
PU6	I would find XXX useful in my English reading.

Moreover, to explore participants' perceptions of using the multi-modal interface, as well as different modality options, the perceived usefulness of the reading interface, Chinese text translation of the key words, and CSL interpretation videos of the key words were evaluated separately.

Table 6.11 illustrates the proportion of agreement among high school participants regarding the perceived usefulness of the multi-modal reading interface in enhancing their reading performance. The overall agreement proportion on the usefulness of the

multi-modal reading interface was 50% in this study. More specifically, 40% of participants agreed that the interface would help them complete their reading tasks more quickly, 31% agreed that the interface effectively improved their reading performance, 31% agreed that their reading outcomes would be increased, 31% agreed that the interface enhanced their reading task effectiveness, 38% believed that the multi-modal reading interface made reading English easier, and 36% found the interface to be useful.

Table 6.11 Perceived usefulness of the reading interface: high school

The interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	7.1%	4.8%	7.1%	40.5%	19.0%	11.9%	9.5%
PU2	4.8%	7.1%	7.1%	50.0%	11.9%	9.5%	9.5%
PU3	7.1%	9.5%	9.5%	42.9%	14.3%	2.4%	14.3%
PU4	9.5%	2.4%	11.9%	45.2%	9.5%	9.5%	11.9%
PU5	4.8%	9.5%	7.1%	40.5%	21.4%	4.8%	11.9%
PU6	4.8%	7.1%	9.5%	42.9%	14.3%	7.1%	14.3%
Overall PU	2.4%	2.4%	7.1%	38.1%	19.0%	14.3%	16.7%

Since the figures of the overall agreement were relatively low, I conducted a Spearman correlation analysis between the participants' demographic characteristics, including degrees of hearing loss, communication preferences and years of learning English. From the analysis, three constructs (PU3, PU4, PU5) showed a positive and statistically significant correlation with the number of years spent learning English (Table 6.12). This suggests that as high school participants had more years of experience learning English, they tended to agree that this multi-modal reading

interface would be useful for increasing comprehension outcomes, enhancing reading efficiency and reducing reading difficulties.

Table 6.12 Spearman correlation between high school participants' years of learning English and perceived usefulness

		PU3	PU4	PU5
Years of learning English	Correlation Coefficient	.358*	.330*	.316*
	Sig. (2-tailed)	.020	.033	.042
	N	42	42	42

On the other hand, the correlation was not significant between high school participants' perceived usefulness of the interface and their demographic features, suggesting that other factors may be at play. As shown in Table 6.11, half of the high school participants chose a neutral position. Since perceived usefulness measures the subjective experiences of users, exploring user acceptance of the interface requires an acknowledgement of unpredictability and complexity in the research process, and allows for indeterminate outcomes rather than predetermined ones (Collins, 2015). However, given that this study was not designed to identify the factors influencing the neutral acceptance of the perceived usefulness of the interface, it would be beneficial for future studies to explore this topic further.

As presented in Table 6.13, in the university group, the overall proportion of agreement on the usefulness of the reading interface was 73%. More specifically, 46% of participants agreed that the interface would help them complete their reading tasks more quickly, 57% agreed that the interface effectively improved their reading

performance, 57% agreed that their reading outcomes would be increased, 57% agreed that the interface enhanced their reading task effectiveness, 57% believed that it made reading English easier, and 65% found it to be useful.

Table 6.13 Perceived usefulness of the reading interface: university

The interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	2.7%	2.7%	13.5%	35.1%	13.5%	21.6%	10.8%
PU2	2.7%	5.4%	10.8%	24.3%	24.3%	13.5%	18.9%
PU3	2.7%	5.4%	10.8%	24.3%	21.6%	24.3%	10.8%
PU4	2.7%	5.4%	8.1%	27.0%	16.2%	24.3%	16.2%
PU5	2.7%	8.1%	2.7%	29.7%	10.8%	24.3%	21.6%
PU6	2.7%	0%	2.7%	29.7%	24.3%	10.8%	29.7%
Overall PU	0%	2.7%	0%	24.3%	21.6%	13.5%	37.8%

In terms of the modality options provided, it transpired that high school students found Chinese text translations of the key words to be more helpful than CSL interpretation videos. Table 6.14 demonstrates the high school participants' perceived usefulness of the two modalities.

Table 6.14 Perceived usefulness of the Chinese text translations (CT) and CSL interpretation videos: high school

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	4.8%	0%	2.4%	33.3%	33.3%	11.9%	14.3%
PU2	2.4%	2.4%	11.9%	33.3%	26.2%	4.8%	19.0%
PU3	2.4%	0%	7.1%	40.5%	21.4%	14.3%	14.3%
PU4	4.8%	0%	0%	42.9%	28.6%	9.5%	14.3%
PU5	2.4%	7.1%	0%	38.1%	28.6%	9.5%	14.3%
PU6	2.4%	0%	4.8%	38.1%	23.8%	9.5%	21.4%

Overall PU	2.4%	0%	0%	28.6%	33.3%	11.9%	23.8%
CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	7.1%	0%	7.1%	45.2%	16.7%	14.3%	9.5%
PU2	4.8%	2.4%	9.5%	45.2%	23.8%	4.8%	9.5%
PU3	7.1%	0%	9.5%	45.2%	19.0%	7.1%	11.9%
PU4	7.1%	0%	7.1%	50.0%	21.4%	4.8%	9.5%
PU5	4.8%	0%	9.5%	45.2%	26.2%	2.4%	11.9%
PU6	4.8%	0%	7.1%	50.0%	16.7%	9.5%	11.9%
Overall PU	4.8%	0%	4.8%	42.9%	19.0%	16.7%	11.9%

As shown in Table 6.14, in the high school group, the overall perceived usefulness of having Chinese text translation on key words in English reading tasks was 69%, compared to 48% for having sign language interpretation videos. This result aligns with the participants' click records on the two modalities. According to the click records on the interface, high school participants had more clicks on the text translations (684) than CSL interpretation videos (482). In addition, according to the data, more than 50% of the participants agreed that Chinese text translations would help increase their English reading efficiency, as well as improve reading performance and outcomes. However, for high school students, the perceived usefulness of having CSL interpretation videos was much lower on each item. Instead, 40% to 50% percent of participants held a neutral viewpoint, indicating they were unsure about the usefulness of having sign language interpretations of key words. As discussed in Section 6.3.1, the correlation was not significant between the participants' communication preferences and their mouse clicks on Chinese text translations and CSL interpretations. This suggests that the perceived usefulness of the two options

was not influenced by language preferences. The high school participants' neutral viewpoints might be related to other factors. Since this study was not designed to explore these reasons, it would be valuable for future research to investigate this topic further.

In the university group, however, even though the overall perceived usefulness of having Chinese text translation on key words in English reading tasks (81%) was still higher than having CSL interpretation videos (78%), the difference was not significant (Table 6.15). More than half of the university participants had positive perspectives on having multi-modal key word assistance in English reading tasks. Not only that, 70% of the participants believed that CSL interpretation videos on key words were useful for improving their reading performance, compared to 68% opting for Chinese text translations.

Table 6.15 Perceived usefulness of the Chinese text translations (CT) and CSL interpretation videos: university

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	2.7%	2.7%	2.7%	21.6%	24.3%	27.0%	18.9%
PU2	2.7%	2.7%	8.1%	18.9%	24.3%	27.0%	16.2%
PU3	2.7%	5.4%	2.7%	21.6%	29.7%	21.6%	16.2%
PU4	8.1%	5.4%	0%	21.6%	29.7%	27.0%	8.1%
PU5	2.7%	2.7%	8.1%	24.3%	24.3%	24.3%	13.5%
PU6	2.7%	0%	8.1%	24.3%	32.4%	18.9%	12.5%
Overall PU	2.7%	0%	0%	16.2%	24.3%	29.7%	27.0%

CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
PU1	0%	2.7%	2.7%	29.7%	24.3%	24.3%	16.2%
PU2	2.7%	0%	2.7%	24.3%	32.4%	21.6%	16.2%
PU3	0%	5.4%	2.7%	27.0%	29.7%	13.5%	21.6%
PU4	2.7%	2.7%	8.1%	29.7%	27.0%	13.5%	16.2%
PU5	0%	5.4%	8.1%	27.0%	24.3%	16.2%	18.9%
PU6	2.7%	0%	5.4%	29.7%	21.6%	18.9%	21.6%
Overall PU	0%	2.7%	0%	18.9%	29.7%	24.3%	24.3%

To summarize, most participants agreed that the multi-modal reading interface enhanced their English reading performance, particularly the university students. The high school students generally found the Chinese text translations more useful than the CSL interpretation videos. The university participants, compared to high school deaf and hard-of-hearing students, had more positive attitudes toward the perceived usefulness of the multi-modal interface. However, unlike the high school participants, the university participants did not show significant differences in the perceived usefulness of the different modalities. It would be beneficial to conduct future studies to investigate the reasons behind Chinese deaf and hard-of-hearing students' perceived usefulness of having multi-modal key word assistance to support their English reading experiences.

6.4.3.2 Perceived ease-of-use

Perceived ease-of-use denotes how students perceive the difficulty level of using the technology for English reading. Following Chang and Hsu's (2011) research, in this study, perceived ease-of-use was measured by six items, as illustrated in Table 6.16.

Table 6.16 Original items of perceived ease-of-use in the TAM questionnaire

Perceived ease-of-use	Items
EU1	I find the XXX is easy to use.
EU2	Learning how to use the XXX is easy for me.
EU3	It is easy to become skilful in using XXX.
EU4	My interaction with the XXX is clear.
EU5	My interaction with the XXX is understandable.
EU6	It will be easy for me to find information through the XXX.

To better fit into the context of this study, when measuring the perceived ease-of-use of the Chinese text translations and CSL interpretations, I made some changes to the original Items 4 and 5. Originally, Item 4 was “My interaction with the XXX is clear”, and Item 5 was “My interaction with the XXX is understandable”. When piloting this questionnaire with deaf and hard-of-hearing students, they reported that they had difficulties distinguishing the two words “clear” and “understandable”. When translating these two words into Chinese, “something is clear” has the meaning of “something is easy to understand”. Therefore, to mitigate confusion, I deleted the original Item 4, and the original Item 5 was changed to “I find the XXX translations/interpretations are easy to understand”. Thus, it was possible to investigate if the comprehension of the key word translations in different modalities was simple and clear to the participants. The modified scale to measure the perceived ease-of-use of different modalities is illustrated in Table 6.17. As mentioned in Section 6.4.3, Cronbach's Alpha scores on the scales are over 0.9 indicating that the items in the scales have high reliability.

Table 6.17 Modified items of perceived ease-of-use in the TAM questionnaire

Perceived ease-of-use	Items
EU1	I find the XXX is easy to use.
EU2	Learning how to use the XXX is easy for me.
EU3	It is easy to become skilful in using XXX.
EU4	The XXX of the key words is easy to understand.
EU5	It will be easy for me to find information through the XXX of the key words.

In the high school group, as presented in Table 6.18, the overall ease-of-use of the multi-modal reading interface was 52%, indicating that half of the participants found it did not require much effort to work on. However, the perceived ease-of-use on each item was not high, which means the high school participants, to some extent, had difficulties with the design of the interface. To be more specific (Table 6.18), the lowest perceived ease-of-use score appeared on Item 3, "It is easy to become skillful in using XXX", followed by Item 5, "My interaction with the interface is clear". In other words, a significant number of the high school participants found the design of the interface posed problems and was not clear enough, and confusing when working on the functions. Future research on this topic might benefit from supplementing this kind of quantitative exploration with follow-up interviews with participants.

Table 6.18 Perceived ease-of-use of the reading interface: high school

The Interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	0%	2.4%	11.9%	42.9%	16.7%	4.8%	21.4%
EU2	0%	4.8%	9.5%	42.9%	16.7%	11.9%	14.3%
EU3	0%	4.8%	7.1%	52.4%	16.7%	2.4%	16.7%
EU4	0%	4.8%	9.5%	40.5%	23.8%	4.8%	16.7%
EU5	2.4%	2.4%	9.5%	47.6%	16.7%	7.1%	14.3%

The Interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU6	2.4%	2.4%	7.1%	47.6%	11.9%	14.3%	14.3%
Overall EU	0%	0%	7.1%	40.5%	16.7%	11.9%	23.8%

In the university group, the overall perceived ease-of-use score was 84% (Table 6.19), indicating that most university deaf and hard-of-hearing students found it easy to work on the reading interface. Additionally, in contrast to the results of the high school participants, the university participants did not report low perceived ease-of-use in Item 3 or Item 5. In other words, the design of the interface was clearer to the university students compared to the high school students.

Table 6.19 Perceived ease-of-use of the reading interface: university

The interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	0%	0%	2.7%	24.3%	24.3%	21.6%	27.0%
EU2	0%	2.7%	2.7%	21.6%	27.0%	21.6%	24.3%
EU3	0%	2.7%	5.4%	24.3%	21.6%	21.6%	24.3%
EU4	0%	2.7%	5.4%	24.3%	16.2%	24.3%	27.0%
EU5	0%	10.8%	5.4%	18.9%	16.2%	27.0%	21.6%
EU6	5.4%	5.4%	2.7%	18.9%	10.8%	24.3%	32.4%
Overall EU	0%	0%	0%	16.2%	16.2%	21.6%	45.9%

Similar to the perceived usefulness, in the high school group, the perceived ease-of-use for the Chinese text translations was higher than that for the CSL interpretations. As shown in Table 6.20, the overall perceived ease-of-use for Chinese text translations on key words was 62%, compared to 57% for the CSL interpretations. In other words, more than half of the high school participants in this study generally

agreed that making use of the Chinese text translations and CSL interpretation of key words in the reading interface did not need too much effort. However, it is also worth noting that the perceived ease-of-use of the CSL interpretations of each item was not particularly high. Specifically, the high school participants' perceived ease-of-use scores were 42.8% for Item 1, Item 2, and Item 3; 45.2% for Item 4, and 54.8% for Item 5. These results indicate that the high school participants found the sign language interpretations more challenging to use. As has been pointed out by Liu (2020), even though sign language interpretations were made by several CSL experts, due to the lack of standardized sign language use in classrooms, it was still possible for the deaf and hard-of-hearing students in this study to find it difficult to comprehend the information transmitted by the CSL videos.

Table 6.20 Perceived ease-of-use of the Chinese text translations (CT) and CSL interpretation videos: high school

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	4.8%	0%	2.4%	31.0%	35.7%	7.1%	19.0%
EU2	2.4%	2.4%	2.4%	42.9%	23.8%	7.1%	19.0%
EU3	2.4%	2.4%	2.4%	45.2%	19.0%	9.5%	19.0%
EU4	2.4%	2.4%	2.4%	42.9%	23.8%	9.5%	16.7%
EU5	2.4%	0%	4.8%	42.9%	23.8%	7.1%	19.0%
Overall	2.4%	0%	2.4%	33.3%	31.0%	9.5%	21.4%
CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	2.4%	2.4%	4.8%	47.6%	23.8%	7.1%	11.9%
EU2	0%	4.8%	11.9%	40.5%	21.4%	11.9%	9.5%
EU3	2.4%	2.4%	4.8%	47.6%	19.0%	9.5%	14.3%
EU4	2.4%	0%	2.4%	50.0%	23.8%	7.1%	14.3%
EU5	0%	2.4%	4.8%	38.1%	28.6%	14.3%	11.9%
Overall	0%	2.4%	2.4%	38.1%	23.8%	19.0%	14.3%

Similar findings apply to the university group. According to Table 6.21, the overall ease-of-use for the Chinese text translations reflected by the university students in this study was 86%, compared to 76% for the CSL interpretation videos. That is, even though most university participants agreed that both modalities were easy to use, Chinese text translations provided clearer and more comprehensible information than sign language interpretations. This finding also applied to university participants' perceived ease-of-use on Item 5, where 68% of the participants reported that it was easy to find information from the sign language interpretation videos, compared to 76% on the same Item for Chinese text translation. Differences in perceived ease-of-use between the two modalities appeared on other items, suggesting that the university students in this study agreed that the use of sign language interpolations needed more effort to use than the Chinese text translations.

Table 6.21 Perceived ease-of-use of the Chinese text translations (CT) and CSL interpretation videos: university

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	0%	0%	0%	13.5%	21.6%	32.4%	32.4%
EU2	0%	0%	0%	16.2%	18.9%	48.6%	16.2%
EU3	0%	0%	0%	18.9%	24.3%	29.7%	27.0%
EU4	0%	0%	0%	24.3%	18.9%	29.7%	27.0%
EU5	0%	0%	5.4%	18.9%	16.2%	40.5%	18.9%
Overall EU	0%	0%	0%	13.5%	13.5%	27.0%	45.9%
CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
EU1	2.7%	5.4%	5.4%	13.5%	24.3%	24.3%	24.3%
EU2	5.4%	0%	2.7%	21.6%	18.9%	37.8%	13.5%
EU3	2.7%	2.7%	2.7%	18.9%	24.3%	24.3%	24.3%
EU4	2.7%	0%	2.7%	24.3%	18.9%	27.0%	24.3%
EU5	0%	2.7%	8.1%	21.6%	21.6%	32.4%	13.5%

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
Overall EU	0%	2.7%	0%	21.6%	16.2%	24.3%	35.1%

In summary, a majority of the participants in this study concurred that the multi-modal reading interface was easy to use. The university participants reported finding the interface more user-friendly than high school students. Both high school and university participants expressed greater ease in understanding and obtaining information from Chinese text translations compared to CSL interpretations. Given that the challenges with CSL interpretations may be linked to how key words were translated, a follow-up study could be valuable in exploring participants' sentiments regarding sign language interpretations and their perceptions of the interface design.

6.4.3.3 Attitude

Attitude, as defined by Ghani et al. (2019), pertains to students' assessment of whether the technology benefits them. Although Chang and Hsu (2011) did not measure attitude in their research. This study included the assessment of participants' attitudes toward the multi-modal reading interface. The aim was to explore how deaf and hard-of-hearing students in the study evaluated and judged the use of the interface, including the presence of Chinese text translations and CSL interpretations as aids for their English reading experiences. As illustrated in the Table 6.22, following Ghani et al.'s (2019) study, attitude was measured using five items, and the reliability score was above 0.9.

Table 6.22 Items of attitude in the TAM questionnaire

Construct of Attitude	Items
AT1	Reading English through using the XXX is a good idea.
AT2	I feel positive about the use of the XXX.
AT3	I believe that the XXX helps me to be more engaged in learning.
AT4	I generally favour the XXX.
AT5	I believe that it is a good idea for me to use XXX for my future coursework.

As illustrated by Table 6.23, in the high school group, 60% of the participants evaluated the multi-modal reading interface as being generally beneficial to them. However, on each item, similar to the perceived usefulness and ease-of-use, half of the participants took the neutral viewpoint, indicating that they were not sure about whether it would be a good idea to have this tool when they were doing English reading tasks. Especially regarding Item 3, only 38% of participants agreed that the multi-modal reading interface would help them to be more engaged in learning. The high school participants' neutral attitudes toward the reading interface correlate with their neutral perspectives on its perceived usefulness and ease-of-use. This suggests that while the interface was functional, it did not particularly stand out or impress this group of participants. This finding highlights the need for future studies to explore factors that could positively influence the attitudes of high school deaf and hard-of-hearing students, such as engagement, emotional appeal, or peer influence, when designing multi-modal learning tools for this demographic.

Table 6.23 Attitude toward the reading interface: high school

The Interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	9.5%	0%	0%	50.0%	14.3%	7.1%	19.0%
AT2	2.4%	9.5%	4.8%	38.1%	19.0%	9.5%	16.7%
AT3	2.4%	2.4%	9.5%	47.6%	11.9%	7.1%	19.0%
AT4	0%	4.8%	2.4%	52.4%	11.9%	4.8%	23.8%
AT5	2.4%	2.4%	4.8%	50.0%	11.9%	7.1%	21.4%
Overall AT	0%	0%	0%	40.7%	28.6%	4.8%	26.2%

In contrast to the high school participants, as shown in Table 6.24, most students from the university group (84%) agreed that having this multi-modal reading interface would be beneficial to their future English reading experiences. Of these participants, 78% believed that reading English through the interface was a good idea, 76% felt positive toward the use of the interface, 76% felt they were more engaged in learning with the help of the interface, 76% generally favored the tool, and 78% liked the idea of having this tool in their future studies. Compared to the data of the high school group, the differences in attitude were obvious. Thus, it would be beneficial for future studies to ask what might have caused high school and university students to have such different attitudes to a potential source of learning.

Table 6.24 Attitude toward the reading interface: university

The Interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	2.7%	2.7%	0%	16.2%	24.3%	21.6%	32.4%
AT2	2.7%	2.7%	2.7%	16.2%	21.6%	24.3%	29.7%
AT3	0%	2.7%	2.7%	18.9%	16.2%	29.7%	29.7%
AT4	0%	5.4%	2.7%	16.2%	24.3%	24.3%	27.0%

The Interface	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT5	0%	2.7%	2.7%	16.2%	21.6%	29.7%	27.0%
Overall AT	0%	2.7%	0%	13.5%	16.2%	24.3%	43.2%

As illustrated in Table 6.25, over 60% of the participants held positive attitudes toward having Chinese text translation and CSL interpretations of key words in an English reading text. However, compared to sign language interpretation, more high school participants held positive attitudes toward Chinese text translation. This finding has also been demonstrated in previous sections, those of perceived usefulness and perceived ease-of-use. Therefore, based on data in this questionnaire, it could be argued that high school participants had a preference for textual assistance, compared to sign language videos, when the textual information is simple and direct, such as translations of key words.

Table 6.25 Attitude toward the Chinese text translations (CT) and CSL interpretation videos: high school

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	0%	0%	2.4%	38.1%	23.8%	7.1%	28.6%
AT2	0%	0%	7.1%	38.1%	23.8%	14.3%	16.7%
AT3	0%	2.4%	2.4%	45.2%	14.3%	16.7%	19.0%
AT4	2.4%	0%	7.1%	40.5%	21.4%	11.9%	16.7%
AT5	4.8%	0%	2.4%	42.9%	23.8%	7.1%	19.0%
Overall	0%	0%	0%	33.3%	26.2%	11.9%	28.6%
CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	2.4%	0%	2.4%	52.4%	16.7%	11.9%	14.3%
AT2	2.4%	2.4%	4.8%	45.2%	23.8%	9.5%	11.9%
AT3	2.4%	0%	4.8%	42.9%	26.2%	9.5%	14.3%
AT4	2.4%	2.4%	0%	52.4%	16.7%	11.9%	14.3%
AT5	2.4%	0%	2.4%	52.4%	23.8%	7.1%	11.9%
Overall	2.4%	0%	0%	38.1%	31.0%	11.9%	16.7%

In the university group, 87% of the participants held positive attitudes toward having Chinese textual translations of key words in English reading passages, while 76% agreed that it would be a good idea to have sign language interpretation assistance for key words (Table 6.26). In other words, like the high school participants, more university students held positive attitudes toward Chinese textual translations, compared to sign language interpretations.

Table 6.26 Attitude toward the Chinese text translations (CT) and CSL interpretation videos: university

CT	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	2.7%	0%	2.7%	13.5%	24.3%	27.0%	29.7%
AT2	2.7%	0%	2.7%	16.2%	16.2%	32.4%	29.7%
AT3	0%	2.7%	0%	18.9%	16.2%	32.4%	29.7%
AT4	2.7%	0%	0%	16.2%	24.3%	18.9%	37.8%
AT5	2.7%	0%	2.7%	16.2%	16.2%	35.1%	27.0%
Overall	0%	2.7%	0%	13.5%	16.2%	16.2%	54.1%
CSL	Extremely Unlikely	Quite Unlikely	Unlikely	Neither	Likely	Quite Likely	Extremely Likely
AT1	0%	5.4%	2.7%	21.6%	10.8%	24.3%	35.1%
AT2	2.7%	0%	8.1%	18.9%	18.9%	18.9%	32.4%
AT3	0%	2.7%	2.7%	21.6%	13.5%	24.3%	35.1%
AT4	2.7%	0%	2.7%	21.6%	18.9%	21.6%	32.4%
AT5	0%	2.7%	0%	21.6%	21.6%	21.6%	32.4%
Overall	0%	2.7%	0%	21.6%	10.8%	18.9%	45.9%

In summary, the university participants generally expressed positive attitudes about the idea of having a multi-modal reading interface and various modalities of key word assistance in their English reading. However, this positive sentiment was not as

evident in the high school group, where half of the participants opted for a neutral viewpoint, indicating uncertainty about whether a multi-modal reading interface would positively impact their English reading experiences. Both the university and high school groups showed a higher level of agreement on the usefulness of Chinese text translation compared to CSL interpretations of key words.

6.5 Discussion

The following sections will discuss the key findings of this study. Additionally, they will address the limitations encountered during the research process, such as sample size and scope constraints, and how these limitations inform the directions for future research.

6.5.1 Multi-modal preferences of deaf and hard-of-hearing students

The results of this study highlight the flexibility of information modalities used by deaf and hard-of-hearing students. The analysis of individual cases shows that, even when sign language was identified as the preferred modality by the participants, they still had more mouse clicks on key word textual translations than on sign language interpretation videos. Such a finding indicates that the preferences of deaf and hard-of-hearing students for language modalities are complex and influenced by their demographic backgrounds, communication subjects, and communication objectives.

Moreover, this study found that deaf and hard-of-hearing students used textual translations significantly more often than sign language interpretations. Thus, it is

difficult to make simple connections between these students' communication preferences, their language use in the classroom, and their academic success. Numerous factors need to be considered, such as the difficulty level of the textual information (Kushalnagar et al., 2018), the accuracy of the sign language interpretation (Marschark et al., 2004), and more.

6.5.2 Key word assistance to promote post-reading performances

The impact of key word assistance on post-reading vocabulary and comprehension performance was more complex than initially assumed. A notable difference emerged between the high school and university participants when they used multi-modal keyword translations.

For the high school group, having key word assistance significantly improved their vocabulary performance in post-reading tasks. This finding aligns with previous discussions on the benefits of textual input enhancement. As noted by Szudarski and Carter (2014), such strategies are advantageous for vocabulary learning in the context of ELL-NESC. Additionally, Chang and Hsu (2011) highlighted that actively looking up a word can lead to increased awareness and better memorization. However, the enhancements in the high school participants' reading comprehension were less evident, with some students even experiencing negative effects when frequently checking the meanings of key words. One possible reason for the lack of effectiveness in enhancing reading comprehension could be the distraction caused by looking up

key words, which may divert attention from the reading itself and increase cognitive load.

Although unknown words are known to hinder reading comprehension (North et al., 2023), Eng et al. (2020) found that shifts in gaze away from the text were negatively associated with children's reading comprehension performance. The design of the reading interface may have contributed to this distraction. In this study, deaf and hard-of-hearing students had to initiate the process by clicking on the key words, selecting their preferred modality, reading or viewing the instructions, and then closing the window before returning to the reading task. This differs from the study by Chang and Hsu (2011), where participants only needed to click on an English word for an immediate translation. As a result, unlike Chang and Hsu's findings (2011), the present study did not show significant improvement in high school students' reading comprehension. Thus, balancing the primary instructional content with supplementary learning assistance is crucial in developing educational resources for deaf and hard-of-hearing students.

For the university group, multi-modal key word assistance led to more significant improvements in reading comprehension than vocabulary in P1. However, in P2, the university experimental group did not show substantial improvements in either reading comprehension or vocabulary scores compared to their counterparts. As discussed in Section 6.4.2.1, these results might be due to increased cognitive load

and learning fatigue as participants worked on P2. Additionally, familiarity with the learning tool may have diminished the novelty effect, reducing the initial motivational boost and potentially leading to a decrease in performance (Miguel-Alonso et al., 2023; Putz et al., 2020).

Beyond the differences between the high school and university groups, individual differences were also noted in the findings of this study. As discussed in Section 6.4.2.2, for some individual students, multi-modal key word assistance had a negative impact on their post-reading performance. This finding further underscores the heterogeneous nature of deaf and hard-of-hearing English learners in non-English-speaking countries (Ellis, 2021; Swanwick, 2016)).

The findings of this study further demonstrate that designing multi-modal learning tools is a complex task involving numerous interconnected factors, including cognitive load, content familiarity, individual learner differences and more. Therefore, it is essential to consider the students' subjective role in this process and to develop tools that are adaptable to their varying needs and preferences.

6.5.3 Users' acceptance of the use of the English reading interface with multi-modal assistance on key words

As indicated by the data results, the university participants showed a higher level of acceptance of the use of the English reading interface with multi-modal assistance with key words than the high school, whereas both groups of participants

demonstrated more acceptance of having Chinese textual translation than sign language interpretation videos on key words when doing English reading tasks.

Social features, encompassing aspects like social cultures and social networks, have been recognized as influential indicators of individuals' acceptance of information technology (Bandyopadhyay and Fraccastoro, 2007; Hossain and de Silva, 2009). Consequently, the variation in acceptance levels observed between high school participants and university students could be attributed to their distinct social features, such as educational environment, learning objectives, exposure to different teaching methods and technologies, and more.

It is also important to note that the findings of this study may reveal differences between university and high school students that arise from various external and internal changes over time, as well as potential selection bias. For instance, the increased availability of hearing devices may have resulted in fewer high school deaf and hard-of-hearing students relying on sign language compared to their university counterparts. Additionally, as individuals grow older and gain more independence from their parents and professionals, they may choose a different primary mode of communication at university than they did at school. The communication options available in their environment and from their peers also play a role; for example, many teachers at school may be more amenable to using sign language than university lecturers. University students may have a more diverse group of friends, including

more hearing individuals, necessitating a greater use of aural communication. However, since this study was not specifically designed to investigate the potential external and internal factors that led to the differences between the high school and university students, it would be beneficial if future research addressed this topic.

The participants' preference for Chinese textual translations over sign language interpretation videos for key words when reading English texts further demonstrates the adaptability of deaf and hard-of-hearing students to various information modalities. The reluctance to embrace sign language interpretation could be attributed to several factors. The lack of standardization in the use of sign language in Chinese classrooms for deaf and hard-of-hearing students (Liu, 2013) makes it difficult to ensure accurate CSL translations of English words and example sentences. Yang et al.'s study (2022) highlights that, unlike in-person sign language interpreters, digital interpretation may not offer immediate adjustments and solutions, potentially hindering comprehension for deaf and hard-of-hearing students. Additionally, due to the interface design, sign language interpretation videos required loading before being displayed, leading participants to find it easier to seek Chinese textual translations of key words.

In conclusion, the participants generally perceived multi-modal key word assistance in English reading texts as beneficial. However, certain adjustments are needed to better align with the specific needs of deaf and hard-of-hearing students, such as optimizing the interface design and reducing video loading time.

6.5.4 Limitations of the study and future work

This study has several limitations. First, the limited sample size reduced the significance value of the correlation analysis. A larger sample of deaf and hard-of-hearing participants would provide more robust and reliable statistical conclusions. Second, the study did not focus on developing multi-modal learning materials to promote vocabulary learning and reading comprehension. As a result, the findings were insufficient to test the effectiveness of the multi-modal reading interface for these goals. Future studies incorporating retention tests would provide valuable quantitative data on this issue. Additionally, it would be beneficial for future research to explore the reasons behind the preferences of Chinese deaf and hard-of-hearing English learners for different language modalities, including when and why they prefer certain ones.

In conclusion, this study has laid the groundwork for future user-centered research aimed at systematically developing teaching and learning resources for Chinese deaf and hard-of-hearing English learners.

Chapter 7 Conclusion and Implications

The field of SLA has been extensively studied, particularly concerning language teaching theories and methods for specific learner groups. However, despite recent research increasing its focus on language learners with special needs, deaf and hard-of-hearing students still do not receive the same level of attention as their hearing peers due to their relatively small number and lack of visibility (Csiźer and Kontra, 2020). Therefore, this thesis aims to develop an understanding of the experiences and preferences of Chinese deaf and hard-of-hearing English learners.

The purpose of this research was to explore (a) the demographic features of Chinese deaf and hard-of-hearing English learners, (b) how English teachers respond to the diverse needs of their deaf and hard-of-hearing students in classroom settings, and (c) the preferences of deaf and hard-of-hearing students for multi-modal key words assistance during English reading tasks. Based on these research questions, this mixed-method study includes a pilot demographic study with deaf and hard-of-hearing high school students, an expanded demographic study such students from both a high school and a university, a semi-structured interview with four English teachers working in different educational settings, and an experimental study testing the participants' language preferences and post-reading performances when working on a multi-modal English reading interface.

This chapter begins with an interpretation of the main findings of each study. Based on these findings, there is a discussion on the potential implications for policymakers, stakeholders, and teachers. The limitations of the research are then discussed, leading to a consideration of future research directions.

7.1 Interpretations of the findings

This section delves into a detailed interpretation of the findings from the studies conducted in this thesis. The interaction among the findings of each study allows for a holistic understanding of the unique challenges and experiences faced by Chinese deaf and hard-of-hearing English learners. This thesis begins with the pilot demographic study of the students, providing foundational insights into the demographic characteristics of this learner group, and setting the stage for the subsequent studies.

7.1.1 The pilot demographic study

The pilot demographic survey invited 15 high school-level deaf and hard-of-hearing students from a deaf school in central China. To investigate the relationship between deafness and learning English in a non-English-speaking country, the questionnaire was designed to focus on the participants' demographic information regarding their deafness (e.g., degree of hearing loss, language backgrounds, family history of hearing loss, use of hearing devices, etc.), communication preferences, and experiences of learning English.

The data reflected a diverse group of students in the language classroom, with varying degrees of hearing loss and different language backgrounds. While the primary language used was CSL, communication were delivered in multi-modal ways. Interestingly, the students expressed dissatisfaction with the overall quality of communication with their teachers, stating that the teachers had difficulty responding to their difficulties in learning English. Additionally, the participants revealed that English reading comprehension posed the greatest challenges, and they lacked additional support for learning English outside of the classroom. The findings from this study highlighted the need for further discussions with English teachers on how to create a more communicative, barrier-free language classroom that catered to the diverse needs of the students. It also highlighted the need to explore the perspectives of teachers regarding the challenges faced by deaf and hard-of-hearing students in learning English in non-English speaking countries.

7.1.2 The expanded demographic survey

Given the small sample size of the pilot demographic study and the potential mismatch of the quality of communication scale to the educational setting, it seemed appropriate to increase the sample size of the demographic survey and reassess certain aspects.

The expanded demographic survey included a total of 83 participants, comprising 39 university students and 44 high school students. As anticipated, the students exhibited even greater heterogeneity regarding their levels of hearing loss, experiences with

hearing devices, language and English learning backgrounds, and communication preferences. Notably, more than half of the participants in this survey had experiences using technical hearing devices, including hearing aids and cochlear implants.

It is important to note that the previous pilot demographic survey indicated a high preference for sign language. However, in this study, the students demonstrated more diversity in their communication modalities. In addition to sign language, they frequently utilized spoken language, written communication, and typing on mobile devices when interacting with teachers, deaf and hard-of-hearing friends, and hearing individuals. The participants also exhibited flexibility in adapting to different communication methods depending on the context. Consequently, their satisfaction with the quality of communication with their teachers improved. Furthermore, their ability to use multiple modalities reflects their proficiency in sign language and Chinese literacy skills, enabling them to effectively utilize both textual and sign information.

In the context of ELL-NESC, the participants in this study demonstrated a wide range of backgrounds in English learning, reflecting various levels of exposure and proficiency. Despite these differences, a common thread emerged among both high school and university students: significant difficulties with English reading comprehension. These challenges were not isolated but were closely linked to the broader issue of vocabulary acquisition, as the Pearson correlation indicated a

moderate to strong correlation between the participants' perceived difficulty in reading comprehension and vocabulary. This finding underscored the critical importance of vocabulary acquisition, not just as a component of language learning but also as a foundational element that significantly impacts reading comprehension (e.g., Perfetti and Stafura, 2016). The data suggested that improving vocabulary knowledge could potentially alleviate some of the reading comprehension difficulties faced by these students, highlighting the need for targeted vocabulary instruction in teaching English to learners in non-English speaking countries.

7.1.3 The semi-structured teacher interview

The results from the pilot study illustrated the heterogeneous nature of the students in the population sample. The pilot demographic survey also indicated the participants' dissatisfaction with the quality of student-teacher communication. According to Borg (2019), teacher's training experience is an important factor, influencing teachers' attitudes, beliefs, cognition, and self-identity. Given that Chinese teachers of deaf and hard-of-hearing English learners have varied initial and in-service training backgrounds, this study aimed to explore how these teachers responded to their students' diverse needs in English classrooms and how their attitudes and teaching practices were influenced by their training experiences.

Four English teachers with different training and professional backgrounds participated in a set of semi-structured interviews. Inspired by the results of the demographic questionnaire with the deaf and hard-of-hearing students, the semi-

structured interviews consisted of three parts. The first part focused on the teachers' initial and in-service training experiences. The second part addressed the teachers' responses to students' dissatisfaction with the quality of communication. The third part gathered the teachers' teaching stories, including how they taught an English lesson and what expectations they had for potential learning materials.

As demonstrated by the interview data, the respondents exhibited different views due to their varied training experiences and the lack of curriculum standards and teaching materials specifically for deaf and hard-of-hearing students. For example, some respondents believed that the curriculum should be more test-oriented, while others emphasized the importance of fostering language abilities. Additionally, regarding language use, some respondents insisted that CSL should be the primary language in language classrooms, while others advocated for more multilingual, multi-modal communication environments. On the other hand, the respondents shared agreements on certain topics. First, they acknowledged that deaf and hard-of-hearing students were highly heterogeneous. Despite this, the interview data revealed that the four respondents were not effectively addressing the students' diverse needs. Second, the respondents who worked primarily with deaf and hard-of-hearing students agreed that the current teaching materials did not meet their students' needs. Therefore, it would be beneficial to develop materials that were more suitable for deaf and hard-of-hearing students.

The interview results revealed that an English teacher for deaf and hard-of-hearing students must navigate multiple roles: that of a special education teacher, a deaf education specialist, and an English language educator.

As a special education teacher, they must create inclusive learning environments that accommodate a range of disabilities. As a deaf education specialist, they need expertise in communication strategies tailored to deaf and hard-of-hearing students. Simultaneously, as an English language educator, they require a strong command of language teaching methodologies to facilitate effective language acquisition. The interaction between these roles means that a lack of training or experience in any one area can lead to gaps in instructional effectiveness and student engagement.

The interviews highlighted that the respondents often felt unprepared due to the absence of integrated training programs that cover all these domains comprehensively. This gap in training can result in a fragmented self-identity, making it difficult for them to balance the demands of their multiple roles. This imbalance may, in turn, reduce their confidence and efficacy in addressing the unique needs of their students. To address these challenges, there is a clear need for more robust and comprehensive training programs that equip educators with the skills and knowledge necessary to fulfill their multifaceted roles effectively. Such programs would not only strengthen their professional self-identity but also enhance their ability to provide high-quality, tailored education to their students.

7.1.4 The experimental study with the multi-modal reading interface

Inspired by the findings from the demographic study with Chinese deaf and hard-of-hearing English learners and the semi-structured interviews with four English teachers, I recognized the potential for developing a multi-modal learning tool that catered to the diverse linguistic communication preferences of the deaf and hard-of-hearing students. Focusing on English reading, and in response to teachers' desire for learning materials that incorporate sign language elements, I aimed to provide multi-modal aids for key words in reading texts. These aids offered the options of Chinese text translations and sign language interpretation videos. By providing these choices, deaf and hard-of-hearing students could select the modality that best aligned with their language preferences.

The primary objective of this study was to examine students' preferences between the two modal options and investigate whether these preferences were influenced by their usual communication habits. Additionally, the study aimed to assess students' post-reading performance in reading tasks with and without key word translation assistance, determining whether their use of the two modalities impacted their reading performance. To address these research questions, the reading interface recorded students' mouse click on the two options and the answers they submitted for the reading tasks.

Interestingly, the findings showed that deaf and hard-of-hearing students generally preferred Chinese text translations over sign language interpretation videos. Even though this preference shows little correlation with their preferences for sign language and spoken language, it can be explained by their inclination toward written information and typing on mobile devices, as the participants demonstrated in the expanded demographic study. Another possible factor contributing to this preference may have been the convenience of checking Chinese text translations compared to videos, which take some time to load. Since Chinese text translations of English words are concise and easy to read, future research could explore offering multi-modal choices for more complex instructions.

Providing this type of assistance generally improved the performance of deaf and hard-of-hearing students in post-reading exercises. However, differences were observed between the high school and university groups. Additionally, individual differences were evident, with some participants showing lower scores in post-reading tasks despite the multi-modal keyword assistance. Considering the heterogeneous nature of deaf and hard-of-hearing students, the findings of this study highlight the complexity of developing learning materials that meet their diverse needs. Several factors need to be considered, including the social differences between high school and university students, as these two groups also demonstrated different perspectives in the TAM questionnaire.

7.2 Implications

The findings from this thesis suggest several important actions for policymakers, stakeholders, and teachers working in the field of education for deaf and hard-of-hearing students, particularly in the context of ELL-NESC.

7.2.1 Suggestions for policymakers and stakeholders

Policymakers and stakeholders should be encouraged to recognize the diverse needs of deaf and hard-of-hearing additional language learners. The heterogeneous nature of this student population, highlighted in both the pilot and expanded demographic studies, indicates the need for the development of inclusive educational policies and collaborative efforts that address their unique challenges. Policies and actions could be made to promote the improvements in various areas, including teacher training programs, developing multi-modal learning materials specifically for deaf and hard-of-hearing learners, and more.

7.2.1.1 Systematic teacher training

Developing and mandating specialized training programs for teachers of deaf and hard-of-hearing students could be highly beneficial. These programs could integrate components of special education, deaf education, and subject-area pedagogy to ensure that teachers are well-equipped to meet the diverse needs of their students. Moreover, ongoing professional development could be mandated to keep teachers updated with the latest research and methodologies in the field. As demonstrated by the interviewees, teachers working in special education settings and general education

settings tend to have separate in-service training focusing on different topics. Therefore, it would be beneficial if institutions and/or government education departments could offer interdisciplinary training programs for these two groups of teachers so that those from different initial training programs could have chances to make up their knowledge gaps according to their needs.

7.2.1.2 Development of multi-modal learning materials

The results of this research demonstrate the potential benefits of developing and implementing multi-modal learning tools that cater to the varying linguistic preferences of deaf and hard-of-hearing students. These tools are essential for addressing the unique challenges faced by this student population in learning English in non-English-speaking countries. For example, providing resources such as Chinese text translations and sign language interpretation videos for English learning materials could potentially enhance comprehension and engagement.

Based on the findings of the experimental study, multi-modal assistance should be easily accessible in the learning interface to facilitate quick reference. Additionally, producing high-quality sign language interpretation videos that explain key concepts and vocabulary can provide an alternative mode of understanding for students more comfortable with sign language. The integration of these videos should be seamless, allowing students to switch between text and video as needed to optimize their learning experiences.

In terms of technology integration, interactive learning platforms that incorporate both Chinese text translations and sign language interpretation videos can offer a comprehensive learning experience. Features such as clickable key words, pop-up translations, and embedded videos can make the platform user-friendly and effective. Ensuring that these multi-modal tools are accessible is also crucial. As indicated by the participants, the design of the interface could have a great impact on their willingness to cooperate with the functions. User-friendly designs and offline capabilities can further enhance accessibility, making learning more flexible and adaptable to different environments. However, as the study is not focused on how to improve students' technology acceptance toward using multi-modal learning interfaces, it would be beneficial for future research to further investigate this area.

7.2.1.3 Enhanced communication infrastructure

The results of this study also highlight the importance of facilitating better communication between teachers and deaf and hard-of-hearing students. Apart from providing necessary training programs to teachers, it could also be beneficial to include platforms that support real-time translation and interpretation services. Given that deaf and hard-of-hearing students are often bi-modal and bilingual, as noted by Swanwick (2016), the integration of advanced technologies can address their diverse communication needs. Multi-modal students may use a combination of sign language, written text, and spoken language, depending on the context and their personal preferences. Therefore, technologies that support multiple forms of communication can be highly beneficial.

7.2.2 Suggestions for teachers

Teachers are at the forefront of implementing the strategies and tools developed for deaf and hard-of-hearing students. The findings from this research offer several insights for improving classroom practices.

First of all, seeking out and participating in professional development opportunities that cover the latest methodologies in deaf education and language education (or other subject areas) is crucial. This ongoing learning is important for adapting to the evolving needs of students. Professional development programs should be readily accessible and may include workshops, online courses, and collaborative learning communities where teachers can share experiences and best practices.

Second, teachers need to be fully aware of their students' diverse communication needs. Developing flexible communication strategies to cater to the diverse preferences of students is important. This includes using a mix of sign language, written communication, and spoken language, as appropriate. Additionally, to respond to their students' diverse needs, teachers should be encouraged to incorporate multi-modal aids into teaching practices. Offering students multi-modal choices, such as visual information and sign language interpretations, could be beneficial in enhancing students' comprehension and engagement with the material.

Third, given the correlation between vocabulary knowledge and reading comprehension difficulties, prioritizing targeted vocabulary instruction in English language classrooms in non-English-speaking countries could be beneficial. This might involve the use of textual enhancement, visual aids, interactive activities, and multi-modal resources to reinforce vocabulary learning. However, since this research is not designed to develop effective vocabulary teaching strategies for teachers of Chinese deaf and hard-of-hearing English learners, it would be meaningful for future studies to research this area.

7.3 Limitations of this research and future research directions

This research has several limitations which could be discussed in future studies.

7.3.1 Limitations of this research

First of all, the studies in this PhD thesis involved a relatively small sample size. The demographic survey recruited deaf and hard-of-hearing students from only one university and one high school, and the semi-structured interviews included only four respondents. Despite the limited sample size, the participants in the demographic survey demonstrated the heterogeneous nature of deaf and hard-of-hearing students, as suggested in the literature (e.g., Archbold, 2015). This diversity encompasses varying degrees of hearing loss, different experiences with technical hearing devices, and a range of language and communication preferences. Meanwhile, the four respondents in the semi-structured interview had diverse training backgrounds and

worked in different educational settings, which provided a broad perspective on the issues explored.

In other words, while the sample size may limit the generalization of the findings, the diversity within the sample provides valuable insights into the varied experiences and demographics of deaf and hard-of-hearing students. This heterogeneity underscores the importance of personalized and adaptable teaching strategies and supports in language education. The findings emphasize the need for further research with larger and more varied samples to build on these initial insights and develop a more comprehensive understanding of the educational needs of deaf and hard-of-hearing students learning English in non-English-speaking countries.

Moreover, the different backgrounds and settings of the interview respondents highlight the variability in training and resources available to teachers of deaf and hard-of-hearing students. This suggests a need for standardized training programs and resources that can be adapted to various educational contexts to ensure teachers are well equipped to meet their students' needs. Future research should continue to explore these areas, potentially expanding the sample size and including a wider range of educational settings and geographic locations to enhance the robustness and applicability of the findings.

Second, the design of the studies also has limitations. For example, the absence of delayed tests to assess participants' vocabulary retention over time means that the results of the experimental study may not effectively conclude the longevity of students' vocabulary learning outcomes. Additionally, the results of the study are not sufficient to explain why the participants' reading comprehension did not improve as assumed.

However, the main focus of this study was to explore deaf and hard-of-hearing students' multi-modal preferences when working on an English reading interface with bimodal assistance on key words. Given that the study was not designed to test the effectiveness of the provided assistance, it would be beneficial if future research expanded on this by incorporating a more comprehensive experimental design.

Another limitation of this research is the reliance on self-reported data from participants, which can introduce bias and affect the accuracy of the findings. Self-reported data, such as the responses collected through the demographic surveys and interviews, is subject to various biases, including the social desirability bias, recall bias, and response bias. Participants may have provided answers they believed were expected or socially acceptable rather than expressing their true feelings or experiences. Additionally, the accuracy of their responses might be affected by their memory and interpretation of the questions.

7.3.2 Future research directions

The findings from this research illustrate a multifaceted framework for understanding the demographics and preferences of Chinese deaf and hard-of-hearing English learners. The results suggest that these students are multilingual and use multi-modal information flexibly, according to their needs. Rather than debating which language should be the primary one for deaf and hard-of-hearing students, a potential research direction could explore under what circumstances these individuals prefer specific language modalities, or how the accuracy and conciseness of information transmission can be ensured with multi-modal resources.

For example, as introduced in Chapter 1 (refer to Section 1.2.3.2), the Chinese government encourages the use of information technologies in special education classrooms. In light of this policy, further research could delve into how these technologies can be effectively used in classroom settings to enhance learning outcomes. This could involve investigating the optimal conditions for employing various technologies and evaluating their impact on student engagement and comprehension. By focusing on these areas, researchers could develop more tailored and effective educational strategies for deaf and hard-of-hearing students.

The results of the research also call for the recognition of the diverse needs of deaf and hard-of-hearing students in communication and learning. Despite the diverse characteristics and needs demonstrated by the deaf and hard-of-hearing students in the

demographic study, the teachers in the semi-structured interviews generally failed to respond effectively to their students' needs. For example, R3 described how she believed she communicated easily with her students; however, this perception was not supported by the students' responses in the pilot demographic study.

Therefore, it would be beneficial to explore this topic further to better understand the root causes of this mismatch. One potential direction for future research could be a detailed study of the interactions between teachers and deaf and hard-of-hearing students. For example, analyzing the content and structure of conversations in the classroom could reveal specific communication barriers and misunderstandings. This might involve recording and transcribing classroom interactions, followed by a qualitative analysis to identify recurring themes and issues. Additionally, implementing observational studies or video analysis could provide insights into nonverbal communication dynamics, allowing researchers to observe firsthand how communication unfolds in real time and how both parties navigate and negotiate understanding.

In the context of teaching and learning English in non-English-speaking countries, it would be meaningful to have empirical studies on several critical aspects. For example, investigating the effectiveness of different instructional methods tailored specifically for deaf and hard-of-hearing students would provide valuable insights. These studies could compare traditional teaching approaches with those incorporating

multi-modal aids, such as sign language interpretation, visual aids, and digital tools, to determine which methods yield the best outcomes in terms of language acquisition and comprehension.

It would also be beneficial to conduct longitudinal studies to assess the long-term impacts of these teaching methods on students' proficiency and retention of English learning outcomes. Such research could track students' progress over several years, providing a comprehensive view of how different instructional strategies influence their language development over time.

Additionally, exploring the role of technology in enhancing English language learning for deaf and hard-of-hearing students in non-English-speaking is another promising area for empirical research. Studies could examine the use of specific technologies, such as speech-to-text software, interactive learning platforms, and mobile applications, in facilitating better understanding and engagement in the classroom. Assessing the usability and effectiveness of these technologies can guide educators in integrating the most beneficial tools into their teaching practices.

In conclusion, while this thesis provides a foundation of the demographics and preferences of Chinese deaf and hard-of-hearing English learners, further empirical research in these areas is vital. The research presented in this thesis should therefore be seen as part of a larger research agenda that informs and supports the enhancement

of educational experiences and outcomes for deaf and hard-of-hearing students, ultimately promoting greater equity and accessibility in multilingual language education.

References

Abbas, F., Rana, A.M., Bashir, D. and Bhatti, A. (2021) 'The English language proficiency as a global employment skill: the viewpoint of pakistani academia'. Available at: https://doi.org/10.18510/hssr.2021.93106.

Abou-Abdallah, M. and Lamyman, A. (2021) 'Exploring communication difficulties with deaf patients', Clinical Medicine, 21(4), pp. e380–e383. Available at: https://doi.org/10.7861/clinmed.2021-0111.

Adnyani, N.L.P.S., Wisudariani, N.M.R., Pradnyana, G.A., Pradnyana, I.M.A. and Suwastini, N.K.A. (2021) 'Multimedia English learning materials for deaf or hard of hearing (DHH) children', Journal of Education Technology, 5(4), pp. 571–578. Available at: https://doi.org/10.23887/jet.v5i4.38829.

Ajzen, I. (1991) 'The Theory of Planned Behavior', Organizational Behavior and Human Decision Processes, 50(2), pp. 179–211. Available at: https://doi.org/10.1016/0749-5978(91)90020-T.

Ajzen, I. (2012) 'The Theory of Planned Behavior', in Handbook of Theories of Social Psychology, pp. 438–459. Available at: https://doi.org/10.4135/9781446249215.n22.

Ajzen, I. (2020) 'The Theory of Planned Behavior: Frequently asked questions', Human Behavior and Emerging Technologies, 2(4), pp. 314–324. Available at: https://doi.org/10.1002/hbe2.195.

Al-Ababneh, M.M. (2020) ‘Linking ontology, epistemology and research methodology’, Science & Philosophy, 8(1). Available at: https://doi.org/10.23756/sp.v8i1.500.

Alam, M.B. and Zhu, Z. (2023) ‘Teaching in the shadows: Exploring teachers’ intentions and behaviors towards private tutoring in Bangladesh’, HELIYON, 9(2), p. e12534. Available at: https://doi.org/10.1016/j.heliyon.2022.e12534.

Alasim, K.N. (2019) ‘Reading development of students who are deaf and hard of hearing in inclusive education classrooms’, Education Sciences, 9(3), p. 201. Available at: https://doi.org/10.3390/educsci9030201.

Al-Dababneh, K.A., Al-Zboon, E.K. and Akour, M.M. (2016) ‘Competencies that teachers need for teaching children who are deaf and hard-of-hearing (DHH) in Jordan’, Deafness & Education International, 18(4), pp. 172–188. Available at: https://doi.org/10.1080/14643154.2016.1249173.

Alexander, L.G. and He (1997) New Concept English 2 new edition. 1st edition. Beijing: Foreign Language Teaching and Research Press.

Almaiah, M.A., Jalil, M.A. and Man, M. (2016) ‘Extending the TAM to examine the effects of quality features on mobile learning acceptance’, Journal of Computers in Education, 3(4), pp. 453–485. Available at: https://doi.org/10.1007/s40692-016-0074-1.

Alothman, A.A. (2021) ‘Language and literacy of deaf children’, Psychology and Education.

Anderson, M.L., Wolf Craig, K.S. and Ziedonis, D.M. (2017) 'Barriers and facilitators to deaf trauma survivors' help-seeking behavior: lessons for behavioral clinical trials research', The Journal of Deaf Studies and Deaf Education, 22(1), pp. 118–130. Available at: https://doi.org/10.1093/deafed/enw066.

Andrews, J.F. and Rusher, M. (2010) 'Codeswitching techniques: Evidence-based instructional practices for the ASL/English bilingual classroom', American Annals of the Deaf, 155(4), pp. 407–424.

Antia, S.D. and Kreimeyer, K.H. (2015) Social competence of deaf and hard-of-hearing children. Oxford University Press.

Archbold, S. (2015) 'Being a deaf student: Changes in characteristics and needs', in Educating deaf learners: Creating a global evidence base. New York: Oxford University Press, pp. 23–46.

Ayantoye, C.A. and Luckner, J.L. (2016) 'Successful students who are deaf or hard of hearing and culturally and/or linguistically diverse in inclusive settings', American Annals of the Deaf, 160(5), pp. 453–466.

Baddeley, A. (2000) 'The episodic buffer: A new component of working memory?', Trends in Cognitive Sciences, 4(11), pp. 417–423. Available at: https://doi.org/10.1016/S1364-6613(00)01538-2.

Bandyopadhyay, K. and Fraccastoro, K.A. (2007) 'The effect of culture on user acceptance of information technology', Communications of the Association

for Information Systems, 19. Available at: https://doi.org/10.17705/1CAIS.01923.

Beal, J.S. (2021) 'American Sign Language (ASL) development: Deaf students' ASL skills across age and time and implications for ASL instruction', Deafness & Education International, 23(4), pp. 335–352. Available at: https://doi.org/10.1080/14643154.2020.1737764.

Berent, G.P., Kelly, R.R., Aldersley, S., Schmitz, K.L., Khalsa, B.K., Panara, J. and Keenan, S. (2007) 'Focus-on-Form instructional methods promote deaf college students' improvement in English grammar', Journal of Deaf Studies and Deaf Education, 12(1), pp. 8–24.

Berent, G.P., Kelly, R.R., Schmitz, K.L. and Kenney, P. (190AD) 'Visual input enhancement via essay coding results in deaf learners' long-term retention of improved English grammatical knowledge', Journal of Deaf Studies and Deaf Education, 14(2), p. 2009.

Bergström, D., Norberg, C. and Nordlund, M. (2023) '"The text comes first" – principles guiding EFL materials developers' vocabulary content decisions', Scandinavian Journal of Educational Research, 67(1), pp. 154–168. Available at: https://doi.org/10.1080/00313831.2021.1990122.

Bernhard, N., Gauger, U., Romo Ventura, E., Uecker, F.C., Olze, H., Knopke, S., Hänsel, T. and Coordes, A. (2021) 'Duration of deafness impacts auditory performance after cochlear implantation: A meta-analysis', Laryngoscope

Investigative Otolaryngology, 6(2), pp. 291–301. Available at: https://doi.org/10.1002/lio2.528.

Birinci, F.G. and Sariçoban, A. (2021) 'The effectiveness of visual materials in teaching vocabulary to deaf students of EFL', Journal of Language and Linguistic Studies, 17(1), pp. 628–645. Available at: https://doi.org/10.3316/informit.221335398012476.

Blommaert, J. and Backus, A. (2013) 'Super diverse repertoires and the individual', in Multilingualism and Multimodality. Brill, pp. 9–32. Available at: https://brill.com/display/book/9789462092662/BP000003.xml (Accessed: 8 April 2024).

Bochner, J. (1982) 'English in deaf population', in Deafness and communication: Assessment and training. Baltimore, MD: Williams and Wilkins, pp. 107–123.

Borella, E. and de Ribaupierre, A. (2014) 'The role of working memory, inhibition, and processing speed in text comprehension in children', Learning and Individual Differences, 34, pp. 86–92. Available at: https://doi.org/10.1016/j.lindif.2014.05.001.

Borg, S. (2003) 'Teacher cognition in language teaching: A review of research on what language teachers think, know, believe, and do', Language teaching, 36(2), pp. 81–109.

Borg, S. (2019) 'Language teacher cognition: Perspectives and debates', in X. Gao (ed.) Second Handbook of English Language Teaching. Cham: Springer

International Publishing, pp. 1149–1170. Available at: https://doi.org/10.1007/978-3-030-02899-2_59.

Bosnjak, M., Ajzen, I. and Schmidt, P. (2020) 'The Theory of Planned Behavior: Selected recent advances and applications', Europe's Journal of Psychology, 16(3), pp. 352–356. Available at: https://doi.org/10.5964/ejop.v16i3.3107.

Boztepe, Ö. (2017) 'The adaptation of Student Communication Satisfaction Scale into Turkish culture', International Journal of Educational Research Review, 2(1), pp. 27–33. Available at: https://doi.org/10.24331/ijere.309970.

Brentari, D. (2019) Sign language phonology. Cambridge University Press.

Butcher, E., Dezateux, C., Cortina-Borja, M. and Knowles, R.L. (2019) 'Prevalence of permanent childhood hearing loss detected at the universal newborn hearing screen: Systematic review and meta-analysis', PLOS ONE, 14(7), p. e0219600. Available at: https://doi.org/10.1371/journal.pone.0219600.

Campbell, R. and Mohammed, T.-J. (2010) 'Speechreading for information gathering: a survey of scientific sources'.

Cannon, J. and Marx, N. (2023) 'Scoping review of research methodologies across language studies with deaf and hard-of-hearing multilingual learners', International Review of Applied Linguistics in Language Teaching [Preprint]. Available at: https://doi.org/10.1515/iral-2022-0206.

Cannon, J.E. and Luckner, J.L. (2016) 'Increasing cultural and linguistic diversity in deaf education teacher preparation programs', American Annals of the Deaf, 161(1), pp. 89–103.

Cárnio, M.S., Vosgrau, J.S. and Soares, A.J.C. (2017) 'The role of phonological awareness in reading comprehension', Revista CEFAC, 19, pp. 590–600. Available at: https://doi.org/10.1590/1982-0216201619518316.

Carretti, B., Borella, E., Cornoldi, C. and De Beni, R. (2009) 'Role of working memory in explaining the performance of individuals with specific reading comprehension difficulties: A meta-analysis', Learning and Individual Differences, 19(2), pp. 246–251. Available at: https://doi.org/10.1016/j.lindif.2008.10.002.

Caselli, N., Pyers, J. and Lieberman, A.M. (2021) 'Deaf children of hearing parents have age-level vocabulary growth when exposed to American Sign Language by 6 months of age', The Journal of Pediatrics, 232, pp. 229–236. Available at: https://doi.org/10.1016/j.jpeds.2021.01.029.

Cates, D.M., Traxler, M.J. and Corina, D.P. (2022) 'Predictors of reading comprehension in deaf and hearing bilinguals', Applied Psycholinguistics, 43(1), pp. 81–123. Available at: https://doi.org/10.1017/S0142716421000412.

Chang, C.-K. and Hsu, C.-K. (2011) 'A mobile-assisted synchronously collaborative translation–annotation system for English as a foreign language (EFL) reading comprehension', Computer Assisted Language Learning, 24(2), pp. 155–180. Available at: https://doi.org/10.1080/09588221.2010.536952.

Chen, H.H., Lee, M.C., Wu, Y.L., Qiu, J.Y., Lin, C.H., Tang, H.Y. and Chen, C.H. (2012) 'An analysis of moodle in engineering education: The TAM perspective', in Proceedings of IEEE International Conference on Teaching,

Assessment, and Learning for Engineering (TALE) 2012. Proceedings of IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) 2012, pp. H1C-1-H1C-5. Available at: https://doi.org/10.1109/TALE.2012.6360324.

Chen, L.J. (2019) '新课标下聋校数学教学中信息技术的应用原则及策略 (Principles and strategies for applying information technology in mathematics teaching in schools for the deaf under the new curriculum standards)', Modern Special Education, (21), pp. 40–42.

Chen, Y. (2018) A case study of two Taiwanese students with hearing loss navigating the English as a foreign language requirement at their university. Ph.D. The University of New Mexico. Available at: https://www.proquest.com/docview/2061725557/abstract/B79C3C858E154986PQ/1.

Chen, Y., Wong, L.L.N., Zhu, S. and Xi, X. (2016) 'Early speech perception in Mandarin-speaking children at one-year post cochlear implantation', Research in Developmental Disabilities, 49–50, pp. 1–12. Available at: https://doi.org/10.1016/j.ridd.2015.11.021.

Cheng, Q., Roth, A., Halgren, E. and Mayberry, R.I. (2019) 'Effects of early language deprivation on brain connectivity: language pathways in deaf native and late first-language learners of American Sign Language', Frontiers in Human Neuroscience, 13. Available at: https://doi.org/10.3389/fnhum.2019.00320.

China's Disabled Person Federation (中国残疾人联合会) (2022a) Statistics of the national basic information database of provision of assistive devices. Available at: https://www.cdpf.org.cn/zwgk/zccx/ndsj/zhsjtj/2022zh/294e679cc9e345388d8496c2dce046ff.htm.

China's Disabled Person Federation (中国残疾人联合会) (2022b) '《中华人民共和国残疾人证》管理办法 (Regulations on the management of the 'People's Republic of China Disability Certificate')'. Available at: https://www.cdpf.org.cn//hdjl/gjflfg1/zzjslzc/a632c5533e034ceabd1e51f837ab5907.htm.

Ching, T.Y.C., Dillon, H., Marnane, V., Hou, S., Day, J., Seeto, M., Crowe, K., Street, L., Thomson, J., Van Buynder, P., Zhang, V., Wong, A., Burns, L., Flynn, C., Cupples, L., Cowan, R.S.C., Leigh, G., Sjahalam-King, J. and Yeh, A. (2013) 'Outcomes of early- and late-identified children at 3 years of age: Findings from a prospective population-based study', Ear and Hearing, 34(5), p. 535. Available at: https://doi.org/10.1097/AUD.0b013e3182857718.

Ching, T.Y.C., Scarinci, N., Marnane, V., Sjahalam-King, J., Button, L. and Whitfield, J. (2018) 'Factors influencing parents' decisions about communication choices during early education of their child with hearing loss: a qualitative study', Deafness & Education International, 20(3–4), pp. 154–181. Available at: https://doi.org/10.1080/14643154.2018.1512393.

Collins, L. (2015) Language, corpus and empowerment: Applications to deaf education, healthcare and online discourses. London: Routledge. Available at: https://doi.org/10.4324/9781315719658.

Compilation Group of English Curriculum Standards Experimental Textbook, Ministry of Education of People's Republic of China. (2013) Go for it English (Grade 7, Volume 2). Beijing: People's Education Press.

Consortium for Research into Deaf Education (CRIDE) (2023) Education provision for deaf children in 2022/23. Available at: https://www.ndcs.org.uk/information-and-support/professionals/research-and-data/cride-reports/ (Accessed: 13 July 2024).

Costan, F., Gonzales, G., Gonzales, R., Valle, L., Dela Cruz, J., Alcantara, G., Mahilum, R., Lauro, M.D., Atibing, N.M., Burdeos, A., Yamagishi, K. and Ocampo, L. (2022) 'Teachers' turnover intentions in view of implementing a flexible learning system: an extended Theory of Planned Behavior', Sustainability, 14(20), p. 13009. Available at: https://doi.org/10.3390/su142013009.

Council of Europe (2007) From linguistic diversity to plurilingual education: Guide for the development of language education policies in Europe. Cambridge University Press.

Cruz, A.D. da, Gagné, J.-P., Cruz, W.M., Isotani, S., Gauthier-Cossette, L. and Jacob, R.T. de S. (2020) 'The effects of using hearing aids and a frequency modulated system on listening effort among adolescents with hearing loss',

International Journal of Audiology, 59(2), pp. 117–123. Available at: https://doi.org/10.1080/14992027.2019.1671992.

Csizér, K. and Kontra, E.H. (2020) 'Foreign language learning characteristics of deaf and severely hard-of-hearing students', The Modern Language Journal, 104(1), pp. 233–249. Available at: https://doi.org/10.1111/modl.12630.

Csiźer, K., Kontra, E.H. and Piniel, K. (2015) 'An investigation of the self-related concepts and foreign language motivation of young deaf and hard-of-hearing learners in Hungary', Studies in Second Language Learning and Teaching, 5, pp. 229–249.

Cunningham, A.E., Zibulsky, J. and Callahan, M.D. (2009) 'Starting small: Building preschool teacher knowledge that supports early literacy development', Reading and Writing, 22(4), pp. 487–510. Available at: https://doi.org/10.1007/s11145-009-9164-z.

Darling-Hammond, L., Hyler, M.E. and Gardner, M. (2017) 'Effective teacher professional development', Learning policy institute. Available at: https://eric.ed.gov/?id=ED606743.

David, A., Kiose, V. and Tzelepi, E. (2023) 'ICTs in education for deaf and hard-of-hearing learners', World Journal of Biology Pharmacy and Health Sciences. Available at: https://doi.org/10.30574/wjbphs.2023.14.3.0273.

Davis, A., McMahon, C.M., Pichora-Fuller, K.M., Russ, S., Lin, F., Olusanya, B.O., Chadha, S. and Tremblay, K.L. (2016) 'Aging and hearing health: The life-

course approach', The Gerontologist, 56(Suppl_2), pp. S256–S267. Available at: https://doi.org/10.1093/geront/gnw033.

Davis, F.D. (1989) 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology', MIS Quarterly, 13(3), pp. 319–340. Available at: https://doi.org/10.2307/249008.

Deci, E.L. and Ryan, R.M. (1985) Intrinsic motivation and self-determination in human behavior. New York: Plenum.

Deep, N.L., Dowling, E.M., Jethanamest, D. and Carlson, M.L. (2019) 'Cochlear Implantation: An overview', Journal of Neurological Surgery Part B: Skull Base, 80(2), pp. 169–177. Available at: https://doi.org/10.1055/s-0038-1669411.

Dillon, C.M., de Jong, K. and Pisoni, D.B. (2012) 'Phonological awareness, reading skills, and vocabulary knowledge in children who use cochlear implants', The Journal of Deaf Studies and Deaf Education, 17(2), pp. 205–226. Available at: https://doi.org/10.1093/deafed/enr043.

Domagala-Zysk, E. (2016) 'Vocabulary teaching strategies in EFL classes for deaf and hard-of-hearing students', in English as a foreign language for deaf and hard-of-hearing persons. Cambridge Scholars Publishing, pp. 135–152.

Domagała-Zyśk, E., Moritz, N. and Podlewska, A. (2021) English as a foreign language for deaf and hard of hearing learners: Teaching strategies and interventions. Routledge.

Dong, X., Xu, J. and Jia, J. (2020) '语音识别技术在聋人大学生课堂教学中的应用研究 (A study of teaching effect of speech recognition system in college class for deaf students)', Journal of Beijing Union University, 34(3), pp. 63–69.

Dorn, B. (2019) 'The changing role of teachers of students who are deaf or hard of hearing: Consultation as an increasing part of the job', Journal of Educational and Psychological Consultation, 29(2), pp. 237–254. Available at: https://doi.org/10.1080/10474412.2018.1502087.

Dörnyei, Z. (2007) Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies. Oxford: Oxford University Press (Oxford applied linguistics).

Drigas, A. and Ioannidou, R.E. (2013) 'Special Education and ICTs', International Journal of Emerging Technologies in Learning (iJET), 8(2), p. 41. Available at: https://doi.org/10.3991/ijet.v8i2.2514.

Dunn, R., Hattie, J. and Bowles, T. (2018) 'Using the Theory of Planned Behavior to explore teachers' intentions to engage in ongoing teacher professional learning', Studies in Educational Evaluation, 59, pp. 288–294. Available at: https://doi.org/10.1016/j.stueduc.2018.10.001.

Editorial Board of the China Education Yearbook (1997) 中国教育年鉴 (Yearbook of China's education). Beijing: People's Education Press.

Ellis, R. (2021) 'A short history of SLA: Where have we come from and where are we going?', Language Teaching, 54(2), pp. 190–205. Available at: https://doi.org/10.1017/S0261444820000038.

Emmorey, K., Li, C., Petrich, J. and Gollan, T.H. (2020) 'Turning languages on and off: Switching into and out of code-blends reveals the nature of bilingual language control', Journal of Experimental Psychology: Learning, Memory, and Cognition, 46(3), pp. 443–454. Available at: https://doi.org/10.1037/xlm0000734.

Eng, C.M., Godwin, K.E. and Fisher, A.V. (2020) 'Keep it simple: Streamlining book illustrations improves attention and comprehension in beginning readers', NPJ Science of Learning, 5, p. 14. Available at: https://doi.org/10.1038/s41539-020-00073-5.

Engelberg, R., Downey, L. and Curtis, J.R. (2006) 'Psychometric characteristics of a quality of communication questionnaire assessing communication about end-of-life care', Journal of Palliative Medicine, 9(5), pp. 1086–1098. Available at: https://doi.org/10.1089/jpm.2006.9.1086.

Engler, K.S. and MacGregor, C.J. (2018) 'Deaf education teacher preparation: A phenomenological case study of a graduate program with a comprehensive philosophy', American Annals of the Deaf, 162(5), pp. 388–418.

Estabrooks, W., MacIver-Lux, K. and Rhoades, E. (1994) 'Auditory-verbal therapy', Washington, DC: Alexander Graham Bell Association for the Deaf [Preprint].

Estabrooks, W., MacIver-Lux, K. and Rhoades, E.A. (2016) Auditory-Verbal therapy: For young children with hearing loss and their families, and the practitioners who guide them. Plural Publishing.

Fahimnia, F. and Haghani Mobarake, Z. (2014) 'The effect of Visual Input Enhancement on English reading comprehension among deaf high school students', Pazand Quarterly, 10(36), pp. 75–87.

Falkowska, J. (2016) 'Monolingual, bilingual, trilingual? Using different languages in an EFL class for the D/deaf', in English as a foreign language for deaf and hard-of-hearing persons: Challenges and Strategies. Cambridge Scholars Publishing, pp. 55–72.

Fishbein, M. and Ajzen, I. (2009) Predicting and changing behavior: The reasoned action approach. New York: Psychology Press. Available at: https://doi.org/10.4324/9780203838020.

Freitas, E., Simões, C., Santos, A.C. and Mineiro, A. (2022) 'Resilience in deaf children: A comprehensive literature review and applications for school staff', Journal of Community Psychology, 50(2), pp. 1198–1223. Available at: https://doi.org/10.1002/jcop.22730.

Frush Holt, R. (2019) 'Assistive Hearing Technology for deaf and hard-of-hearing spoken language learners', Education Sciences, 9(2), p. 153. Available at: https://doi.org/10.3390/educsci9020153.

Gao, Y. and Gu, D. (2013) '中国手语的发展历史回顾 (Historical review of the development of Chinese Sign Language)', Contemporary Linguistics, 15(1), pp. 94–100.

Geers, A.E. and Hayes, H. (2011) 'Reading, writing, and phonological processing skills of adolescents with 10 or more years of cochlear implant experience',

Ear and Hearing, 32(1), p. 49S. Available at: https://doi.org/10.1097/AUD.0b013e3181fa41fa.

Geers, A.E., Mitchell, C.M., Warner-Czyz, A., Wang, N.-Y., Eisenberg, L.S. and Team, the Cd.I. (2017) 'Early sign language exposure and cochlear implantation benefits', Pediatrics, 140(1). Available at: https://doi.org/10.1542/peds.2016-3489.

Geers, A.E., Moog, J.S., Biedenstein, J., Brenner, C. and Hayes, H. (2009) 'Spoken language scores of children using cochlear implants compared to hearing age-mates at school entry', The Journal of Deaf Studies and Deaf Education, 14(3), pp. 371–385. Available at: https://doi.org/10.1093/deafed/enn046.

Gentry, M.M., Chinn, K.M. and Moulton, R.D. (2004) 'Effectiveness of multimedia reading materials when used with children who are deaf', American Annals of the Deaf, 149(5), pp. 394–403.

Ghani, M.T.A., Hamzah, M., Ramli, S., Ab, W., Daud, A.W., Romli, T.R.M. and Mokhtar, N.N.M. (2019) 'A questionnaire-based approach on technology acceptance model for mobile digital game-based learning', Journal of Global Business and Social Entrepreneurship (GBSE), 5(14).

Giese, K.A. (2020) Factors that influence parent communication decisions for their deaf or hard of hearing child in Illinois. Ed.D. Illinois State University. Available at: https://www.proquest.com/docview/2491863916/abstract/AFCDA8FB04E54963PQ/1 (Accessed: 19 July 2024).

Gilakjani, A.P. and Sabouri, N.B. (2012) ‘A study on the role of motivation in foreign language learning and teaching’, International Journal of Modern Education and Computer Science, 4. Available at: https://doi.org/10.5815/ijmecs.2012.07.02.

Gonzalez, R.J., Pagan, M., Wendell, L. and Love, C. (2011) Supporting ELL/culturally and linguistically diverse students for academic achievement, International Center for Leadership in Education.

Goodboy, A.K., Martin, M.M. and Bolkan, S. (2009) ‘The development and validation of the Student Communication Satisfaction Scale’, Communication Education, 58(3), pp. 372–396. Available at: https://doi.org/10.1080/03634520902755441.

Goodman, B. and Tastanbek, S. (2021) ‘Making the shift from a codeswitching to a translanguaging lens in English language teacher education’, TESOL Quarterly, 55(1), pp. 29–53. Available at: https://doi.org/10.1002/tesq.571.

Grabe, W. and Stoller, F.L. (2019) Teaching and researching reading. 3rd edition. United Kingdom: Routledge (Applied Linguistics in Action). Available at: https://doi.org/10.4324/9781315726274.

Granić, A. and Marangunić, N. (2019) ‘Technology acceptance model in educational context: A systematic literature review’, British Journal of Educational Technology, 50(5), pp. 2572–2593. Available at: https://doi.org/10.1111/bjet.12864.

Gui, J. and Ismail, S.M. (2024) 'The effect of planning time on vocabulary acquisition in a task-based environment: The mediating roles of working memory and field (in)dependence', BMC Psychology, 12(1), p. 145. Available at: https://doi.org/10.1186/s40359-024-01638-4.

Guo (2017) '手语在聋生英语课堂教学中的使用探究—聋校英语教学案例研究 (An exploration of the use of sign language in teaching English to deaf students in the English classroom - a case study of English teaching in deaf schools)', Journal of Beijing Union University, 31(1), pp. 25-28+61.

Hall, M.L. and Bavelier, D. (2011) 'Short-term memory stages in sign vs. speech: The source of the serial span discrepancy', Cognition, 120(1), pp. 54–66. Available at: https://doi.org/10.1016/j.cognition.2011.02.014.

Hall, M.L., Eigsti, I.-M., Bortfeld, H. and Lillo-Martin, D. (2017) 'Auditory deprivation does not impair executive function, but language deprivation might: Evidence from a parent-report measure in deaf native signing children', The Journal of Deaf Studies and Deaf Education, 22(1), pp. 9–21. Available at: https://doi.org/10.1093/deafed/enw054.

Hall, M.L., Hall, W.C. and Caselli, N.K. (2019) 'Deaf children need language, not (just) speech', First Language, 39(4), pp. 367–395. Available at: https://doi.org/10.1177/0142723719834102.

Hall, W.C. (2017) 'What you don't know can hurt you: The risk of language deprivation by impairing sign language development in deaf children',

Maternal and Child Health Journal, 21(5), pp. 961–965. Available at: https://doi.org/10.1007/s10995-017-2287-y.

Harris, M., Terlektsi, E. and Kyle, F.E. (2017a) 'Concurrent and longitudinal predictors of reading for deaf and hearing children in primary school', The Journal of Deaf Studies and Deaf Education, 22(2), pp. 233–242. Available at: https://doi.org/10.1093/deafed/enw101.

Harris, M., Terlektsi, E. and Kyle, F.E. (2017b) 'Literacy outcomes for primary school children who are deaf and hard of hearing: A cohort comparison study', Journal of Speech, Language, and Hearing Research, 60(3), pp. 701–711. Available at: https://doi.org/10.1044/2016_JSLHR-H-15-0403.

Hashemi, M.R. (2012) 'Reflections on mixing methods in applied linguistics research', Applied Linguistics, 33(2), pp. 206–212. Available at: https://doi.org/10.1093/applin/ams008.

Hashemi, M.R. (2019) 'Expanding the scope of mixed methods research in applied linguistics', in The Routledge Handbook of Research Methods in Applied Linguistics. Routledge.

Helder, A., Van Leijenhorst, L., Beker, K. and Van den Broek, P. (2013) 'Sources of comprehension problems during reading', Unraveling the Behavioral, Neurobiological, and Genetic Components of Reading Comprehension, pp. 43–53.

Hellmich, F., Löper, M.F. and Görel, G. (2019) 'The role of primary school teachers' attitudes and self-efficacy beliefs for everyday practices in inclusive

classrooms – a study on the verification of the Theory of Planned Behavior', Journal of Research in Special Educational Needs, 19(S1), pp. 36–48. Available at: https://doi.org/10.1111/1471-3802.12476.

Henner, J., Caldwell-Harris, C.L., Novogrodsky, R. and Hoffmeister, R. (2016) 'American Sign Language syntax and analogical reasoning skills are influenced by early acquisition and age of entry to signing schools for the deaf', Frontiers in Psychology, 7. Available at: https://doi.org/10.3389/fpsyg.2016.01982.

Herman, D.R., Roy, P.P. and Kyle, D.F. (2017) 'Reading and dyslexia in deaf children', Nuffield Foundation; City University London [Preprint].

Hickok, G., Bellugi, U. and Klima, E.S. (1996) 'The neurobiology of sign language and its implications for the neural basis of language', Nature, 381(6584), pp. 699–702. Available at: https://doi.org/10.1038/381699a0.

Hickok, G., Love-Geffen, T. and Klima, E.S. (2002) 'Role of the left hemisphere in sign language comprehension', Brain and Language, 82(2), pp. 167–178. Available at: https://doi.org/10.1016/S0093-934X(02)00013-5.

Hintermair, M. (2008) 'Self-esteem and satisfaction with life of deaf and hard-of-hearing people—A resource-oriented approach to identity work', Journal of Deaf Studies and Deaf Education, 13(2), pp. 278–300.

Hjetland, H.N., Brinchmann, E.I., Scherer, R. and Melby-Lervåg, M. (2017) 'Preschool predictors of later reading comprehension ability: A systematic

review', Campbell Systematic Reviews, 13(1), pp. 1–155. Available at: https://doi.org/10.4073/csr.2017.14.

Hogan, T.P., Catts, H.W. and Little, T.D. (2005) 'The relationship between phonological awareness and reading', Language, Speech, and Hearing Services in Schools, 36(4), pp. 285–293. Available at: https://doi.org/10.1044/0161-1461(2005/029).

Holcomb, L., Dostal, H. and Wolbers, K.A. (2023) 'Supporting deaf students', Odyssey: New Directions in Deaf Education, 23, pp. 28–33.

Holzinger, D., Dall, M., Sanduvete-Chaves, S., Saldaña, D., Chacón-Moscoso, S. and Fellinger, J. (2020) 'The impact of family environment on language development of children with cochlear implants: A systematic review and meta-analysis', Ear and Hearing, 41(5), p. 1077. Available at: https://doi.org/10.1097/AUD.0000000000000852.

Hornberger, N.H. and Link, H. (2012) 'Translanguaging and transnational literacies in multilingual classrooms: a biliteracy lens', International Journal of Bilingual Education and Bilingualism, 15(3), pp. 261–278. Available at: https://doi.org/10.1080/13670050.2012.658016.

Hossain, L. and de Silva, A. (2009) 'Exploring user acceptance of technology using social networks', The Journal of High Technology Management Research, 20(1), pp. 1–18. Available at: https://doi.org/10.1016/j.hitech.2009.02.005.

Howerton-Fox, A. and Falk, J.L. (2019) ‘Deaf children as “English learners”: The psycholinguistic turn in deaf education’, Education Sciences, 9(2), p. 133. Available at: https://doi.org/10.3390/educsci9020133.

Huang, Z.J., Zeng, F.L. and Liu, C.L. (2019) ‘新中国成立 70 年来我国特殊教育课程改革的回顾与前瞻 (Seventy years of curriculum reform in special education: Review and prospect)’, Chinese Journal of Special Education, (12), pp. 3–11.

Humphries, T., Kushalnagar, P., Mathur, G., Napoli, D.J., Padden, C. and Rathmann, C. (2014) ‘Ensuring language acquisition for deaf children: What linguists can do’, Language, 90(2), pp. e31–e52.

Hurst, N. and Hill, D.A. (2023) ‘The visual elements in EFL coursebooks’, in Developing Materials for Language Teaching. Bloomsbury Publishing, pp. 173–182.

Idol, L. (2006) ‘Toward inclusion of special education students in general education: A program evaluation of eight schools’, Remedial and Special Education, 27(2), pp. 77–94. Available at: https://doi.org/10.1177/07419325060270020601.

Jiang, Y., Wang, Q. and Weng, Z. (2022) ‘The influence of technology in educating English language learners at-risk or with disabilities: A systematic review’, CEPS Journal, 12(4), pp. 53–74.

Johnson, C. and Goswami, U. (2010) ‘Phonological awareness, vocabulary, and reading in deaf children with cochlear implants’, Journal of Speech, Language, and Hearing Research, 53, pp. 237–261.

Johnson, H.A. (2004) ‘U.S. deaf education teacher preparation programs’, American Annals of the Deaf, 149(2), pp. 75–91.

Johnson, H.A. (2013) ‘Initial and ongoing teacher preparation and support’, American Annals of the Deaf, 157(5), pp. 439–449.

Johnson, K.E. (2004) Deaf education in China: 2002 to 2020. PhD thesis. University of Minnesota. Available at: http://nottingham.idm.oclc.org/login?url=https://www.proquest.com/dissertations-theses/deaf-education-china-2002-2020/docview/305157245/se-2.

Jones, G.A., Ni, D. and Wang, W. (2021) ‘Nothing about us without us: Deaf education and sign language access in China’, Deafness & Education International, 23(3), pp. 179–200. Available at: https://doi.org/10.1080/14643154.2021.1885576.

Jones, M.K. and Roberts, M.Y. (2024) ‘Speech, sign, or both? Factors influencing caregivers’ communication method decision making for deaf/hard of hearing children’, Journal of Speech, Language, and Hearing Research, 67(1), pp. 187–195. Available at: https://doi.org/10.1044/2023_JSLHR-23-00386.

Kaefer, T., Neuman, S.B. and Pinkham, A.M. (2015) ‘Pre-existing background knowledge influences socioeconomic differences in preschoolers’ word

learning and comprehension', Reading Psychology, 36(3), pp. 203–231. Available at: https://doi.org/10.1080/02702711.2013.843064.

Kalaja, P. and Pitkänen-Huhta, A. (2020) 'Raising awareness of multilingualism as lived – in the context of teaching English as a foreign language', *Language and Intercultural Communication*, 20(4), pp. 340–355. Available at: https://doi.org/10.1080/14708477.2020.1786918.

Kang, K.Y. and Scott, J.A. (2021) 'The experiences of and teaching strategies for deaf and hard of hearing foreign language learners: A systematic review of the literature', American Annals of the Deaf, 165(5), pp. 527–547.

Kramsch, C. (2012) 'Authenticity and legitimacy in multilingual SLA', *Critical Multilingualism Studies*, 1(1), pp. 107–128.

Katz and Shahar, B.-H. (2015) 'What makes a motivating teacher? Teachers' motivation and beliefs as predictors of their autonomy-supportive style', School Psychology International, 36(6), pp. 575–588.

Kim, Y. (2006) 'Effects of input elaboration on vocabulary acquisition through reading by Korean learners of English as a foreign language', TESOL Quarterly, 40(2), pp. 341–373. Available at: https://doi.org/10.2307/40264526.

Knoors, H. (2015) 'Foundations for language development in deaf children and the consequences for communication choices', in M. Marschark and P.E. Spencer (eds) The Oxford Handbook of Deaf Studies in Language. Oxford University Press. Available at: https://doi.org/10.1093/oxfordhb/9780190241414.013.2.

Knoors, H. and Marschark, M. (2015a) Educating deaf learners: Creating a global evidence base. Oxford University Press.

Knoors, H. and Marschark, M. (2015b) 'Educating deaf students in a global context', in Educating deaf learners: Creating a global evidence base. Oxford University Press New York, pp. 1–22.

Kong, Y. and Ali, N.L. (2024) 'Research status of medical English based on CNKI bibliometric analysis and its development trend in China: Professional cultivation and teacher development', International Journal of Learning, Teaching and Educational Research, 23(5), pp. 198–218.

Kontra, E.H., Csizér, K. and Piniel, K. (2015) 'The challenge for deaf and hard-of-hearing students to learn foreign languages in special needs schools', European Journal of Special Needs Education, 30(2), pp. 141–155.

Korthagen, F.A.J. (2004) 'In search of the essence of a good teacher: Towards a more holistic approach in teacher education', Teaching and Teacher Education, 20(1), pp. 77–97. Available at: https://doi.org/10.1016/j.tate.2003.10.002.

Korver, A.M.H., Smith, R.J.H., Van Camp, G., Schleiss, M.R., Bitner-Glindzicz, M.A.K., Lustig, L.R., Usami, S. and Boudewyns, A.N. (2017) 'Congenital hearing loss', Nature reviews. Disease primers, 3, p. 16094. Available at: https://doi.org/10.1038/nrdp.2016.94.

Kovačević, T. and Isaković, L. (2024) 'The role and significance of lip-reading', TEME, XLVII(4), pp. 923–928. Available at: https://doi.org/10.22190/TEME230125057K.

Kožuh, I., Hintermair, M. and Debevc, M. (2016) ‘Community building among deaf and hard of hearing people by using written language on social networking sites’, Computers in Human Behavior, 65, pp. 295–307. Available at: https://doi.org/10.1016/j.chb.2016.08.035.

Kushalnagar, P., Smith, S., Hopper, M., Ryan, C., Rinkevich, M. and Kushalnagar, R. (2018) ‘Making cancer health text on the internet easier to read for deaf people who use American Sign Language’, Journal of Cancer Education : the Official Journal of the American Association for Cancer Education, 33(1), pp. 134–140. Available at: https://doi.org/10.1007/s13187-016-1059-5.

Kusters, A., Spotti, M., Swanwick, R. and Tapio, E. (2017) ‘Beyond languages, beyond modalities: Transforming the study of semiotic repertoires’, International Journal of Multilingualism, 14(3), pp. 219–232. Available at: https://doi.org/10.1080/14790718.2017.1321651.

Kyriacou, C. and Zhu, D. (2008) ‘Shanghai pupils’ motivation towards learning English and the perceived influence of important others’, Educational Studies, 34(2), pp. 97–104. Available at: https://doi.org/10.1080/03055690701811099.

Ladd, P. and Lane, H. (2013) ‘Deaf ethnicity, deafhood, and their relationship’, Sign Language Studies, 13(4), pp. 565–579.

Lederberg, A. (2006) ‘Language development of deaf children with hearing parents’, in K. Brown (ed.) Encyclopedia of Language & Linguistics (Second Edition). Oxford: Elsevier, pp. 361–368. Available at: https://doi.org/10.1016/B0-08-044854-2/00847-6.

Leppink, J., Paas, F., Van Gog, T., van Der Vleuten, C.P. and Van Merrienboer, J.J. (2014) 'Effects of pairs of problems and examples on task performance and different types of cognitive load', Learning and instruction, 30, pp. 32–42.

Letina, A. and Dikovic, M. (2021) 'Student teachers' classroom management orientations and their beliefs on effective teaching behaviour', Sodobna Pedagogika-Journal of Contemporary Educational Studies, 72(1), pp. 128–143.

Levine, D., Strother-Garcia, K., Golinkoff, R.M. and Hirsh-Pasek, K. (2016) 'Language development in the first year of life: What deaf children might be missing before cochlear implantation', Otology & Neurotology, 37(2), p. e56. Available at: https://doi.org/10.1097/MAO.0000000000000908.

Levlin, M., Okonski, L. and Sullivan, K.P.H. (2024) 'Educational attainment in Swedish (L1) and English (L2) for students with reading difficulties: A longitudinal case study from primary to the end of secondary school', Scandinavian Journal of Educational Research, 68(2), pp. 172–188. Available at: https://doi.org/10.1080/00313831.2022.2123850.

Li, J., Mayr, R. and Zhao, F. (2022a) 'Speech production in Mandarin-speaking children with cochlear implants: A systematic review', International Journal of Audiology, 61(9), pp. 711–719. Available at: https://doi.org/10.1080/14992027.2021.1978567.

Li, J.-N., Chen, S., Zhai, L., Han, D.-Y., Eshraghi, A.A., Feng, Y., Yang, S.-M. and Liu, X. (2017) 'The advances in hearing rehabilitation and cochlear implants

in China', Ear and hearing, 38(6), pp. 647–652. Available at: https://doi.org/10.1097/AUD.0000000000000441.

Li, L. (2015) 对新中国特殊教育师范教育制度建设的考察 (An examination of the construction of special education teacher training system in China). PhD thesis. Nanjing Normal University.

Li, S., Hiver, P. and Papi, M. (2022b) 'Individual differences in second language acquisition: Theory, research, and practice', in The Routledge Handbook of Second Language Acquisition and Individual Differences. Routledge.

Li, W. (2011) 'Multilinguality, multimodality, and multicompetence: Code- and modeswitching by minority ethnic children in complementary schools', The Modern Language Journal, 95(3), pp. 370–384. Available at: https://doi.org/10.1111/j.1540-4781.2011.01209.x.

Li, W., Dai, C., Li, H., Chen, B. and Jiang, Y. (2016) 'Factors impacting early cochlear implantation in Chinese children', European Archives of Oto-Rhino-Laryngology, 273(1), pp. 87–92. Available at: https://doi.org/10.1007/s00405-015-3492-1.

Li, Z.X. (2021) '信息技术在聋校美术教学中的应用探索——以六年级美术课《圆柱体》为例 (Exploring the application of information technology in art teaching at schools for the deaf: A case study of the sixth grade art lesson "cylinders")', Modern Special Education, (11), pp. 64–65.

Liang, H. (2024) '信息技术与聋校语文教学深度融合的诉求、内涵及实践路径 (The demand, connotation, and practical pathways for the deep integration of

information technology and Chinese language teaching in schools for the deaf)', Modern Special Education, (11), pp. 53–55.

Liang, Q. and Mason, B. (2013) 'Enter the dragon--China's journey to the hearing world', Cochlear Implants International, 14 (Suppl 1), pp. S26–S31.

Liao, Y. (2021) '基于聋生需求的普校初中英语教材改编——以《新目标英语》为例 (Adaptation of middle school English textbooks in general education schools based on the needs of deaf students: A case study of "New Target English")', Modern Special Education, (23), pp. 56–58.

Lichtert, G., Miller, K., Okalidou, A., Simpson, P., van Wieringen, A., Marschark, M., Lampropoulou, V. and Skordilis, E. (2016) 'High standard competencies for teachers of the deaf and other qualified professionals: Always necessary, not always guaranteed', Diversity in Deaf Education, pp. 135–170.

Liddell, S.K. (2021) American Sign Language syntax. Walter de Gruyter GmbH & Co KG.

Liu (2020) '语用学视角下的国家通用手语推广(The promotion of national sign language from the perspective of pragmatics)', Modern Special Education, (8), pp. 32–38.

Liu, D. and Nelson, R. (2017) 'Diversity in the classroom', in The TESOL Encyclopedia of English Language Teaching. John Wiley & Sons, Ltd, pp. 1–6. Available at: https://doi.org/10.1002/9781118784235.eelt0224.

Liu, G.L. and Wang, Y. (2024) 'Modeling EFL teachers' intention to integrate informal digital learning of English (IDLE) into the classroom using the

theory of planned behavior', System, 120, p. 103193. Available at: https://doi.org/10.1016/j.system.2023.103193.

Liu, H.L. (2013) 融合教育理念下资源教师角色的指导模式研究 (Research on the guidance model of resource teacher roles under the concept of inclusive education). PhD thesis. Huazhong Normal University.

Luckner, J.L. and Handley, C.M. (2008) 'A summary of the reading comprehension research undertaken with students who are deaf or hard of hearing', American Annals of the Deaf, 153(1), pp. 6–36.

Luo, M., Main, S., Lock, G., Joshi, R.M. and Zhong, C. (2020) 'Exploring Chinese EFL teachers' knowledge and beliefs relating to the teaching of English reading in public primary schools in China', Dyslexia, 26(3), pp. 266–285. Available at: https://doi.org/10.1002/dys.1630.

Lyall, F.C., Clamp, P.J. and Hajioff, D. (2016) 'Smartphone speech-to-text applications for communication with profoundly deaf patients', The Journal of Laryngology & Otology, 130(1), pp. 104–106. Available at: https://doi.org/10.1017/S0022215115003151.

Lytle, R.R., Johnson, K.E. and Yang, Y.H. (2005) 'Deaf education in China: History, current issues, and emerging deaf voices', American Annuals of the Deaf, 150(5), pp. 457–469.

Lyu, H. (2019)中国手语语言学 (Chinese Sign Language linguistics). 1st Edition. Beijing: Intellectual Property Publishing House.

Ma, W.L. (2018) ‘STEAM 教育背景下聋校物理与信息技术学科有效融合的探索 (Exploration of the effective integration of physics and information technology in schools for the deaf within the context of STEAM education)’, Modern Special Education, (21), pp. 39–41.

Magaldi, D. and Berler, M. (2020) ‘Semi-structured interviews’, in V. Zeigler-Hill and T.K. Shackelford (eds) Encyclopedia of Personality and Individual Differences. Cham: Springer International Publishing, pp. 4825–4830. Available at: https://doi.org/10.1007/978-3-319-24612-3_857.

Marschark, M. and Hauser, P.C. (2012) How deaf children learn: What parents and teachers need to know. Oxford University Press, USA.

Marschark, M. and Knoors, H. (2012) ‘Educating deaf children: language, cognition, and learning’, Deafness & Education International, 14(3), pp. 136–160. Available at: https://doi.org/10.1179/1557069X12Y.0000000010.

Marschark, M., Leigh, G., Sapere, P., Burnham, D., Convertino, C., Stinson, M., Knoors, H., Vervloed, M.P. and Noble, W. (2006) ‘Benefits of sign language interpreting and text alternatives for deaf students’ classroom learning’, Journal of Deaf Studies and Deaf Education, 11(4), pp. 421–437.

Marschark, M., Paivio, A., Spencer, L.J., Durkin, A., Borgna, G., Convertino, C. and Machmer, E. (2017) ‘Don’t Assume Deaf Students are Visual Learners’, Journal of Developmental and Physical Disabilities, 29(1), pp. 153–171. Available at: https://doi.org/10.1007/s10882-016-9494-0.

Marschark, M., Sapere, P., Convertino, C., Seewagen, R. and Maltzen, H. (2004) 'Comprehension of Sign Language Interpreting: Deciphering a Complex Task Situation', Sign Language Studies, 4(4), pp. 345–368.

Marschark, M., Sapere, P., Convertino, C.M., Mayer, C., Wauters, L. and Sarchet, T. (2009) 'Are deaf students' reading challenges really about reading?', American Annals of the Deaf, 154(4), pp. 357–370.

Marschark, M., Sarchet, T. and Trani, A. (2016) 'Effects of Hearing Status and Sign Language Use on Working Memory', The Journal of Deaf Studies and Deaf Education, 21(2), pp. 148–155. Available at: https://doi.org/10.1093/deafed/env070.

Marschark, M., Shaver, D.M., Nagle, K.M. and Newman, L.A. (2015) 'Predicting the academic achievement of deaf and hard-of-hearing students from individual, household, communication, and educational factors', Exceptional Children, 81(3), pp. 350–369. Available at: https://doi.org/10.1177/0014402914563700.

Marschark, M. and Spencer, P.E. (2009) Evidence of best practice models and outcomes in the education of deaf and hard-of-hearing children: An international review. Trim, Ireland: National Concil for Special Education.

Marschark, M., Tang, G. and Knoors, H. (2014) Bilingualism and bilingual deaf education. Oxford University Press.

May, S. (2019) 'Negotiating the multilingual turn in SLA', *The Modern Language Journal*, 103, pp. 122–129.

Mayberry, R.I. (2002) ‘Cognitive development in deaf children: The interface of language and perception in neuropsychology’, in Handbook of neuropsychology. 2nd ed. Amsterdam: Elsevier Science B.V., pp. 71–107.

Mayberry, R.I. (2007) ‘When timing is everything: Age of first-language acquisition effects on second-language learning’, Applied Psycholinguistics, 28(3), pp. 537–549. Available at: https://doi.org/10.1017/S0142716407070294.

Mayberry, R.I. and Kluender, R. (2018) ‘Rethinking the critical period for language: New insights into an old question from American Sign Language | Bilingualism: Language and Cognition | Cambridge Core’, Bilingualism: Language and Cognition, 21(5), pp. 886–905.

Mayer, C. and Trezek, B.J. (2018) ‘Literacy outcomes in deaf students with cochlear implants: Current state of the knowledge’, The Journal of Deaf Studies and Deaf Education, 23(1), pp. 1–16. Available at: https://doi.org/10.1093/deafed/enx043.

Mayer and Trezek (2023) ‘Communication, language, and modality in the education of deaf students’, Education Sciences, 13(10). Available at: https://pubscholar.cn/articles/ab3729a001d5867b6b400aecf9d052c95bd29e965e15e7f72c43079b8007f4bf149af77470edb0c837901ea823f2b498.

McAnally, P.L., Rose, S. and Quigley, S.P. (2007) Reading practices with deaf learners. PRO-ED, Incorporated.

McCreery, R.W. and Walker, E.A. (2022) ‘Variation in auditory experience affects language and executive function skills in children who are hard of hearing’,

Ear and Hearing, 43(2), p. 347. Available at: https://doi.org/10.1097/AUD.0000000000001098.

McKinley, J. (ed.) (2019) 'Introduction: Theorizing research methods in the "golden age" of applied linguistics research', in The Routledge Handbook of Research Methods in Applied Linguistics. Routledge.

McNamara, D.S. and Magliano, J. (2009) 'Toward a comprehensive model of comprehension', Psychology of Learning and Motivation, 51, pp. 297–384.

Meier, G. and Conteh, J. (2014) 'Conclusion: The multilingual turn in language education', in *The multilingual turn in languages education: Opportunities and challenges.* Bristol: Multilingual Matters, pp. 292–299.

Meier, G.S. (2017) 'The multilingual turn as a critical movement in education: Assumptions, challenges and a need for reflection', *Applied Linguistics Review*, 8(1), pp. 131–161. Available at: https://doi.org/10.1515/applirev-2016-2010.

Middleton, Turner, G.H., Bitner-Glindzicz, M., Lewis, P., Richards, M., Clarke, A. and Stephens, D. (2010) 'Preferences for communication in clinic from deaf people: A cross-sectional study', Journal of Evaluation in Clinical Practice, 16(4), pp. 811–817.

Miguel-Alonso, I., Rodriguez-Garcia, B., Checa, D. and Bustillo, A. (2023) 'Countering the novelty effect: A tutorial for immersive virtual reality learning environments', Applied Sciences, 13(1), p. 593. Available at: https://doi.org/10.3390/app13010593.

Miller, E.M., Lederberg, A.R. and Easterbrooks, S.R. (2013) 'Phonological awareness: Explicit instruction for young deaf and hard-of-hearing children', The Journal of Deaf Studies and Deaf Education, 18(2), pp. 206–227. Available at: https://doi.org/10.1093/deafed/ens067.

Miller, P. (2010) 'Phonological, orthographic, and syntactic awareness and their relation to reading comprehension in prelingually deaf individuals: What can we learn from skilled readers?', Journal of Developmental and Physical Disabilities, 22(6), pp. 549–580. Available at: https://doi.org/10.1007/s10882-010-9195-z.

Millett, P. (2021) 'Accuracy of speech-to-text captioning for students who are deaf or hard of hearing', Journal of Educational, Pediatric & (Re) Habilitative Audiology, 25, pp. 1–13. Available at: https://openurl.ebsco.com/contentitem/gcd:155359972?sid=ebsco:plink:crawler&id=ebsco:gcd:155359972.

Ministry of Education of the People's Republic of China (2007) 教育部关于印发《盲校义务教育课程设置实验方案》、《聋校义务教育课程设置实验方案》和《培智学校义务教育课程设置实验方案》的通知(Notice from the Ministry of Education on Issuing the 'Experimental Plan for Compulsory Education Curriculum for Schools for the Blind,' 'Experimental Plan for Compulsory Education Curriculum for Schools for the Deaf,' and 'Experimental Plan for Compulsory Education Curriculum for Schools for Children with Intellectual Disabilities'). Available at:

http://www.moe.gov.cn/srcsite/A06/s3331/200702/t20070202_128271.html (Accessed: 23 July 2024).

Ministry of Education of the People's Republic of China (2010) 国家中长期教育改革和发展规划纲要（2010-2020 年）(National Medium and Long-term Educational Reform and Development Outline (2010-2020)). Available at: http://www.moe.gov.cn/srcsite/A01/s7048/201007/t20100729_171904.html.

Ministry of Education of the People's Republic of China (2012) 教育部关于印发《教育信息化十年发展规划（2011-2020 年）》的通知 (Notice of the Ministry of Education on the issuance of the 'Ten-Year Development Plan for Educational Informatization (2011-2020)'). Available at: http://www.moe.gov.cn/srcsite/A16/s3342/201203/t20120313_133322.html.

Ministry of Education of the People's Republic of China (2015) 教育部关于印发《特殊教育教师专业标准（试行）》的通知"Notice of the Ministry of Education on Printing and Distributing the 'Professional Standards for Special Education Teachers (Trial)'". Available at: http://www.moe.gov.cn/srcsite/A10/s6991/201509/t20150901_204894.html.

Ministry of Education of the People's Republic of China (2017) 教育部等七部门关于印发《第二期特殊教育提升计划（2017-2020 年）》的通知 (Notice on Issuing the Second Phase of the Special Education Improvement Plan (2017-2020) by the Ministry of Education and Six Other Departments). Available at: http://www.moe.gov.cn/srcsite/A06/s3331/201707/t20170720_309687.html.

Ministry of Education of the People's Republic of China (2022a) Basic Statistics of Special Education (2021). Available at: http://www.moe.gov.cn/jyb_sjzl/moe_560/2021/quanguo/202301/t20230103_1037868.html.

Ministry of Education of the People's Republic of China (2022b) Basic Statistics of Special Education Schools (2021). Available at: http://www.moe.gov.cn/jyb_sjzl/moe_560/2021/quanguo/202301/t20230103_1037867.html.

Ministry of Education of the People's Republic of China (2016b) 教育部关于印发《教育信息化"十三五"规划》的通知 (Notice of the Ministry of Education on the issuance of the 'Thirteenth Five-Year Plan for Educational Informatization'). Available at: http://www.moe.gov.cn/srcsite/A16/s3342/201606/t20160622_269367.html.

Ministry of Education of the People's Republic of China (2016a) 教育部关于发布实施《盲校义务教育课程标准（2016 年版）》《聋校义务教育课程标准（2016 年版）》《培智学校义务教育课程标准（2016 年版）》的通知 (The Ministry of Education's Notice on the Implementation of the 'Compulsory Education Curriculum Standards for Schools for the Blind (2016 Edition),' 'Compulsory Education Curriculum Standards for Schools for the Deaf (2016 Edition),' and 'Compulsory Education Curriculum Standards for Schools for Children with Intellectual Disabilities (2016 Edition)'. Available at:

http://www.moe.gov.cn/srcsite/A06/s3331/201612/t20161213_291722.html (Accessed: 23 July 2024).

Mintz, J., Hick, P., Solomon, Y., Matziari, A., Ó'Murchú, F., Hall, K., Cahill, K., Curtin, C., Anders, J. and Margariti, D. (2020) 'The reality of reality shock for inclusion: How does teacher attitude, perceived knowledge and self-efficacy in relation to effective inclusion in the classroom change from the pre-service to novice teacher year?', Teaching and Teacher Education, 91, p. 103042. Available at: https://doi.org/10.1016/j.tate.2020.103042.

Mitchell and Karchmer, M.A. (2006) 'Demographics of Deaf Education', American Annals of the Deaf (Washington, D.C. 1886), 151(2), pp. 95–104.

Mitchell, R.E. (2022) 'Persistent dilemmas for demographic studies of deaf and hard of hearing populations', Working Paper No. DRC2201. Gallaudet University, Demographics Research Center. Available at: https://doi.org/10.13140/RG.2.2.26413.15842.

Mitchell, R.E. (2017) 'Demographics for deaf education', in Research in deaf education: Contexts, challenges, and considerations. Oxford University Press, pp. 93–202.

Mitchell, R.E. and Karchmer, M. (2004) 'Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the united states', Sign Language Studies, 4(2), pp. 138–163.

Montaño, D. and Kasprzyk, D. (2008) 'Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model', in Health behavior

and health education: Theory, research and practice. 4th ed. San Francisco: Jossey-Bass, pp. 67–96.

Montaño, D.E., Kasprzyk, D., and others (2015) 'Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model', Health Behavior: Theory, Research and Practice, 70(4), p. 231.

Morgan, G. (2015) 'Social-cognition for learning as a deaf student', in Educating deaf learners: Creating a global evidence base. Oxford University Press New York, NY, pp. 261–282.

Morris, T.H. (2019) 'Self-directed learning: A fundamental competence in a rapidly changing world', International Review of Education, 65(4), pp. 633–653. Available at: https://doi.org/10.1007/s11159-019-09793-2.

Muljono, M., Saraswati, G.W., Winarsih, N.A.S., Rokhman, N., Supriyanto, C. and Pujiono, P. (2019) 'Developing BacaBicara: An Indonesian lipreading system as an independent communication learning for the deaf and hard-of-hearing', International Journal of Emerging Technologies in Learning (Online), 14(4), pp. 44–57. Available at: https://doi.org/10.3991/ijet.v14i04.9578.

Nation, I.S.P. (2008) Teaching ESL/EFL reading and writing. New York: Routledge. Available at: https://doi.org/10.4324/9780203891643.

National Academies of Sciences, Engineering, and Medicine, Health and Medicine Division, Board on Health Sciences Policy and Committee on Accessible and Affordable Hearing Health Care for Adults (2016) Hearing health care for

adults: Priorities for improving access and affordability. National Academies Press.

National Institute on Deafness and Other Communication Disorders (NIDCD) (2024) Quick Statistics About Hearing, Balance, & Dizziness | NIDCD. Available at: https://www.nidcd.nih.gov/health/statistics/quick-statistics-hearing (Accessed: 13 July 2024).

Netten, A., Droop, M. and Verhoeven, L. (2011) 'Predictors of reading literacy for first and second language learners', Reading and Writing, 24(4), pp. 413–425. Available at: https://doi.org/10.1007/s11145-010-9234-2.

NICE (2019) Cochlear implants for children and adults with severe to profound deafness. Available at: https://www.nice.org.uk/guidance/ta566/chapter/1-Recommendations.

Niparko, J.K., Tobey, E.A., Thal, D.J., Eisenberg, L.S., Wang, N.-Y., Quittner, N.L., Fink, N.E. and Team, C.D.I. (2010) 'Spoken language development in children following cochlear implantation', JAMA, 303, pp. 1498–1506.

Nordlund, M. and Norberg, C. (2020) 'Vocabulary in EFL teaching materials for young learners', International Journal of Language Studies, 14(1), pp. 89–116.

North, K., Zampieri, M. and Shardlow, M. (2023) 'Lexical complexity prediction: An overview', ACM Computing Surveys, 55(9), p. 179:1-179:42. Available at: https://doi.org/10.1145/3557885.

Ntinda, K., Thwala, S.K. and Tfusi, B. (2019) ‘Experiences of teachers of deaf and hard-of-hearing students’ in a special needs school: An exploratory study’, Journal of Education and Training Studies, 7(7), pp. 79–89.

Oliveira, L.N. de, Soares, A.D. and Chiari, B.M. (2014) ‘Speechreading as a communication mediator’, CoDAS, 26, pp. 53–60. Available at: https://doi.org/10.1590/S2317-17822014000100008.

Oliveira, T., Escudeiro, N., Escudeiro, P., Rocha, E. and Barbosa, F.M. (2019) ‘The VirtualSign channel for the communication between deaf and hearing users’, IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 14(4), pp. 188–195. Available at: https://doi.org/10.1109/RITA.2019.2952270.

Onuigbo, L., Osadebe, N.E. and Achebe, N.E. (2020) ‘Classroom environment required for meeting the information needs of students with hearing impairment in Nigerian universities’, International Journal of Inclusive Education, 24(3), pp. 266–287. Available at: https://doi.org/10.1080/13603116.2018.1459887.

Ormel, E. and Giezen, M. (2014) ‘Bimodal bilingual cross-language interaction’, in Bilingualism and bilingual deaf education. Oxford University Press Oxford, UK, pp. 74–101.

Padden, C. and Ramsey, C. (2000) ‘American Sign Language and reading ability in deaf children’, Language Acquisition by Eye, 1, pp. 65–89.

Pallant, J. (2020) SPSS survival manual: A step by step guide to data analysis using IBM SPSS. Routledge. Available at: https://doi.org/10.4324/9781003117452.

Paltridge, B. (2019) ‘Multi-perspective research’, in The Routledge Handbook of Research Methods in Applied Linguistics. Routledge.

Park, C.C. (2001) ‘Learning style preferences of Armenian, African, Hispanic, Hmong, Korean, Mexican, and Anglo students in American secondary schools’, Learning Environments Research, 4, pp. 175–191.

Peng and Fu, R. (2021) ‘The effect of Chinese EFL students’ learning motivation on learning outcomes within a blended learning environment’, Australasian Journal of Educational Technology, 37(6), pp. 61–74.

Perfetti, C. and Stafura, J. (2014) ‘Word knowledge in a theory of reading comprehension’, Scientific Studies of Reading, 18(1), pp. 22–37. Available at: https://doi.org/10.1080/10888438.2013.827687.

Perfetti, C.A. and Hart, L. (2002) ‘The Lexical Quality Hypothesis’, Precursors of functional literacy, 11, pp. 67–86.

Pham, C.Q., Bremen, P., Shen, W., Yang, S.-M., Middlebrooks, J.C., Zeng, F.-G. and Laughlin, M.M. (2015) ‘Central auditory processing of temporal and spectral-variance cues in cochlear implant listeners’, PLOS ONE, 10(7), p. e0132423. Available at: https://doi.org/10.1371/journal.pone.0132423.

Piao, Y.X. (2009) ‘新中国特殊教育的十大变化 (The ten major changes in special education in China)’, 教育学术月刊, 6, p. 19.

Piao, Y.X. (2014) 特殊教育学（Special Education). Fuzhou: 福州教育出版社.

Pimperton, H., Kreppner, J., Mahon, M., Stevenson, J., Terlektsi, E., Worsfold, S., Yuen, H.M. and Kennedy, C.R. (2017) ‘Language outcomes in deaf or hard of

hearing teenagers who are spoken language users: Effects of universal newborn hearing screening and early confirmation', Ear and Hearing, 38(5), p. 598. Available at: https://doi.org/10.1097/AUD.0000000000000434.

Pozas, M., Letzel, V. and Schneider, C. (2020) 'Teachers and differentiated instruction: Exploring differentiation practices to address student diversity', Journal of Research in Special Educational Needs, 20(3), pp. 217–230. Available at: https://doi.org/10.1111/1471-3802.12481.

Punch, R. (2016) 'Employment and adults who are deaf or hard of hearing: Current status and experiences of barriers, accommodations, and stress in the workplace', American Annals of the Deaf, 161(3), pp. 384–397.

Qi, H. and Li, Y. (2020) '河南省特殊教育师资队伍现状与参训需求的调查研究 (A study on the current situation of special education teachers and their training needs in Henan Province)', Journal of Modern Special Education (Research in Higher Education), (8), pp. 21–24.

Rayner, K. and Reichle, E.D. (2010) 'Models of the reading process', WIREs Cognitive Science, 1(6), pp. 787–799. Available at: https://doi.org/10.1002/wcs.68.

Reed, S., Antia, S.D. and Kreimeyer, K.H. (2008) 'Academic status of deaf and hard-of-hearing students in public schools: Student, home, and service facilitators and detractors', Journal of Deaf Studies and Deaf Education, 13(4), pp. 485–502.

Rendel, K., Bargones, J., Blake, B., Luetke, B. and Stryker, D.S. (2018) 'Signing exact English: A simultaneously spoken and signed communication option in deaf education', Journal of Early Hearing Detection and Intervention, 3(2), pp. 18–29.

Rinaldi, P. and Caselli, M.C. (2014) 'Language development in a bimodal bilingual child with cochlear implant: A longitudinal study', Bilingualism: Language and Cognition, 17(4), pp. 798–809. Available at: https://doi.org/10.1017/S1366728913000849.

Rodrigues, L., Pereira, F.D., Toda, A.M., Palomino, P.T., Pessoa, M., Carvalho, L.S.G., Fernandes, D., Oliveira, E.H.T., Cristea, A.I. and Isotani, S. (2022b) 'Gamification suffers from the novelty effect but benefits from the familiarization effect: Findings from a longitudinal study', International Journal of Educational Technology in Higher Education, 19(1), p. 13. Available at: https://doi.org/10.1186/s41239-021-00314-6.

Rodrigues, Rato, Mineiro and Holmström (2022a) 'Unveiling teachers' beliefs on visual cognition and learning styles of deaf and hard of hearing students: A Portuguese-Swedish study', PLOS ONE, 17(2), p. e0263216.

Rydberg, E., Gellerstedt, L.C. and Danermark, B. (2009) 'Toward an equal level of educational attainment between deaf and hearing people in Sweden?', The Journal of Deaf Studies and Deaf Education, 14(3), pp. 312–323. Available at: https://doi.org/10.1093/deafed/enp001.

Rydell, M. (2018) Constructions of language competence: Sociolinguistic perspectives on assessing second language interactions in basic adult education. PhD Thesis. Department of Swedish and Multilingualism, Stockholm University.

Sadaf, A. and Gezer, T. (2020) 'Exploring factors that influence teachers' intentions to integrate digital literacy using the decomposed theory of planned behavior', Journal of Digital Learning in Teacher Education, 36(2), pp. 124–145. Available at: https://doi.org/10.1080/21532974.2020.1719244.

Salkić, N., Hasanbegović, H. and Švraka, E. (2018) 'Content analysis of the written communication form of deaf children', Journal Human Research in Rehabilitation, 8(2), pp. 55–64. Available at: https://doi.org/10.21554/hrr.0918106.

Sandler, W. and Lillo-Martin, D. (2003) 'Natural Sign Languages', in The Handbook of Linguistics. John Wiley & Sons, Ltd, pp. 533–562. Available at: https://doi.org/10.1002/9780470756409.ch22.

Sarant, J.Z., Holt, C.M., Dowell, R.C., Ricards, F.W. and Blamey, P.J. (2009) 'Spoken language development in oral preschool children with permanent childhood deafness', Journal of Deaf Studies and Deaf Education, 14(2), pp. 205–217.

Scarinci, N., Gehrke, M., Ching, T.Y., Marnane, V. and Button, L. (2018) 'Factors influencing caregiver decision making to change the communication method

of their child with hearing loss', Deafness & Education International, 20(3–4), pp. 123–153. Available at: https://doi.org/10.1080/14643154.2018.1511239.

Schmidt, R. (2001) 'Attention', in P. Robinson (ed.) Cognition and Second Language Instruction. Cambridge: Cambridge University Press (Cambridge Applied Linguistics), pp. 3–32. Available at: https://doi.org/10.1017/CBO9781139524780.003.

Schmitt, L., Weber, A., Venitz, L. and Leuchter, M. (2023) 'Preschool teachers' pedagogical content knowledge predicts willingness to scaffold early science learning', British Journal of Educational Psychology, 93(4), pp. 1034–1052. Available at: https://doi.org/10.1111/bjep.12618.

Schorr, E.A., Roth, F.P. and Fox, N.A. (2008) 'A comparison of speech and language skills of children with cochlear implants and children with normal hearing', Communication Disorders Quarterly, 29, pp. 195–210.

Scott, J. and Cohen, S. (2023) 'Multilingual, multimodal, and multidisciplinary: Deaf students and translanguaging in content area classes', Languages, 8(1), p. 55. Available at: https://doi.org/10.3390/languages8010055.

Scott, J.A. and Dostal, H.M. (2019) 'Language development and deaf/hard of hearing children', Education Sciences, 9(2), p. 135. Available at: https://doi.org/10.3390/educsci9020135.

Sedláčková, J. (2021) 'Individual differences in deaf learners' second language acquisition', in English as a Foreign Language for Deaf and Hard of Hearing Learners. Routledge.

Sedláčková, M.J. (2016) Reading in English as a foreign language in deaf university students. PhD thesis. Masaryk University.

Shanghai Municipal Education Commission (2007) 关于印发上海市聋人高级中学相关课程标准的通知 (Notice on Issuing the Curriculum Standards for Shanghai High School for the Deaf). Available at: https://edu.sh.gov.cn/shgy_tsjy_gz_1/20211222/v2-0015-gw_402142009001.html (Accessed: 23 July 2024).

Sharma, U. and Jacobs, D.K. (2016) 'Predicting in-service educators' intentions to teach in inclusive classrooms in India and Australia', Teaching and Teacher Education, 55, pp. 13–23. Available at: https://doi.org/10.1016/j.tate.2015.12.004.

Sheikh, M., Noreen, H., Khalid, H., Irshad, A., Sultana, R. and Ain, Q. ul (2023) 'Factors influencing spoken language outcomes in children following early use of hearing aids', Journal of Health and Rehabilitation Research, 3(1). Available at: https://jhrlmc.com/index.php/home/article/view/37 (Accessed: 21 March 2024).

Silvestri, J.A. and Hartman, M.C. (2022) 'Inclusion and deaf and hard of hearing students: Finding asylum in the lRE', Education Sciences, 12(11), p. 773. Available at: https://doi.org/10.3390/educsci12110773.

Skelton, T. and Valentine, G. (2003) '"It feels like being Deaf is normal": An exploration into the complexities of defining D/deafness and young D/deaf people's identities.', The Canadian Geographer, 47(4).

Skutnabb-kangas, T. (2012) ‘Mother-Tongue-Medium Education’, in C.A. Chapelle (ed.) The Encyclopedia of Applied Linguistics. 1st edn. Wiley. Available at: https://doi.org/10.1002/9781405198431.wbeal0776.

Skutnabb-Kangas, T. (2017) ‘Language rights and bilingual education’, Bilingual and Multilingual Education, pp. 51–63.

Smith, A. and Wang, Y. (2010) ‘The impact of visual phonics on the phonological awareness and speech production of a student who is deaf: A case study’, American Annals of the Deaf, 155(2), pp. 124–130.

Smoski, W., Brunt, M.A. and Tannahill, J.C. (1998) ‘Children’s auditory performance scale (CHAPS)’, Tampa, FL: Educational Audiology Association, pp. 1–10.

Snoddon, K. and Weber, J.C. (2021) Critical perspectives on plurilingualism in deaf education. Multilingual Matters.

Song, B. (2019) ‘Exploring the cultural content in Chinese ELT textbooks from intercultural perspectives’, Journal of Asia TEFL, 16(1), pp. 267–278. Available at: https://doi.org/10.18823/asiatefl.2019.16.1.17.267.

Spencer, L.J. and Tomblin, J.B. (2009) ‘Evaluating phonological processing skills in children with prelingual deafness who use cochlear implants’, The Journal of Deaf Studies and Deaf Education, 14(1), pp. 1–21. Available at: https://doi.org/10.1093/deafed/enn013.

Spencer, P. and Marschark, M. (2010) Evidence-based practice in educating deaf and hard-of-hearing students. New York, NY: Oxford University Press.

Sun, R.B. (2014) ‘泛在学习背景下聋校信息化架构——以南京市聋人学校为例 (Information architecture in deaf schools within the context of ubiquitous learning: A case study of Nanjing Deaf School)’, Modern Special Education, (03), pp. 15–18.

Svartholm, K. (1994) ‘Second language learning in the deaf’, in Bilingualism in deaf education. Hamburg, Germany: Signum, pp. 61–70.

Svensson, A. (2017) ‘The challenge of teaching English in a heterogeneous classroom’, Educare, 17(2), pp. 56–80.

Swanson, H.L. and Berninger, V. (1995) ‘The role of working memory in skilled and less skilled readers’ comprehension’, Intelligence, 21(1), pp. 83–108. Available at: https://doi.org/10.1016/0160-2896(95)90040-3.

Swanwick, R. (2016) Languages and languaging in deaf education: A framework for pedagogy. Oxford University Press.

Swanwick, R., Elmore, J. and Salter, J. (2021) ‘Educational inclusion of children who are deaf or hard of hearing and from migrant Roma families: Implications for multi-professional working’, Deafness & Education International, 23(1), pp. 25–42. Available at: https://doi.org/10.1080/14643154.2019.1685756.

Swanwick, R., Wright, S. and Salter, J. (2016) ‘Investigating deaf children’s plural and diverse use of sign and spoken languages in a super diverse context’, Applied Linguistics Review, 7(2), pp. 117–147. Available at: https://doi.org/10.1515/applirev-2016-0009.

Sweller, J. (2020) ‘Cognitive load theory and educational technology’, Educational Technology Research and Development, 68(1), pp. 1–16. Available at: https://doi.org/10.1007/s11423-019-09701-3.

Szudarski, P. and Carter, R. (2014) ‘The role of input flood and input enhancement in EFL learners’ acquisition of collocations’, International Journal of Applied Linguistics, 26(2). Available at: https://doi.org/10.1111/ijal.12092.

Taljaard, D. s., Olaithe, M., Brennan-Jones, C. g., Eikelboom, R. h. and Bucks, R. s. (2016) ‘The relationship between hearing impairment and cognitive function: A meta-analysis in adults’, Clinical Otolaryngology, 41(6), pp. 718–729. Available at: https://doi.org/10.1111/coa.12607.

Tang, P., Yuen, I., Xu Rattanasone, N., Gao, L. and Demuth, K. (2021) ‘Longer cochlear implant experience leads to better production of mandarin tones for early implanted children’, Ear and Hearing, 42(5), p. 1405. Available at: https://doi.org/10.1097/AUD.0000000000001036.

Teo, T., Zhou, M. and Noyes, J. (2016) ‘Teachers and technology: Development of an extended theory of planned behavior’, Educational Technology Research and Development, 64(6), pp. 1033–1052. Available at: https://doi.org/10.1007/s11423-016-9446-5.

Tharpe, A.M., Ashmead, D.H. and Rothpletz, A.M. (2002) ‘Visual attention in children with normal hearing, children with hearing aids, and children with cochlear implants’, Journal of Speech, Language, and Hearing Research, 45(2), pp. 403–413. Available at: https://doi.org/10.1044/1092-4388(2002/032).

The Douglas Fir Group (2016) ‘A transdisciplinary framework for SLA in a multilingual world’, *The Modern Language Journal*, 100(S1), pp. 19–47. Available at: https://doi.org/10.1111/modl.12301.

The State Council of the People’s Republic of China (2017) 残疾人教育条例 (Regulations of the People’s Republic of China on the Education of Persons with Disabilities). Available at: http://www.moe.gov.cn/jyb_sjzl/sjzl_zcfg/zcfg_jyxzfg/202109/t20210922_565679.html.

Tiggs, S.C. (2021) Perceptions of professional development: A descriptive study investigating learning opportunities for teachers of students who are deaf or hard of hearing. Ed.D thesis. Regent University. Available at: https://www.proquest.com/docview/2568607744/abstract/C258A018F1A342F6PQ/1 (Accessed: 15 June 2024).

Trezek, B.J., Wang, Y. and Paul, P.V. (2010) Reading and deafness: Theory, research, and practice. Clifton Park, NY: Cengage Learning.

Ulker-Demirel, E. and Ciftci, G. (2020) ‘A systematic literature review of the theory of planned behavior in tourism, leisure and hospitality management research’, Journal of Hospitality and Tourism Management, 43, pp. 209–219. Available at: https://doi.org/10.1016/j.jhtm.2020.04.003.

Välimaa, T., Kunnari, S., Laukkanen-Nevala, P., Lonka, E. and Team, the N.C.R. (2018) ‘Early vocabulary development in children with bilateral cochlear

implants', International Journal of Language & Communication Disorders, 53(1), pp. 3–15. Available at: https://doi.org/10.1111/1460-6984.12322.

Verhoeven, L., Reitsma, P. and Siegel, L.S. (2011) 'Cognitive and linguistic factors in reading acquisition', Reading and Writing, 24(4), pp. 387–394. Available at: https://doi.org/10.1007/s11145-010-9232-4.

Vu, D.V. and Peters, E. (2022) 'Learning vocabulary from reading-only, reading-while-listening, and reading with textual input enhancement: Insights from Vietnamese EFL learners', RELC Journal, 53(1), pp. 85–100. Available at: https://doi.org/10.1177/0033688220911485.

Wang (2014) '中国聋人学生英语教学研究述评 (A review of research into English teaching for deaf students in China)', Chinese Journal of Special Education (Monthly), (3), pp. 17–23.

Wang (2022) '聋校英语教学现状调查研究 (An investigation of English teaching in the deaf schools)', Modern Special Education (Research in Higher Education), (10), pp. 16–22.

Wang, F. (2018) '如何在聋校语文课堂中合理使用自然手语和文法手语 (How to rationalize the use of natural sign language and signed language in the language classroom in deaf schools)', Modern Special Education, (5), pp. 21–24.

Wang, Q., Andrews, J., Liu, H.T. and Liu, C.J. (2016) 'Case studies of multilingual/multicultural Asian deaf adults: Strategies for success', American Annals of the Deaf, 161(1), pp. 67–88.

Wang, Q. and Andrews, J.F. (2017) ‘Literacy instruction in primary level deaf education in China’, Deafness & Education International, 19(2), pp. 63–74. Available at: https://doi.org/10.1080/14643154.2017.1344464.

White, K.R. (2018) ‘Demographic considerations in serving children who are hard of hearing or deaf’, Journal of Early Hearing Detection and Intervention, 3(2), pp. 14–17.

World Federation of the Deaf (2016) Position paper on the language rights of deaf children, WFD. Available at: https://wfdeaf.org/news/resources/wfd-position-paper-on-the-language-rights-of-deaf-children-7-september-2016/ (Accessed: 8 August 2024).

World Health Organization (2021) World report on hearing. World Health Organization.

World Health Organization (2024) Deafness and hearing loss. Available at: https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss (Accessed: 21 February 2024).

Wu, D., Woodson, E.W., Masur, J. and Bent, J. (2015) ‘Pediatric cochlear implantation: Role of language, income, and ethnicity’, International Journal of Pediatric Otorhinolaryngology, 79(5), pp. 721–724. Available at: https://doi.org/10.1016/j.ijporl.2015.02.030.

Xu, B. (2018) ‘Using new media in teaching English reading and writing for hearing impaired students—Taking Leshan Special Education School as an example’,

Theory and Practice in Language Studies, 8(6), p. 588. Available at: https://doi.org/10.17507/tpls.0806.05.

Xu, Cai and Qin (2021) ‘聋人大学生英语词汇与语法学习的问题与对策研究 (Problems and countermeasures of college deaf students’ English vocabulary and grammar learning)’, Modern Special Education(Research in Higher Education, (24), pp. 48–52.

Xu W. and Case R.E. (2015) ‘Age-related differences in motivation in learning English among Mainland Chinese students’, International Journal of Applied Linguistics, 25(1), pp. 67–82. Available at: https://doi.org/10.1111/ijal.12050.

Yan, G., Lan, Z., Meng, Z., Wang, Y. and Benson, V. (2021) ‘Phonological coding during sentence reading in Chinese deaf readers: An eye-tracking study’, Scientific Studies of Reading, 25(4), pp. 287–303. Available at: https://doi.org/10.1080/10888438.2020.1778000.

Yan, Y. (2012) ‘文法手语在聋校课堂教学中的信息传播局限性解析 (An analysis of the limitations of signed language’s Information dissemination in deaf school classrooms)’, Chinese Journal of Special Education (Monthly), 143(5), pp. 24–28.

Yanbay, E., Hickson, L., Scarinci, N., Constantinescu, G. and Dettman, S.J. (2014) ‘Language outcomes for children with cochlear implants enrolled in different communication programs’, Cochlear Implants International, 15(3), pp. 121–135. Available at: https://doi.org/10.1179/1754762813Y.0000000062.

Yang, J. (2015) ‘Chinese sign language’, in Sign languages of the world: A comparative handbook. De Gruyter Mouton, pp. 177–194. Available at: https://doi.org/10.1515/9781614518174-012.

Yang, L. and Coxhead, A. (2022) ‘A corpus-based study of vocabulary in the New Concept English Textbook series’, RELC Journal, 53(3), pp. 597–611. Available at: https://doi.org/10.1177/0033688220964162.

Yang, Y., Liu, Y.-H., Fu, M.-F., Li, C.-L., Wang, L.-Y., Wang, Q. and Sun, X.-B. (2015) ‘Home-based early intervention on auditory and speech development in mandarin-speaking deaf infants and toddlers with chronological aged 7–24 months’, Chinese Medical Journal, 128(16), pp. 2202–2207. Available at: https://doi.org/10.4103/0366-6999.162504.

Yao, X.X. (2016) ‘家长如何在聋儿康复过程中发挥应有的作用 (The role of parents in aural rehabilitation of hearing impaired children)’, Chinese Scientific Journal of Hearing and Speech Rehabilitation, 5(4), pp. 38–40.

Ye, X. (2021) ‘EFL learning motivation differences of Chinese junior secondary school students: A mixed-methods study’, Education 3-13, 49(2), pp. 203–216. Available at: https://doi.org/10.1080/03004279.2019.1711143.

You, C. (Julia) and Dörnyei, Z. (2016) ‘Language learning motivation in China: Results of a large-scale stratified survey’, Applied Linguistics, 37(4), pp. 495–519. Available at: https://doi.org/10.1093/applin/amu046.

Young, A. and Temple, B. (2014) Approaches to social research: The case of deaf studies. Oxford University Press.

Young, D.C. (2024) English language teacher preparedness to teach students with disabilities: The case of postsecondary Japan. PhD Thesis. Waseda University.

Yuriev, A., Dahmen, M., Paillé, P., Boiral, O. and Guillaumie, L. (2020) 'Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review', Resources, Conservation and Recycling, 155, p. 104660. Available at: https://doi.org/10.1016/j.resconrec.2019.104660.

Zhang, L., Hong, T., Li, Y., Wang, J., Zhang, Y. and Shu, H. (2021) 'Differences and similarities in the contributions of phonological awareness, orthographic knowledge and semantic competence to reading fluency in Chinese school-age children with and without hearing loss', Frontiers in Psychology, 12. Available at: https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2021.649375 (Accessed: 16 February 2024).

Zhang, S. (2009) '中国聋人英语学习影响因素调查及对教学的启示 (A study on the effects of hearing impairment on English learning of the deaf in China and the implication for teaching)', Chinese Journal of Special Education, 105(3), pp. 33–37.

Zhang, S. (2013) 中国聋校英语教育：教学体系的构建 (EFL in Chinese deaf schools: The construction of the curriculum system). PhD thesis. Shanghai International Studies University.

Zhao, W., Mok, I.A.C. and Cao, Y. (2020) 'Factors influencing teachers' implementation of a reformed instructional model in China from the theory of

planned behavior perspective: A multiple case study', Sustainability, 12(1), p. 1. Available at: https://doi.org/10.3390/su12010001.

Zhao, Y., Sun, P., Xie, R., Chen, H., Feng, J. and Wu, X. (2019) 'The relative contributions of phonological awareness and vocabulary knowledge to deaf and hearing children's reading fluency in Chinese', Research in Developmental Disabilities, 92, p. 103444. Available at: https://doi.org/10.1016/j.ridd.2019.103444.

Zhao, Y., Wu, X., Sun, P. and Chen, H. (2021) 'Relationship between vocabulary knowledge and reading comprehension in deaf and hard of hearing students', The Journal of Deaf Studies and Deaf Education, 26(4), pp. 546–555. Available at: https://doi.org/10.1093/deafed/enab023.

Zhu, L. and Sun, Y. (2011) '北京市特殊教育师资培训现状调查(An investigation into the current teacher training for special education in Beijing)', Chinese Journal of Special Education (Monthly), 134(8), pp. 20–24.

Appendix I Informed Consent Form of Students' Demographic Questionnaires

Description of the Study: You are invited to take part in a survey about your experience of learning English in China. Being the first study of the program, you will be invited to answer the questions about yourselves and about your English learning experience.

By choosing "Yes", you agree that you voluntarily join this survey and you authorize the use of your data for my PhD research.

¨ Yes	¨ No	I confirm that the purpose of the study has been explained and that I have understood it
¨ Yes	¨ No	I have had the opportunity to ask questions, and they have been successfully answered
¨ Yes	¨ No	I understand that my participation in this study is voluntary and that I am free to withdraw from the study at any time, without giving a reason and without consequence
¨ Yes	¨ No	I understand that all data are anonymous and that there will not be any connection between the personal information provided and the data
¨ Yes	¨ No	I understand that all data are anonymous and that there will not be any connection between the personal information provided.
¨ Yes	¨ No	I understand that there are no known risks or hazards associated with participating in this study
¨ Yes	¨ No	I confirm that I have read and understood the above information and that I agree to participate in this study.

Researcher's Signature: _____ Date: _____

Printed Signature: _____

Participant's Signature: _____ Date: _____

Printed Signature: _____

Appendix II Pilot Demographic Questionnaire

Part 1 Demographic information

1.1 What is your age group?

7-9	
10-12	
13-15	
16-18	

1.2 What is your gender?

Male	
Female	
Prefer not to say	

1.3 What grade are you in?

Grade 7 (First year of junior high school)	
Grade 8 (Second year of junior high school)	
Grade 9 (Last year of junior high school)	
Grade 10 (First year of senior high school)	
Grade 11 (Second year of senior high school)	
Grade 12 (Last year of senior high school)	

1.4 How would you prefer to identify yourself?

I am Deaf.	
I am hard of hearing.	
I am hearing impaired.	

1.5a Did you have severe hearing loss Before or 3 years old.

Yes		No	

1.5b Did your hearing loss start before or after you acquired a language?

Before I have acquired a language.	
After I have acquired a language. (I can speak when I had my hearing loss.)	
After I have acquired a language. (I can read and write when I had my hearing loss.)	

1.6a. What is the level of hearing loss that your **left ear** has?

Normal hearing	
Mild hearing loss (26 to 40 dB HL)	
Moderate hearing loss (41 to 55 dB HL)	
Moderate severe hearing loss (56 to 70 dB HL)	

Severe hearing loss (71 to 90 dB HL)	
Profound hearing loss (91+ dB HL)	
I don't know	

1.6b. What is the level of hearing loss that your **right ear** has?

Normal hearing	
Mild hearing loss (26 to 40 dB HL)	
Moderate hearing loss (41 to 55 dB HL)	
Moderate severe hearing loss (56 to 70 dB HL)	
Severe hearing loss (71 to 90 dB HL)	
Profound hearing loss (91+ dB HL)	
I don't know	

1.7a Do you have any technical hearing support?

I don't have any technical hearing support.		
I wear hearing aids.		From the age of

1.7b How do you wear your technical hearing support?

I wear my hearing aid only in my left ear.	
I wear my hearing aid only in my right ear.	
I wear my hearing aids in both of my ears.	
I wear my cochlear implant only in my left ear.	
I wear my cochlear implant only in my right ear.	
I wear my cochlear implant only in both of my ears.	
I wear my hearing aid in my left ear, while my cochlear implant in my right ear.	
I wear my hearing aid in my right ear, while my cochlear implant in my left ear.	
I don't wear any technical hearing support.	

1.7c Please estimate the number of hours per day for you wearing your technical hearing device:

1.8a If listening in a room where there is background noise such as TV, music, others talking, children playing, etc., do you have difficulty in hearing and understanding when you wear your technical hearing device?

Strongly disagree	1
Disagree)	2
Neither disagree nor agree	3
Agree	4

Strongly agree	5

	1	2	3	4	5
I have difficulty hearing and understanding a face to face communication when I pay attention to it.					
I have difficulty hearing and understanding when being asked a question.					
I have difficulty understanding simple instructions.					
I have difficulty understanding complex instructions.					
I have difficulty hearing and understanding when I am doing other activities, such as reading.					
I have difficulty hearing and understanding a group communication.					

1.8b If listening in a quiet room (for example, in a classroom during class time)., do you have difficulty in hearing and understanding when you wear your technical hearing device?

Strongly disagree	1
Disagree	2
Neither disagree nor agree	3
Agree	4
Strongly agree	5

	1	2	3	4	5
I have difficulty hearing and understanding a face to face communication when I pay attention to it.					
I have difficulty hearing and understanding when being asked a question.					
I have difficulty understanding simple instructions.					
I have difficulty understanding complex instructions.					
I have difficulty hearing and understanding when I am doing other activities, such as reading.					
I have difficulty hearing and understanding a group communication.					

1.9a Do you have hearing parents or deaf parents?

My parent(s) are deaf people.	
My parent(s) are hearing people.	
One parent is deaf people, and the other one is hearing people.	

1.9b Does your family have a history of hearing loss? If yes, please put your relationship with the family member into the box.

Yes. My ___ is/are deaf.	
No.	
I don’t know.	

Part 2 Communication preferences

2.1a Do you talk to your parents and seek for help when you have difficulties in learning and everyday activities?

Never	Randomly	Always

2.1b Do you talk to your teachers and seek for help when you have difficulties in learning and everyday activities

Never	Randomly	Always

2.1c Do you talk to your friends/classmates and seek for help when you have difficulties in learning and everyday activities?

Never	Randomly	Always

2.1d Please rank from 1-3, with 1 being most often. How often would you communicate with this group of people and try to seek for help from them when you have difficulties in every day activties?

	1	2	3
My parents			
My teachers			
My friends			

2.1e Please rank from 1-3, with 1 being most often. How often would you communicate with this group of people and try to seek for help from them when you have difficulties in English learning?

	1	2	3
My parents			
My teachers			
My friends			

2.2a How do you communicate with the person who ranks the first in the last question? Please tick any that apply

Sign language		Finger spelling	
Spoken language		Writing	
Body language/gestures		Typing on the mobile phone	
Speech reading/lip reading		Other	

2.2b. How would you evaluate the communication quality when you communicate with this person by using your most preferred way?

Strongly disagree	1
Disagree	2
Neither disagree nor agree	3
Agree	4
Strongly agree	5

	1	2	3	4	5
I am satisfied with the overall communication with my parents.					

I feel safe having discussions about my learning difficulties.					
He/She/They will listen to what I have to express during the conversation.					
He/She/They know exactly what I want or how I feel when I express my difficulties to them.					
He/She/They will answer my questions and give suggestions to me.					

Part 3 Experience of Learning English

3.1a Have you learned English before your hearing loss?

Yes		No	

3.1b For how many years have you studied English?

3.2 Why do you learn English? Please tick any that apply:

I hope one day I can study abroad.		I need to learn English to get into a university/high school	
I hope one day I can travel abroad.		I need to learn English because it is one of my compulsory courses in my curriculum	
I want to know a foreign language so that I can be more competitive in the future.		I learn English because my parents think it is necessary.	
I hope I can watch English films without translation subtitles.		Other Please describe:	

3.3 Do you enjoy learning English?

I enjoy learning English, and it is easy to me.	
I enjoy learning English, but it is difficult to me.	
I don’t enjoy learning English, even though it is easy to me.	
I don’t enjoy learning English, and it is difficult to me.	
I have no specific feelings about learning English.	

3.4a How do you feel about learning the following English skills?

Very easy	1
Easy	2
Normal	3
A little bit difficult but I can handle it by myself.	4
Difficult and I need extra help from my teacher.	5
Very difficult and I don't think I can learn it at all.	6

	1	2	3	4	5	6
English grammar						
English vocabulary recognition						
English vocabulary spelling						

	1	2	3	4	5	6
English reading comprehension						
English writing						

3.4b Please rank from 1-5, 1 being the best. Which literacy skill of English do you think you have learned the best?

	1	2	3	4	5
English grammar					
English vocabulary recognition					
English vocabulary spelling					
English reading comprehension					
English writing					

3.5 Please answer the following questions based on your personal feelings.

	Never	Sometimes	Always
1. Are you under the pressure of learning English?			
2. Do you have any symptoms because of the pressure? For example, insomnia, anxiety, depression.			
3. Do you think your pressure will be reduced if you are given more information about learning English?			
4. Do you think your hearing loss makes it harder for you to learn English?			

3.6a Apart from your English teacher at school, has anybody else helped with your English learning out of school?

There is no such a person.	
My parents.	
My relatives.	
My friends.	
My personal tutor.	

3.6b Are they deaf?

Yes		No	

3.7 Is this person an English Teacher or Native Speaker of English (or both)?

There is no such a person.	
He/She is an English Teacher.	
He/She is a Native Speaker of English.	
He/She is a Native Speaker of English and an English Teacher.	
He/She is neither a Native Speaker of English, nor an English Teacher	

3.8 Apart from your English curriculum at school, do you have other access to English out of school? Please tick any that apply.

I watch English movies with English		I set my cellphone/computer's	

subtitles.		language to English.	
I play computer or cellphone games of which the main language is English.		I go to English language training programs out of school.	
I chat with friends online in English.		I read logos and signs written in English on the street.	
I read books/novels/stories/newspaper articles written in English.		Others: (Please write it down)	
Not applicable.			

This is the end of the questionnaire. Thanks for your participatatio

Appendix III Expanded Demographic Questionnaire

Part 1 Demographic information

1.1 Please fill in your username (account number)

1.2 What is your age group?

7-9	
10-12	
13-15	
16-18	
over 18	

1.3 What is your gender?

Male	
Female	
Prefer not to say	

1.4 What educational level are you in?

High school	
University	

1.5 How would you prefer to identify yourself?

I am Deaf.	
I am hard of hearing.	
I am hearing impaired.	

1.6a Did you have severe hearing loss Before or 3 years old.

Yes		No	

1.6b Did your hearing loss start before or after you acquired a language?

Before I have acquired a language.	
After I have acquired a language. (I can speak when I had my hearing loss.)	
After I have acquired a language. (I can read and write when I had my hearing loss.)	

1.7a. What is the level of hearing loss that your **left ear** has?

Normal hearing	
Mild hearing loss (26 to 40 dB HL)	
Moderate hearing loss (41 to 55 dB HL)	
Moderate severe hearing loss (56 to 70 dB HL)	
Severe hearing loss (71 to 90 dB HL)	
Profound hearing loss (91+ dB HL)	
I don't know	

1.7b. What is the level of hearing loss that your **right ear** has?

Normal hearing	
Mild hearing loss (26 to 40 dB HL)	
Moderate hearing loss (41 to 55 dB HL)	
Moderate severe hearing loss (56 to 70 dB HL)	
Severe hearing loss (71 to 90 dB HL)	
Profound hearing loss (91+ dB HL)	
I don't know	

1.8a Do you have any technical hearing support?

I don't have any technical hearing support.		
I wear hearing aids.		From the age of

1.8b How do you wear your technical hearing support?

I wear my hearing aid only in my left ear.	
I wear my hearing aid only in my right ear.	
I wear my hearing aids in both of my ears.	
I wear my cochlear implant only in my left ear.	
I wear my cochlear implant only in my right ear.	
I wear my cochlear implant only in both of my ears.	
I wear my hearing aid in my left ear, while my cochlear implant in my right ear.	
I wear my hearing aid in my right ear, while my cochlear implant in my left ear.	
I don't wear any technical hearing support.	

1.8c Please estimate the number of hours per day for you wearing your technical hearing device:

1.9a If listening in a room where there is background noise such as TV, music, others talking, children playing, etc., do you have difficulty in hearing and understanding when you wear your technical hearing device?

Strongly disagree	1
Disagree	2
Neither disagree nor agree	3

Agree	4
Strongly agree	5

	1	2	3	4	5
I have difficulty hearing and understanding a face to face communication when I pay attention to it.					
I have difficulty hearing and understanding when being asked a question.					
I have difficulty understanding simple instructions.					
I have difficulty understanding complex instructions.					
I have difficulty hearing and understanding when I am doing other activities, such as reading.					
I have difficulty hearing and understanding a group communication.					

1.9b If listening in a quiet room (for example, in a classroom during class time)., do you have difficulty in hearing and understanding when you wear your technical hearing device?

Strongly disagree	1
Disagree	2
Neither disagree nor agree	3
Agree	4
Strongly agree	5

	1	2	3	4	5
I have difficulty hearing and understanding a face to face communication when I pay attention to it.					
I have difficulty hearing and understanding when being asked a question.					
I have difficulty understanding simple instructions.					
I have difficulty understanding complex instructions.					
I have difficulty hearing and understanding when I am doing other activities, such as reading.					
I have difficulty hearing and understanding a group communication.					

1.10a Do you have hearing parents or deaf parents?

My parent(s) are deaf people.	
My parent(s) are hearing people.	
One parent is deaf people, and the other one is hearing people.	

1.10b Does your family have a history of hearing loss? If yes, please put your relationship with the family member into the box.

Yes. My _____ is/are deaf.。	
No.	
I don’t know.	

Part 2 Communication preferences

2.1 When you have difficulties in learning English, you will seek for help from?

	Never	Sometimes	Always
Parents			
Teachers			
Friends/Classmates			

2.2a How do you communicate with your teacher in an English classroom?

	Never	Rarely	Sometimes	Often	Always
Sign language					
Spoken language					
Speech reading/lip reading					
Body language/gestures					
Signed Chinese					
Writing					
Typing on the mobile phone					

2.2b What is your preferred way to communicate with your teacher in an English classroom?

Sign language		Signed Chinese	
Spoken language		Writing	
Body language/gestures		Typing	
Speech reading/lip reading		Other	

2.3. How do you evaluate the current communication quality when you communicate with your teacher?

Severely disagree	1
Disagree	2
Slightly disagree	3
Neither disagree nor agree	4
Slightly agree	5
Agree	6
Severely agree	7

	1	2	3	4	5	6	7
My communication with my teacher feels satisfying.							
*I dislike talking with my teacher.							
*I am not satisfied after talking to my teacher.							
Talking with my teacher leaves me feeling like I accomplished something.							
My teacher fulfills my expectations when I talk to him/her.							
My conversations with my teacher are worthwhile.							
When I talk to my teacher, the conversations are rewarding.							
My teacher makes an effort to satisfy the concerns I have.							

2.4 Do you have hearing friends or deaf friends?

I only have hearing friends.	
I only have deaf friends.	
I have both hearing and deaf friends, and most of them are hearing people.	
I have both hearing and deaf friends, and most of them are deaf.	

2.5a How do you communicate with your deaf friends?

	Never	Rarely	Sometimes	Often	Always
Sign language					
Spoken language					
Speech reading/lip reading					
Body language/gestures					
Signed Chinese					
Writing					
Typing					

2.5b What is your preferred way to communicate with your deaf friends?

Sign language		Signed Chinese	
Spoken language		Writing	
Body language/gestures		Typing	
Speech reading/lip reading		Other	

2.6a How do you communicate with hearing people?

	Never	Rarely	Sometimes	Often	Always
Sign language					
Spoken language					
Speech reading/lip reading					
Body language/gestures					
Signed Chinese					
Writing					
Typing on the mobile phone					

2.6b What is your preferred way to communicate with hearing people?

Sign language		Signed Chinese	
Spoken language		Writing	
Body language/gestures		Typing	
Speech reading/lip reading		Other	

Part 3 Experiences of learning English

3.1a Have you learned English before your hearing loss?

Yes		No	

3.1b For how many years have you studied English?

1-2 years	

2-3 years	
3-4 years	
4-5 years	
5-6 years	
6-7 years	
7-8 years	
8-9 years	
9-10 yeas	
Over 10 years	

3.2 Why do you learn English? Please tick any that apply:

I hope one day I can study abroad.		I need to learn English to get into a university/high school	
I hope one day I can travel abroad.		I need to learn English because it is one of my compulsory courses in my curriculum	
I want to know a foreign language so that I can be more competitive in the future.		I learn English because my parents think it is necessary.	
I hope I can watch English films without translation subtitles.		Other Please describe:	

3.3 Do you enjoy learning English?

I enjoy learning English, and it is easy to me.	
I enjoy learning English, but it is difficult to me.	
I don’t enjoy learning English, even though it is easy to me.	
I don’t enjoy learning English, and it is difficult to me.	
I have no specific feelings about learning English.	

3.4a How do you feel about learning the following English literacy skills?

Very easy	1
Easy	2
Normal	3
A little bit difficult but I can handle it by myself.	4
Difficult and I need extra help from my teacher.	5
Very difficult and I don't think I can learn it at all.	6

	1	2	3	4	5	6
English grammar						
English vocabulary recognition						
English vocabulary spelling						
English reading comprehension						
English writing						

3.4b Please rank from 1-5, 1 being the best. Which literacy skill of English do you think you have learned the best?

	1	2	3	4	5

English grammar					
English vocabulary recognition					
English vocabulary spelling					
English reading comprehension					
English writing					

3.5a Apart from your English teacher at school, has anybody else helped with your English learning out of school?

There is no such a person.	
My parents.	
My relatives.	
My friends.	
My personal tutor.	

3.5b Are they deaf?

Yes		No	

3.6 Is this person an English Teacher or Native Speaker of English (or both)?

There is no such a person.	
He/She is an English Teacher.	
He/She is a Native Speaker of English.	
He/She is a Native Speaker of English and an English Teacher.	
He/She is neither a Native Speaker of English, nor an English Teacher	

3.7 Apart from your English curriculum at school, do you have other access to English out of school? Please tick any that apply.

I watch English movies with English subtitles.		I set my cellphone/computer's language to English.	
I play computer or cellphone games of which the main language is English.		I go to English language training programs out of school.	
I chat with friends online in English.		I read logos and signs written in English on the street.	
I read books/novels/stories/newspaper articles written in English.		Others: (Please write it down)	
Not applicable.			

This is the end of the questionnaire. Thanks for your participation

Appendix IV Informed Consent Form of Teachers' Semi-structured Interview

Description of the Study: You are invited to take part in this survey which is being undertaken as part of my PhD research. The whole program aims at giving an insight observation of how deaf and hard-of-hearing students learn English in China. Being the second study of the program, you will be invited to join in a semi-structured interview and will be asked about yourselves and about your English teaching experience.

By choosing "Yes", you agree that you voluntarily join this survey and you authorize the use of your data for my PhD research.

¨ **Yes**	¨ **No**	I confirm that the purpose of the study has been explained and that I have understood it
¨ **Yes**	¨ **No**	I have had the opportunity to ask questions, and they have been successfully answered
¨ **Yes**	¨ **No**	I understand that my participation in this study is voluntary and that I am free to withdraw from the study at any time, without giving a reason and without consequence
¨ **Yes**	¨ **No**	I understand that all data are anonymous and that there will not be any connection between the personal information provided and the data
¨ **Yes**	¨ **No**	I understand that there are no known risks or hazards associated with participating in this study
¨ **Yes**	¨ **No**	I confirm that I have read and understood the above information and that I agree to participate in this study
¨ **Yes**	¨ **No**	I confirm that I am over 16 years of age
¨ **Yes**	¨ **No**	I consent to my data being transcribed and wish to be referred to anonymously in written forms of dissemination
¨ **Yes**	¨ **No**	I consent to an audio file of my participation to be used but would like to identify factors (e.g. my name) to be removed.

If you have any concerns, please contact:

Researcher's Signature: _____ Date: _____

Printed Signature: _____

Participant's Signature: _____ Date: _____

Printed Signature: _____

Appendix V Semi-structured Interview Guide

Beginning:

1. An introduction on myself, the whole design of the research, including of the goals, the methods and what will be covered.
2. Ask the teachers to introduce themselves and their work. (This conversation might cover some questions in Part 1)

Part 1: Foreign language teachers of deaf and hard-of-hearing students

1. Factual demographic questions on the teacher's personal information

What subject(s) are you teaching?	
What kind of educational setting you are teaching at?	
What grade you are teaching?	
For how many years you have been a teacher?	
How would you identify yourself? An English teacher? A deaf education teacher? Or a special education teacher?	Probe: Ask the interviewee to further explain her choice. e.g. Why?

2. Demographic questions on the teacher's training experience

Before becoming a teacher, what training have you received?	Probe: Ask the interviewee to introduce some main modules in her previous training experience.
Does your working school offer training to teachers?	Probe: If the answer is "no", ask for self-training experience. If the answer is "yes", ask for more explanation by mainly focusing on the training content.

3. Demographic questions on the teacher's experiences with deaf students.

In your teaching career, you have had deaf student(s) in your classroom. Do you have any particular stories to share?	Probe: 1. Ask for more details about the story to increase the competent feeling and motivation of the interviewee. This question could be asked at the beginning of the interview. 2. Ask for the reason: why do you choose this story?
How would you describe your deaf students?	Probe: Do you think they are able to/should/must sit together with hearing students? Why?
Has your school/teaching community given you any support in teaching deaf students?	Probe: 1. If "yes", ask the interviewee to introduce more, and ask if those training are effective. 2. If "no", ask the interviewee how she

	managed to teach deaf students? Any self-training?

Part 2. Communication with deaf and hard-of-hearing students

3. Demographic questions on the teacher's language use

What are the languages you use in an English class?	
Are you familiar with the national sign language? To what extent you are familiar with the national sign language?	Probe: Ask for the teacher's opinion about the use of sign language when teaching deaf students. e.g. You have mentioned XXX, could you explain more? Why do you think it works? Why do you think it doesn't work? Do you think it is necessary/practical to give sign language training to teachers? Do you have any suggestions?

4. Opinion questions on communication quality from the teacher's perspective.

How would you evaluate the communication quality between you and your deaf students?	Probe: What kind of communication works well? What doesn't work?
In the students' questionnaire, they have expressed unsatisfactory level of the communication quality, what is your opinion?	Probe: In this discussion, ask for teacher's expectations of effective communication. What works well and what doesn't. What kind of support might be helpful?

Part 3. Teaching English to deaf and hard-of-hearing students

5. Factual questions on English teaching

In your English classroom, how many students do you have?	This is an initial question to lead to the second part of the interview and guide teachers to start thinking about English teaching particularly.
What textbook/teaching material do you usually use?	Probe: 1. Ask teachers what language skills they would focus on in language teaching, and if the textbook can meet their needs and expectations. (Is the book written for deaf students or hearing students? What works well and what doesn't? How do you manage to use this textbook to meet with deaf students' needs?) 2. Do you have any expectations on textbook design?
Describe a typical lesson	Probe: How to prepare a lesson? How to deliver (teaching strategies/language

	use/activities/homework) a lesson? Focus on how the teacher takes care of deaf students' needs.
How would you assess students' learning?	Probe: 1. Assessment methods/standards used by the teacher. 2. Deaf students' learning outcome. What works good? What needs to be improved.

Ending question:
Do you have any expectations about this research? Would you like to participate in further studies in this program?

Ending:
This is the end of this interview. Thank you for your participation.

Appendix VI Informed Consent Form of the Experimental Study

Printed Consent Forms will be handed to students before the experiments.

Purpose:
The purpose of this study is to develop an learning website to support deaf and hard of hearing students in EFL reading classes, and to test the efficiency of this learning website.

Role of participants:
You will be asked to join in reading class experiments and randomly be put into a conventional group and an experimental group. As all students will be required to use the newly developed learning website, to ensure that student data is anonymised, you will be given a set of account passwords made up of numbers and will use this account password to log on to the website to learn. During the course of the lesson, you are required to actively participate in the experiment and use the functions on the website. Subsequently, you are required to complete reading comprehension questions based on the general meaning of the reading text and submit your answers. The web platform will record the history of the your actions during the process and the reading comprehension answers submitted.

Upon completion of the reading process, you will be required to participate in a questionnaire. The questionnaire will be conducted using the Jisc. Online Survey platform. The questionnaire will consist of four sections: demographic information, learning interest and classroom engagement, perceived cognitive load, and experience of using the technology. the questionnaire will not contain any questions related to personal information of you.

Rest assured that all data collected will be handled anonymously, ensuring that your identity cannot be discerned through any means of data collection.
This research is being undertaken as part of a PhD in Applied Linguistics at the University of Nottingham.

Part One
You must include all of the following questions on your Consent Form:

¨ Yes	¨ No	I confirm that the purpose of the study has been explained and that I have understood it
¨ Yes	¨ No	I have had the opportunity to ask questions and they have been successfully answered
¨ Yes	¨ No	I understand that my participation in this study is voluntary and that I am free to withdraw from the study at any time, without giving a reason and without consequence

¨ Yes	¨ No	I understand that all data are anonymous and that there will not be any connection between the personal information provided and the data
¨ Yes	¨ No	I understand that there are no known risks or hazards associated with participating in this study
¨ Yes	¨ No	I confirm that I have read and understood the above information and that I agree to participate in this study
¨ Yes	¨ No	I confirm that I am over 16 years of age

Part Two

¨ Yes	¨ No	I consent to my data being transcribed and wish to be referred to anonymously in written forms of dissemination
¨ Yes	¨ No	I consent to an audio file of my participation to be used, but would like identifying factors (e.g. my name to be removed) from any presentation of my data including research dissemination [and knowledge exchange activities with non-academic partners]

I have read this form and agree to participate in this study.

¨ Yes ¨ No

For consent forms that require physical or digital signatures (the following will be added)
Researcher's Signature ……
Date ……
Participant's Signature ……
Date ……

For consent forms that require the participants to provide their approval by return of email (the following will be added)
If you agree with all the statements above please resent this email to the researcher