

THE CHINESE INPUT CHALLENGES FOR CHINESE AS SECOND LANGUAGE LEARNERS IN COMPUTER-MEDIATED WRITING: AN EXPLORATORY STUDY

Lung-Hsiang Wong

lunghsiang.wong@nie.edu.sg

Learning Sciences Laboratory, National Institute of Education, Singapore

Ching-Sing Chai

Learning Sciences Laboratory, National Institute of Education, Singapore

chingsing.chai@nie.edu.sg

Ping Gao

Learning Sciences Laboratory, National Institute of Education, Singapore

ping.gao@nie.edu.sg

ABSTRACT

This paper reports an exploratory study on Singapore secondary and primary school students' perceptions and behaviors on using a variety of Chinese input methods for Chinese composition writing. Significant behavioral patterns were uncovered and mapped into a cognitive process, which are potentially critical to the training of students in inputting Chinese via computers. Due to the cognitive complexity of Chinese computer input, there seemed to be a misalignment between the perceived effectiveness of these input methods and their actual benefits. They will only be effective if the composition writers possess appropriate language abilities and technical skills. In addition, as secondary school composition writers had higher level linguistic and technical skills, for example, the ability to guess the correct pinyin (a Romanized phonetic scheme that is required for Chinese text input) based on experience, they were more likely to view the input system favorably than primary school students. This has implications in how to prepare primary school students for information and technology mediated composition writing in Singapore. Pinyin and technical skills should be introduced as early as possible for them to appreciate the benefits of computer-mediated Chinese text input and subsequently, composition writing.

Keywords: Computer-aided Chinese learning, Chinese compositions, Chinese computer input, Qualitative methods, Student perceptions

INTRODUCTION

There is a keen interest in promoting the learning of Chinese globally. However, given the non-alphabetic nature of the Chinese script, it is found that learners face substantial problems in mastering the language (Wong, Boticki, Sun & Looi, 2011; Wong, Chin, Chen & Gao, 2009; Wong, Gao, Chai & Chin, 2011), especially for the purpose of reading and writing (Fu, 2005; Mori, Sato & Shimizu, 2007).

In Singapore's context, although over 75% of the population is ethnic Chinese, Chinese Language (Chinese) education faces many challenges. Since 1984, Chinese has been taught as an isolated second language (L2) subject in the primary and secondary schools. The amount of time allocated for learning Chinese in the schools is about two and a half hours weekly. In addition, there is a dramatic decline of using Chinese at home. According to the Ministry of Education's (MOE) statistics, 9.3% Primary 1 (7-year-old) students of Chinese origin used English at home in 1980, but the figure soared to 45% in 2003 (People's Daily Online, 2004). Hence, Singaporean students who have intensive training in English since they were young find it a challenge to learn Chinese (Liang, 2000). Moreover, their Chinese oral skills are relatively better than the writing skills (Liang, 1999; Wong, Chin, Chen & Chai, 2011).

Indeed, there is a need for Chinese Language educators to find more effective ways to facilitate Chinese learning. One possible solution is to exploit the affordances of computer technologies. In particular, a recent development in the Chinese education landscape in Singapore is the MOE's plan (January 18, 2011 press release) of phasing in computerized input for selected sections, including compositions, of national Chinese exams between 2013 and 2015. Therefore, it is timely to study the feasibility and challenges in introducing and reinforcing the computer input in Chinese writing among typical Singapore students.

This paper reports an exploratory study with twelve secondary and six primary school students to determine their perceptions of using selected ICT tools to write Chinese compositions rather than the traditional way of writing with paper and pen. The study was conducted to determine the range of student views about the use of technological tools in the transcribing process and the composition writing process. According to American Heritage Dictionary, one of the definitions of the term "transcription" (n.d.) is that "*something written, especially copied from one medium to another, as a typewritten version of dictation.*" In the context of paper-and-pen writing, transcribing involves handwriting and spelling (Berninger & Winn, 2007). In this paper,

transcription refers to the input of (Chinese) text on the computer (e.g., Crook & Bennett, 2007). This paper has attempted to answer the following research questions:

1. How did the participants perceive Chinese composition writing?
2. How did they perceive the ICT-mediated Chinese transcribing process?
3. What are their usage patterns for the various ICT tools for Chinese transcribing?

Research question one was included in this study because it formed the context for the researchers to understand the students' perspectives in research question 2 and 3.

LITERATURE REVIEW

Challenges in Chinese learning

Chinese literacy began over three thousand years ago with writers etching the plastron shell of the turtle (Chang & Chang, 1978). As the technology of literacy evolved, first with rice paper and now with the computer and the Internet, this tradition of literacy has also evolved (Bloch, 2004). Technology tools for writing are becoming more user-friendly and there are many affordances of the tools that can be employed to enhance the writing performances of students. Computer-based technologies such as word processors, e-dictionaries, automated writing templates, web blogs and voice input systems are just some examples. Given these tools, Sullivan and Porter (1997), and Selfe (1999), argued that electronic writing (including word processing, e-mail, WWW) is the key for future writing. Writing in the 21st century would largely mean electronic writing. However, integrating technology into classroom teaching and learning is a complex process that needs iterative designs and experiments (Pelgrum, 2001). While there was some research in integrating computers for writing in other languages (see below), employing computers for Chinese writing seemed to be rare or perhaps under-reported in English Language journals. This phenomenon might be due to the unique characteristics of Chinese words. A Chinese input system for the computer was not invented until 1976 (Qiu, 1990). Input systems that were both user-friendly and easily accessible to students did not emerge until the 1990's (e.g., Chinese Star). This might help to explain the lack of research in this area.

Scientific research (Washington Observer Weekly, July 23, 2003) suggested that Chinese takes more "brain power" than English to learn, as both left and right temporal lobes become active when Mandarin speakers hear Chinese, whereas only the left lobe is active when English speakers hear English. For the learners of Chinese as L2, learning the Chinese script is the most difficult task, including the recognition, reading, and writing of characters (DeFrancis, 1984; Ke, Wen & Kottenbeutel, 2001; Wong, Chai & Gao, 2010; Zhu & Hong, 2005). Fan, Tong & Song (1987) claimed that the logographic nature of the Chinese script constitutes the hurdle to memorization. Shen (2004) attributed the challenge to the retention of the sound, shape and meaning of a character in the learner's long-term memory and the instant retrieval of these three elements. Ho, Ng & Ng's (2003) study suggested different word recognition strategies are required for Chinese as compared to English (or any other alphabetic script), which makes it even harder for a learner whose first language is based on an alphabetic writing system to pick up Chinese.

Could such a difficulty translate into higher cognitive load for children learning to write Chinese compositions? Graham's (1990) study in English writing process may shed light on this issue. He observed that writers' conscious attention to handwriting and spelling in paper-and-pen-based English writing can interfere with other writing processes. McCutchen (1988) proposed that such skills are so demanding for beginning writers that they minimize the use of other essential writing processes, such as planning and revising. However, the researchers argued that such problems would occur, perhaps more seriously, in Chinese writing as well, due to the logographic nature of the Chinese script as discussed above.

ICT-mediated writing pedagogy – the studies

There is little doubt that ICT-mediated writing influences the writing process (Kang, 2011; Penington, 2003) and research in this area has been conducted since early 1980s. Reed (1996) observed a research shift for ICT-mediated writing and the design of the study. According to his survey, pre-1987 studies tended to be tool-centric experimental designs. The general findings were that students in computer groups performed better than those in non-computer groups. Post-1987 research was better grounded in research designs which were built on theoretical frameworks; there were much more pedagogically rich treatments as well as greater focus on the writing process, thus a reduced need for control groups.

With this shift, research has begun to uncover areas that may not benefit from ICT-mediated writing. Peckham (1996) cautioned practitioners in integrating technology with existing writing pedagogy. He found that the move between in-class and online peer responses is not seamless. Vician and Brown (2000) argued for the need to

carefully craft writing assignments to align with their intended outcomes. Erickson's (1992) study showed that the quality of compositions written on computers depends on variables like writers' experience, maturity, technical competency, and instruction received in the writing process. Wolfe and Manalo (2004) further argued that the imposition of keyboard composition requires students with less computer experience to perform the equivalent of translation in order to produce the text, which is not part of their natural written communication process. It is likely that such an effort would be more pronounced for L2 learners because they would perform a double translation – native language to L2 and then L2 to keyboard strokes. What make the ICT-based writing task even more challenging in Chinese compositions are the indirect Chinese input methods – either phonetic- or component-based input methods as the means to Romanize or code the logographic characters – that requires writers' additional mental processing, that is, recalling the pronunciations or decomposing the “shapes” of individual characters, among others (Xie, 2001). All these findings pointed to the need for educators to help learners overcome the technical challenges that they might face before the advantages of ICT-mediated compositions can be realized.

ICT mediated Chinese writing – Perceived Advantages and Challenges

The past decade has witnessed active studies in applying ICT to Chinese teaching and learning (see a comprehensive survey in Bourgerie, 2003). Since ICT can provide great opportunities for Chinese teaching and learning, it is imperative for Chinese teachers to tap the potential of ICT to enhance Chinese learning. Specifically, there are an increasing number of discussions related to IT-mediated strategies for composition pedagogy in Singapore. Integrating ICT into the Chinese curriculum had raised individual learners' confidence and aroused their interest in learning Chinese (Lim, 1999; Zhang, 2009). Lim (1997) argued that IT support offering great advantages in Singapore students' Chinese composition exercises, including the nurturing of creative and abstract thinking. Therefore, Sim (2005) advocated the construction of a pedagogical model for online Chinese compositions in order to overcome the common challenges faced by Singapore students in traditional paper-and-pen-based compositions.

As such, in order to ensure the effective use of ICT in Chinese compositions, it is vital to understand students' perceptions and experiences of using ICT for Chinese compositions, including the linguistic and technical difficulties that the young learners of Chinese as L2 may face due to the introduction of the new writing medium.

METHODS

Background Information and Sampling

Three qualitative case studies were conducted for this research between September 2006 and February 2007. Case study one was conducted at a co-ed neighborhood secondary school (Sec A). Case study two involved a boys' school (Sec B). Both studies involved six Secondary 3 (15-years-old) students respectively. Case study three was conducted in a neighborhood primary school (Pri C) and it involved six Primary 5 (11-years-old) students. The three participating schools were typical Singapore schools in which English is the medium of instruction.

To explore how language abilities influence the students' use of ICT for Chinese composition writing and their perception about it, maximum variation was adopted as the sampling strategy. Based on the students' Chinese language performances obtain from school records, the teachers were requested to select two students each from the high, medium, and low academic abilities in Chinese. Table 1 presents the demographic information of the participants by assigned pseudonyms.

Table 1: General Information of the Target Students

Secondary School A (Sec A)		Secondary School B (Sec B)		Primary School C (Pri C)	
Pseudonyms (gender)	Chinese Composition Standard	Pseudonyms (All Male)	Chinese Composition Standard	Pseudonyms (gender)	Chinese Composition Standard
Liewu-A (M)	Low	Longzhi-B	Low	Lisha-C (F)	Low
Luowen-A (M)	Low	Lingchuan-B	Low	Lianqing-C (M)	Low
Minyu-A (F)	Medium	Laide-B	Low	Minghui-C (F)	Medium
Meiqing-A (F)	Medium	Lida-B	Low	Mucheng-C (M)	Medium
Hanjia-A (F)	High	Mengjie-B	Medium	Huiyi-C (F)	High
Haiyin-A (F)	High	Minzhong-B	Medium	Hanyun-C (F)	High

The conduct of the case studies

Two hours of training on using the selected Chinese input tools was conducted prior to the study. Table 2 lists the software tools that the research team recommended the students to use for writing Chinese compositions

during the observed activities. The emphasis was on researching into how the students perceived ICT-based writing and the challenges they faced. To this end, a variety of tools or input methods were provided for the students to mix and match. They were free to switch to any of the provided tools or input methods based on their needs.

For Microsoft Pinyin IME, in particular, the target students were trained in three input modes, namely, single character input (inputting character by character, and manually performing candidate selection due to homophones), *pinyin character group* (拼音词组, similar to single character input except that the user inputs pinyin by phrase¹ (词)), and *full sentence input* (全句输入, inputting the pinyin of all the characters in a full sentence and let the computer perform real-time, automatic, supposedly context-sensitive candidate selection). The *full sentence input* is supposedly the most efficient input method among the three, except that the user might need to go back to edit the automatically generated sentences because of the software's occasional wrong selections of single characters or phrases (due to homophones). After the training, three composition activities per school were conducted. The topics of the compositions in the secondary schools were all argumentative. The primary school students were assigned narrative compositions, two topical and one pictorial.

Table 2: Software tools used during the empirical activities

Category	Name	Functionalities related to compositions
Word processor	Microsoft Word	General word processing
Chinese character input	PenPlus (一笔通)	<input type="checkbox"/> Handwriting input along with the bundled tablet (writing pad) <input type="checkbox"/> <i>Pinyin</i> -based ² (phonetic) input with bundled Chinese Plus 一件通 (software)
	Microsoft Global Input Method Editors (IME)	<input type="checkbox"/> Microsoft Pinyin IME for <i>Pinyin</i> -based input <input type="checkbox"/> Microsoft IME pad for handwriting input along with the PenPlus tablet
Reference	PowerWord 金山词霸	Chinese-English two-way e-dictionary

Data Collection and Analysis

Results from multiple data sources were triangulated to search for regularities in the data (Goard & Symonds, 2010; Guba & Lincoln, 1989). Data were collected from one-to-one interviews, focus group interviews, and observational field notes. Interviews were conducted at the beginning and the end of the study to investigate the participants' perceptions in ICT-mediated Chinese writing. Focus groups were also facilitated after each writing session. In addition, the researchers installed and launched MORAE, a software application that uses a webcam and a microphone attached to the computer to capture video of the participants' on-screen activities, together with their facial expressions and speech when they were using the computers to write their composition.

On-going data analysis was performed during the study. The researchers started with coding the activity data captured by MORAE and the field notes to identify emerging themes: perceptions on using the ICT tools and the experience of using the ICT tools. Themes were cross-classified to look for patterns between them, and evaluated them based on continued re-examining of the existing data (Bogdan & Biklen, 1998). MORAE recordings were used to verify the existing data and added new themes when necessary. The researchers also wrote a profile for each participant at the final stage of their data analysis and invited the students to "member-check" the accuracy of the account. By the end of the empirical activities, a summative analysis was performed to compile the findings. Due to the adopted research methodology, the findings were not intended to be generalized to a larger population. However, from the study, the researchers had uncovered issues that are critical to the training of students in inputting Chinese via computers.

MAJOR FINDINGS

Guided by the above-mentioned research questions, the researchers organized their major findings into three sections, namely, (1) Students' perceptions of writing Chinese compositions; (2) Students' perceptions of using the ICT tools for writing Chinese compositions; (3) Preferences for using the selected ICT tools for writing Chinese compositions. Three assertions were formulated to summarize the findings.

¹ In the context of Chinese Language, "phrase" is known as "word" in some literature. It is important to distinguish phrase/word from "character" (字). One phrase/word consists of two or more characters.

² "Pinyin" (or "Hanyu Pinyin") is the most common standard Mandarin romanization system in use. The phonetic-based scheme has become the basis of one of the most popular and easiest-to-learn Chinese computer input methods.

Assertion 1: The interview data revealed that the participants' perceptions of Chinese composition writing seem to be fragmented and inconsistent. The secondary school students' views could be categorized as (1) being exam-oriented; (2) wishing to be trained in the language and the Chinese way of thinking; and (3) for expressing oneself and communicating with others. The primary school students were unable to articulate their views but their frequent counting of words during composition writing shows that they were being exam-oriented. Overall, most of them are not motivated to learn Chinese and write in Chinese.

The interview records indicated that the secondary school students had different views about the why they had to learn to write compositions in Chinese. Their views could be categorized in three groups, namely, (1) Being exam-oriented; (2) Wishing to be trained in the language and thinking; (3) Using writing to express and communicate.

For those who fell into group (1), Luowen-A, Liewu-A and Minzhong-A were noticeably passive. Luowen-A's articulation captured the essence of their attitude towards writing Chinese composition, *"I write Chinese composition for the sake of exams. Actually, I am not interested in writing composition."* (Sep 22, 2006) This illustrated both his and his peers' contradictory attitude towards Chinese writing: intellectually, they recognized the need to practise Chinese writing but affectively, they disliked doing so. At the post-interview, Luowen-A was frank in talking about his view on writing in Chinese, *"If it is not for the exams, I do not need to write in Chinese in my daily life at all. It is enough to be able to speak Mandarin."* (Apr 18, 2007)

Meiqing-A from group 1 offered a slightly more positive view. She held the same view throughout the pre- and post-interviews: *"I wish to receive good results [in Chinese]. I can feel a sense of achievement."* (Sep 22, 2006 & Apr 18, 2007) She felt that exams give her the momentum to write.

Participants belonging to group (2) were Minyu-A, Laide-B, Lida-B, Longzhi-B and Lingchuan-B. Minyu-A claimed in the pre-interview, *"I could learn to write stories in Chinese, which would train me to write creatively."* (Sep 22, 2006) In the post-interview, she said, *"Compositions would train me to contemplate on specific topics."* (Apr 18, 2007) Laide-B said in the pre-interview, *"I am better in speaking Mandarin but weak in writing Chinese. Training to write compositions is important to me."* (Sep 22, 2006) Lida-B stated in the pre-interview, *"Learning to write could improve my language skills, so that I could write letters or emails in Chinese in future."* (Sep 22, 2006) After the intervention, his perspective slanted towards learning to write in order to take the Secondary 4 National "O" Level Examination. Longzhi-B told the researchers during the pre-interview, *"Writing develops our creativity."* Conversely, Lingchuan-B reflected during the pre-interview (Sep 22, 2006) that he wrote because the teacher wanted him to, and changed his mind about writing after the intervention to *"writing Chinese can probably help me in speaking Mandarin."* (Apr 18, 2007) These five students were not consistent in their perceptions before and after the study. This could be because they had not put much thought into this issue in both the pre- and post-interviews but just gave the researchers quick replies with whatever came into their mind.

The third group of students viewed writing Chinese composition as a form of self-expression and communication. Hanjia-A, Haiyin-A and Mengjie-B belonged to this group. Their views during pre-interview were consistent with those of the post-interview. Mengjie-B's view was profound, *"If a reader encounters an article which she can fully empathize how the author think and feel, she will know she is not alone in her thinking. It is likened to searching for friends via the compositions."* (Apr 18, 2007)

It was even harder to get Pri C participants to articulate their perceptions in learning Chinese and Chinese compositions. They either liked or disliked Chinese; but they just did not manage to give reasons. Instead, most of them just quipped, *"I don't know."* (Mar 3, 2006) The only exception was Huiyi-C who said during the pre-interview, *"I like writing Chinese compositions because I can learn more knowledge and idioms."* (Mar 3, 2006) While the researchers were unable to obtain articulation among the primary students, it seems clear to them that the primary school participants showed an unwillingness to write in Chinese by either heaving a deep sigh or complaining that they had to write *another* composition at the beginning of each session.

Conversely, the observation data showed that the majority of the Pri C participants tended to write Chinese composition for the sake of passing exams rather than for communication. They considered fulfilling the word count requirement (100 words for Primary 5; compared to 350 words for Secondary 3) as their priority in writing a Chinese composition. For example, when being asked, *"What do you care the most when you write a Chinese composition?"* All the participants except Huiyi-C quipped, *"Counting the number of characters."* (Mar 3, 2006) Moreover, according to our MORAE recordings, they did count the number of characters from time to time when they were writing their compositions, especially towards the end. When they reached the 100-character

requirement, they would just wrap up their compositions. They were not interested in revising or proofreading their work.

The secondary students who were weak in Chinese were also exhibiting the above-mentioned behavior when they were writing the composition. This included Luowen-A, Lingchuan-B, Laide-B and Longzhi-B. Most other secondary school students could keep writing and before they knew it, they had exceeded the word count by a great deal. The reason could be, from the analysis of the MORAE recordings, that the secondary school students were more familiar with inputting Chinese on the computer, more mature in their thinking, and had better language skills. The weaker students were more concerned about the word count. They considered they had done their work as long as they could come up with the necessary number of words.

Nevertheless, due to the difficulties in learning Chinese, mainly in learning to write logographic characters, the students preferred to write in English while communicating socially in Mandarin after school. An exception to this was Sec B which was a traditional English school where students rarely use Chinese or speak Mandarin.

In short, the participants had various personal goals in learning Chinese compositions. Many students were not motivated to practice Chinese compositions as there is no perceived need by most of them to write Chinese in their daily lives.

Assertion 2: The participants had different perceptions of using ICT tools for Chinese compositions. Their perceptions were in general related to the technical competency level (pertaining to the input system) in their writing process and greatly influenced by their experiences in using the tools. They were in general enthusiastic to try out ICT-based writing in the beginning. However, those who could not cope with the linguistic and technical challenges of Chinese input gradually became frustrated by the end of the study.

Typing Chinese texts on computer has been perceived by many “Chinese input savvy” adults as an easier means of writing than writing with paper and pen (Xie, 2004). However, it was observed that the participating students did not make the fullest use of the technologies. The interview and observation data revealed that their perceptions of using ICT tools varied from session to session. For many of them, their perceptions at the end of the writing sessions could be the complete opposite of what they thought before they started using the tools. Such a change was more pronounced in primary school pupils as compared to secondary school students.

Secondary school: Pro-computer input students' perceptions

The secondary school students had great expectations before they engaged in the study. Most of them have had experience with Chinese input systems. However, not all of them had the experience of writing a complete composition on computer. They therefore assumed that inputting pinyin and letting the computer retrieve the Chinese characters would solve their problem of not being able to recall the logography of how to write the characters. It will speed up their writing. Those who had such expectations are Hanjia-A, Minyu-A, Minzhong-B, Laide-B and Lida-B.

Among them, Hanjia-A reported that she wrote faster on the computer than with pen and paper. In addition, she perceived that writing on the computer helped in her composition. She reported that she learned new words from the candidate window, which contains homophones for the user to select the intended character. When selecting the intended character, she could see many other homophones. She learned those characters and made use of them during the class composition (using pen and paper) lessons. This contradicted one of the teachers' concerns: with computer input, the students would forget about how to handwrite Chinese characters (e.g., Qi, 2003; Gao, 2006; Xiong, 2007). The researchers related her perception with her academic results and found that she was good in Chinese in her class. That is probably why she could obtain unexpected learning gains from the input method. In the United States, Xie (2001) conducted a study in ICT-mediated Chinese writing on non-Chinese college students who studied the language and reached a similar conclusion that they learned more Chinese characters through frequent use of pinyin input.

Other pro-computer input students voiced other reasons for their preference, for example, while Haiyin-A said it was strenuous to write with pen and paper, Luowen-A, apart from appreciating the convenient access to the e-dictionary, wished that the future generation of e-dictionary could interpret the writer's writing and recommend related idioms and figurative expressions – he admitted that such an aspiration or a desire had increased his willingness to try out ICT-based compositions.

Secondary school: Anti-computer input students' perceptions

In contrast, Meiqing-A liked to write with pen and paper as she could practice handwriting. She believed that handwriting with pen and paper would show one's sincerity. Lingchuan-B, Mengjie-B and Liewu-A held a similar opinion. In particular, Lingchuan-B thought that it was very inconvenient to write with the writing pad. Mengjie-B further remarked that he preferred pen and paper because his hand was linked to his brain.

Longzhi-B was the only student that had the same perception of ICT input as most of the primary school pupils (see below). Before the writing sessions, he had favorable perception of ICT-based input, *"It is faster to use computer input. It is inconvenient to use pen and paper."* (Sep 22, 2006) However, at the post-interview, he said, *"It is easier to do editing with pen and paper. I found pinyin input troublesome and indirect; and the computer kept recognizing my handwriting incorrectly when I used the writing pad. I was only able to pick up some speed when I wrote my composition written during the 3rd session."* (Apr 18, 2007) Word processors had often been touted as more efficient in editing as compared to pen and paper (e.g., Graham, 2008; Khalid, Swift, & Cullingford, 2002; Russell, Bebell, Higgins, 2004), but Longzhi-B thought otherwise. It could be due to his relatively weak pinyin and transcription skills.

Primary school students' perceptions

The six primary school pupils had similar perceptions and exhibited similar changes in opinions towards computer-based input. At the beginning, they were excited about using ICT-based Chinese compositions and unanimously indicated a preference for using the ICT tools. During the focus group discussion after the training session, all of them expressed their enthusiasm and preference for using the ICT tools to pen-and-paper, *"It is fun to write on a computer. I can use Pinyin to find Chinese characters. It is very interesting. It is a time saver because I don't need to write stroke by stroke."* (Huiyi-C, Mar 7, 2006) *"It is much easier to make correction when writing on computer."* (Hanyun-C, Mar 7, 2006)

Their reaction toward using ICT tools differed greatly after the first writing session. Only half of them remained excited about using the ICT tools to write Chinese composition. While Lianqing-C and Liya said respectively, *"Using computers makes Chinese composition writing much easier, because I can use the e-dictionary."*, *"I want to use computers to write Chinese composition, because I can use the e-dictionary."* (Apr 13, 2006), others changed from excitement to frustration after they encountered a variety of linguistic and technical difficulties, including repeated misrecognition of their handwriting. For example, Hanyun-C said, *"I felt a little bit nervous, because I haven't used computers for a long time."* (Apr 13, 2006) Minghui-C shared her frustration by saying, *"When I wanted to write a character, the computer showed a strange character. I had to write that character again, and a wrong character showed up. I had to delete them one by one. Then I forgot what my next sentence was."* (Apr 13, 2006) Huiyi-C, who encountered the same problem more frequently, voiced out her fear, *"I'll definitely fail the examination if I use a computer to write my composition."* (Apr 13, 2006) During the post-interview, she said, *"I prefer to write Chinese compositions with pen and paper to on a computer."* (May 25, 2006) Her preference has a close connection with the ICT tools she chose to use, which will be elaborated in the following section.

In short, whereas many of the participants indicated their preference in writing Chinese compositions with ICT tools, more than half of them gradually changed from excitement to frustration over the three composition sessions; The novelty effect at work. Linguistic and technical difficulties surfaced. They had found themselves struggling with the technical challenges before they could even start to enjoy the perceived benefits of the new writing medium. Such change seemed to be more pronounced among primary school pupils as compared to secondary school students. Primary students had higher initial excitement. Yet, because of their lower technical competency level and weaker language skills, the challenges they experienced were relatively greater than their older peers and their excitement diminished.

Assertion 3: Due to the complex process of writing Chinese on computer, the participants found it difficult to learn all input skills simultaneously within a short period. As a result, they selectively used those tools that are similar to writing with pen and paper or with what they were most familiar with. In other words, they each have their preference for a unique combination of tools.

All the participants mentioned that writing Chinese characters was the most difficult part of writing with paper and pen. They were frequently stuck in transcription, as they did not know how to write certain characters. Therefore, most of them preferred to speak Mandarin, and read and write in English. Could writing Chinese on computer affect this preference?

There is a great difference between typing English and Chinese on a computer. When one types English texts, one uses the keyboard to type what one wants to compose. Inputting Chinese characters may require one to choose from various input methods, that is, it involves decision-making. Due to the complex process of writing Chinese on a computer, the participants found it difficult to learn all input skills simultaneously. As a result, some participants selectively used those tools that are similar to writing with pen and paper or with what they were most familiar with, such as using the phonetic (pinyin) input method. Others challenged themselves to use a combination of tools to solve the difficulties they encountered. Table 3 depicts the students' choices of using the input methods during the writing sessions as compiled from the coded MORAE recordings.

Pinyin versus handwriting input

Based on the researchers' analysis, secondary school participants overwhelmingly used pinyin input (see Table 3). It was because they were relatively skilled in the pinyin scheme. They were selecting the input method most familiar to them. For inexperienced primary school users, handwriting on the writing pad seemed most intuitive. According to their Chinese teacher, although Pri C pupils were taught pinyin in Primary 1, they rarely used it after Primary 3 and were therefore unable to recall much.

Secondary school students: Challenges faced in using pinyin input

Although secondary school students overwhelmingly employed the pinyin input method, some of them also used handwriting input when they could not find the characters they needed via the pinyin input. The pinyin mistakes they made tended to be mixing up the pronunciations of “zh” and “z”, “ch” and “c”, “d” and “t”, “b” and “p”, “s” and “x”, “n” and “ng”, etc., and Singapore-accented pronunciations (which shows strong influence of various southern Chinese dialects). Occasional users of the handwriting input device faced another challenge. They usually had to write the character repeatedly before the software was able to recognize it (or, in some cases, unable to recognize it at all). This could be due to the incorrect stroke order.

Table 3 Students' Choices of Using the Input Methods [PY = pinyin / HW = handwriting]

		1 st writing session		2 nd writing session		3 rd writing session	
		Mainly used	Occasionally used	Mainly used	Occasionally used	Mainly used	Occasionally used
Secondary School	Liewu-A	PY	HW	(absent)		PY	-
	Luowen-A	PY / HW		PY / HW	-	PY / HW	-
	Minyu-A	PY	-	PY	-	PY	-
	Meiqing-A	PY	HW	(absent)		PY / HW	-
	Hanjia-A	PY	-	PY	-	PY	-
	Haiyin-A	PY	HW	PY	HW	PY	-
Primary School	Longzhi-B	PY / HW	-	PY	HW	PY / HW	-
	Lingchuan-	PY	-	PY	-	PY	-
	Laide-B	PY	HW	PY	HW	(absent)	
	Lida-B	PY	-	PY	-	(absent)	
	Mengjie-B	PY	HW	PY	HW	(absent)	
	Minzhong-B	PY	HW	PY / HW	-	PY	-
Primary School	Lisha-C	PY / HW	-	PY	ED	HW	-
	Lianqing-C	HW	PY	HW	PY	PY	-
	Minghui-C	HW		PY	HW	PY	-
	Mucheng-C	HW	PY	PY	-	HW	PY
	Huiyi-C	HW	-	HW	-	HW	-
	Hanyun-C	HW	-	PY	-	PY	-

Secondary school students: Challenges faced in using “full sentence input” method

Conversely, many of the participants employed “pinyin character group” (input by phrase). Few of them employed the IME “full sentence input method”. However, the computer system will usually make mistakes in selecting individual characters or phrases within a sentence, either because it being homophones with other phrases, or due to the student entering the incorrect pinyin. The students were therefore forced to work backward in their writing to make the change. It slowed them down and disrupted their train of thoughts. As a result, some participants such as Haiyin-A, Laide-B, and Longzhi-B who had chosen the *full sentence input* method during their first writing session gradually reduced or stopped using it.

In Laide-B's case, as he was very weak in pinyin, he experienced the greatest difficulty in “full sentence input” as compared to Haiyin-A and Longzhi-B. When he inputted the entire sentence, he discovered that it had many

mistakes due to his mis-pronunciations. This frustrated him a great deal. In Haiyin-A's case, she was reminded by the researchers during the first writing session to make use of *full sentence input*. She was able to improve her speed while writing the composition during that session. However, when she came back to write her second composition three weeks later, she seemed to have forgotten this function. She reverted back to the slow way of inputting by character or phrase.

In contrast, Hanjia-A, Minyu-A, Mengjie-B, and Lingchuan-B who were relatively good in pinyin and keen on exploring new software features were more and more proficient in "full sentence input". As such, they almost stopped using the handwriting pad. However, they would once in awhile overlook the incorrect selections by the computer.

Secondary school students: Frequent switches between input methods

Luowen-A was the only secondary school participant who frequently switched between pinyin and handwriting input methods. He was weak in both pinyin and handwriting. He used mainly pinyin input at the first and second writing sessions, and the first half of the third writing session. However, because his peer who was sitting next to him became impatient with his frequent inquires, he switched to using handwriting input at the latter part of the session. He faced great challenge in handwriting input as he could not write proper Chinese characters.

Primary school students: Challenges faced in employing handwriting input

Some pupils in Pri C adhered to handwriting input throughout the sessions. Others switched from handwriting input to using a combination of ICT tools to solve the problems they encountered.

Even with the same tool, the pupils varied in terms of the input speed and methods. For example, Hanyun-C preferred to use the tablet to handwrite each character. Using the same tool, Huiyi-C could input two or three characters at a time. Minghui-C became quite proficient in the handwriting input method by the third session and set the record of writing seven characters in one shot. On the other hand, she was weak in pinyin and preferred to just input the beginning sound of a character (that is, the first one or two Latin characters of the *pinyin*) and then scroll the candidate window to look for the character. Often, she missed the character because there were too many characters in the window than she could handle.

Both frequent and occasional users of the handwriting input found that the reliance on the writing pad and character recognition software for inputting characters was not as intuitive as pen and paper handwriting. For example, although Huiyi-C was the only pupil who used handwriting input throughout, in one occasion, she had to write the character “友” nine times to get it correct – it was misrecognized as 支、歹、交 before the computer finally recognized the character she wrote as 友. She said in her final interview that handwriting input with a tablet was more troublesome than writing with paper and pen.

Primary school students: Challenges faced in employing pinyin input

Although the pinyin input method could solve the character recognition problems, the majority of the participants were weak in pronunciation and therefore weak in pinyin. They therefore would only use it as a quick fix and then switched back to handwriting input. There are two possible explanations for their preference. First, as they reported in their pre-interviews, they lacked confidence in using pinyin as they rarely used it after Primary 3. Second, because they were trained first in handwriting input and second in the pinyin input during the training session they felt more comfortable with the former.

Primary school students: Frequent switches between input methods

Some of the participants chose to alternate between the handwriting and pinyin input methods due to their weak transcribing skills. For example, Mucheng-C's handwriting in Chinese is not good enough to be easily recognized. Furthermore, he is left-handed. He frequently encountered the problems of wrong handwriting recognition due to the positioning of the pad and the poise of his hand in holding the pen. He also wrote with wrong stroke sequence which contributed to the handwriting input difficulty. The challenges he faced distracted him a great deal. For example, when he wrote the phrase “开心” (happy), the characters could not be recognized by the handwriting software, even after five tries. This was similar to Huiyi-C's above-mentioned experience of trying to input “友”. However, unlike Huiyi-C who stuck to handwriting input until the software got it right, Mucheng-C opted to switch to *pinyin* input. Unfortunately, he keyed in the erroneous phonetic symbols (*pinyin*) for 心, “sin” (the correct *pinyin* should be “xin”). As a result, he wasted a lot of time switching between the input methods and yet his problem was still unresolved (see the screenshots in Figure 1a-11). During the last 15 minutes of the session, he was worn out and lost concentration, causing more recognition errors.

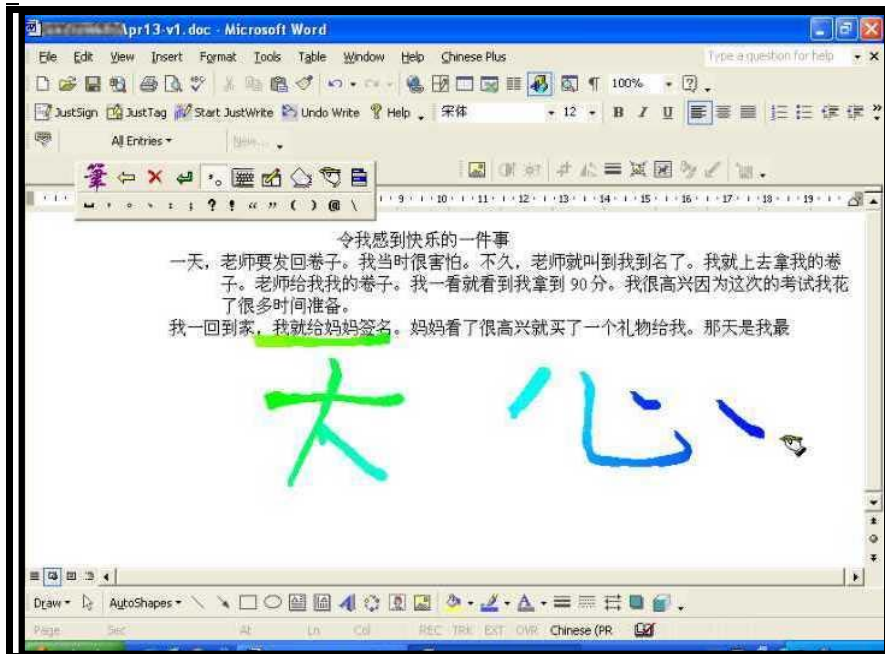


Figure 1a: Mucheng-C's first attempt to handwrite 开心

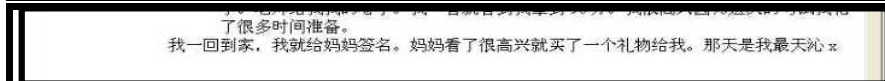


Figure 1b: 心 is mis-recognized as another character 么



Figure 1c: Second attempt to handwrite 开心

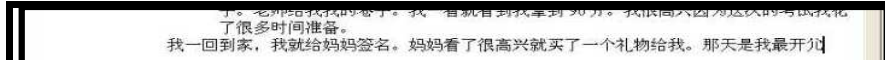


Figure 1d: Misrecognized as 开 允



Figure 1e: Deleted 允 but kept 开, then attempted to write 心

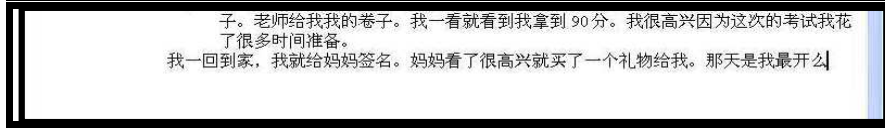


Figure 1f: Misrecognized as 么

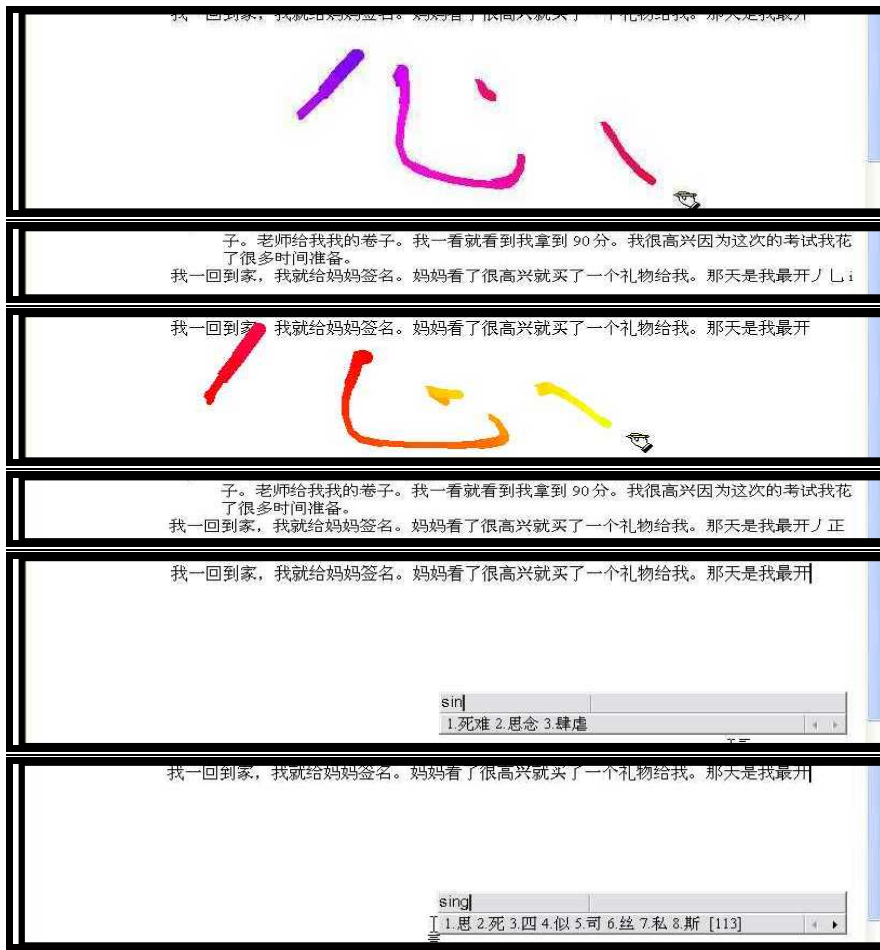


Figure 1g: Attempted to write 心 again

Figure 1h: Mis-recognized as two separate character strokes and an alphabet “i”

Figure 1i: Attempted to write 心 yet again

Figure 1j: Mis-recognized as a character stroke J and

another character 正
Figure 1k: Switched to pinyin input but keyed in the wrong pinyin of 心 as “sin” (should be “xin”) and therefore could not find the character from the candidate list.

Figure 1l: Tried “sing” instead but still could not find the character from the list. (Eventually, he asked a researcher for the correct pinyin.)

E-dictionary

Albeit being a reference tool, the e-dictionary did play a role in some of the target students' transcribing process. When a student encountered a character that he could only recall the pronunciation but not the shape, she could either just input the *pinyin* and search for the character from the candidate window, or search for it with the e-dictionary by *pinyin* or by English-to-Chinese and then cut and paste the character from the e-dictionary window to the word processor.

Based on our MORAE video analysis, while students from Sec B frequently looked meanings up the e-dictionary, students from Sec A almost never used it. Sec A students would consult their peers *about* pinyin, translations, and how to write certain characters. Meiqing-A, Minyu-A and Hanjia-A all thought that the user interface of the e-dictionary was complicated. They had to go through a few steps to find the characters. Only Liewu-A thought that using the e-dictionary was easier than using a print dictionary.

Sec B's students who studied in a typical English school depended a lot on the e-dictionary and seldom asked for help from their peers. Except for Lida-B, they frequently made use of the e-dictionary to look up translated terms. They conceded that they had seldom consulted their peers even in the actual composition classes to avoid disrupting one another's train of thought. However, the real reason could be that they thought that their peers' standards of Chinese were not high enough, as what Longzhi-B said during the post-interview, "*I only consult those whose Chinese are better than me.*" (Apr 18, 2007) They reported that the e-dictionary had provided substantial help to them.

The behaviors of Pri C participants in looking up the e-dictionary were similar to Sec A participants—most of them find it too troublesome to check either the e- or printed dictionary. Whenever they did not know how to write a Chinese character, they would asked their teacher for help as that is "*the quickest resort*" (Huiyi-C, 13 April 2006). In addition, Pri C participants were not familiar with *pinyin*. Some of them did not know how to deal with two windows on the computer either.

In summary, the participants' choices of using the ICT tools had some connection with the linguistic and technical challenges they encountered. Some participants reacted actively by choosing an appropriate ICT tool or a combination of the tools to overcome their difficulties. Others reacted passively as they were overwhelmed by the difficulties they encountered.

DISCUSSIONS AND FUTURE DIRECTIONS

The reported study started off with the major focus on how Singapore students perceived ICT-mediated Chinese compositions and how they made use of the ICT tools to accomplish the stated task. Through the analysis of the collected data, it was discovered that the students' competency level in using the ICT tools, particularly in Chinese computer input devices, is a potential hurdle that will significantly undermine the potential benefits of ICT-mediated writing. Although the issue of students' difficulties in Chinese input has been discussed in prior literature (e.g., Ding, 2002; Du & Crestani, 2005; He, 2003), little or no in-depth, academic-oriented, school-based study has been reported.

Many participants, especially the primary school students, were not able to overcome the hurdle of inputting Chinese using the *pinyin* method. The reasons were two-fold: they had low retention rate in the *pinyin* scheme and they were affected by the Singapore-accented Chinese. Since most of the students in our study encountered a *three-level* translation/transcription hurdle, that is, translating from English to Chinese, from Chinese to *pinyin* and then to keyboard strokes, Singaporean Chinese language teachers should be made aware of this issue. They should consider helping their students overcome the *pinyin* issue before starting ICT composition writing. This three-level translation process is more complicated than the reported double translation process (Wolfe & Manalo, 2004) experienced by L2 learners of European languages. Based on the findings of this study, the research derived the following breakdown of such a complex process (adapted from Xie, 2001):

- a. Transforming ideas into words and syntactic structures in mind
- b. Recalling the pronunciations of individual characters
- c. Mapping the pronunciations into *pinyin*
- d. Mapping the *pinyin* representations into keyboard strokes
- e. Identifying the right characters from the candidate window
- f. Selecting the right characters

The process breakdown confirmed Wolfe & Manalo's (2004) argument that writing with keyboard, an indirect, unnatural written communication process, is more tedious for students with less computer experience. As such, the students may devote too much effort in this aspect and neglect the other higher level writing processes such as planning and revising (Graham, 1990; McCutchen, 1988). This problem is not unique to Singapore students or any student studying Chinese as L2, as a considerable number of learners in China may be facing similar problems due to the interference of dialects (e.g., Du & Crestani, 2005; Duan, 2004; Wang, 2006) or improper design of the curriculum for primary schools (e.g., Ding, 2002). In the foreseeable future, inputting Chinese characters into the computer will remain as a challenge for young learners to carry out e-writing in Chinese.

Therefore, it is necessary to design new pedagogy for learning these tools so that the students can benefit from the technologies, not be hampered by them (Peckham, 1996; Vician & Brown, 2000; Chinnery, 2006). There should also be ample opportunities for the students to practice using the software, the input methods, and training in *pinyin*, as there is often a gap between "having learned the skill" and "making good use of it". Their aim is not only to help the students to pick up, but internalize these skills.

On the other hand, the researchers argued that the training of *pinyin* input should not wait till higher primary school or even secondary school when the pupils are about to write compositions with ICT tools. *Pinyin* training needs to be commenced lower primary school, and incorporate Chinese ICT-based learning into the *pinyin*, speech, and reading curriculum. The Chinese curriculum should include ICT-based activities for assignments such as sentence writing. With such training, the students will be as skilled as they are using English ICT tools when they start Chinese ICT-mediated writing.

Another issue that arose from the study was the designs of the tools. The researchers argued that most of the popular software products in the market (e.g., Microsoft Word, Microsoft IME, PenPlus and PowerWord) have been designed mainly for adult uses (user-interface, software features, Chinese input methods, etc.). It is important to guide the students in selecting the right applications, simplify the user-interface (for example, remove the unneeded menu bars in the Word interface), and to provide them with sufficient training and long-term support.

The researchers' experience in looking for collaborating schools in the early stage of this study shows that a scaling-up of ICT-mediated Chinese writing in Singapore schools may still be hampered by the examination-oriented mindset of the school leaders and teachers in general (Looi, Hung, Chen & Wong, 2006; Tan, 2006). As the Chinese composition papers of the national examinations is still paper-and-pen-based, the educators were likely to raise their concern on the students' ability to revert back to the paper-and-pen writing mode during the examinations if their teachers adopt ICT-mediated writing pedagogy extensively. A positive development is, as stated in the Introduction section of this paper, is that the MOE has been considering the introduction of ICT-based compositions in the national examinations – though it may take a long time for such major change to happen.

The researchers would like to acknowledge two major limitations of this study. First, they had only selected eighteen participants from three schools for the study as we have opted for an ethnographic and qualitative study approach. Despite of the small sample size which cannot grant for generalization of the findings, the researchers argued that some significant trends emerged from the data would offer teachers a good picture of salient challenges that they should take note in nurturing students' Chinese input skills.

Second, because of the time constraint, they had only conducted three empirical sessions of ICT-mediated Chinese compositions for the participants. The primary school participants were overwhelmed by learning so many things in a short period. In addition, the participants did not practice Chinese input at home.

Based on the research findings, they had formulated a long term plan which: a) incorporates teacher professional development and input method pedagogical design; b) develop a student-oriented Chinese writing platform.

As the researchers were also involved in teacher education, they started a teacher professional development project in February, 2007. Curriculum design was one of the goals of the research project. However, they did not adopt the traditional instructor-centered approach. Instead, they conducted a Collaborative Inquiry, an approach that promotes the collaboration between researchers and practitioners to advance both knowledge and action (Darling-Hammond, 1996). They invited 14 Chinese Language teachers from 12 schools, and two MOE officials to participate in the project. They intended to research into designing and developing an ICT-based Chinese writing curriculum. Their goal was that the curriculum must not only ensure that the needs of the students are met, it should also be integrated to the existing curriculum. Therefore, it was crucial to involve in-service teachers and MOE officials in the design process.

After they had developed the pedagogy, conducted trials and successive refinements, they would be able to identify the parts of the learning process and scaffolding that can be automated. They would then work with software developers to develop writing software. The aim of the software was to lighten the workload of the teacher during students' writing activities and allow the students to practice Chinese writing during their free time. From the Chinese input stand point, they hoped to design a seamless environment for switching between handwriting and pinyin input methods. This would enable the students to select the appropriate input method as and when needed. With such a platform, many more schools would be likely to promote Chinese writing activities.

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