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# Studying Chinese Characters in a Web-Based Learning Environment: A Case Study of Swedish University Students

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## Abstract

This survey study aims to investigate the perceptions learners have of the character-learning strategies they employ when taking a web-based course in Chinese. The seven Likert-scale statements are included in the questionnaire to examine learners' opinions on the three character-learning strategies that are widely used in traditional campus courses. A total of 65 students who completed the beginner level 'Chinese Characters' web-based course at a university in Sweden completed the survey. The results suggest that students in web-based courses consider these three strategies to be just as helpful and effective as campus students; moreover, the more orthodox strategy – rote learning – is found to be the most popular among distance students. Furthermore, findings of this study provide insight into the limitations and advantages associated with a web-based course, and also the possible effect learners' age and gender may have on learning strategy preferences.

*Keywords:* Chinese characters, character-learning strategy, web-based courses, distance education

## Introduction

The widespread impact of digitalization on every aspect of our lives has led to distance education becoming an important mode of education. With the rapid development of information and communication technology tools, online courses not only provide the flexibility to study from any location and at any time, but have also been proven to lead to positive learning outcomes and higher level of satisfaction from students (Johnson et al., 2000; Navarro & Shoemaker, 2000; Kirtman, 2009; Feeley & Parris, 2012). The last two decades have seen a growing interest in research on web-based education in general; however, few studies investigate distance education in relation to specific subjects, such as teaching Chinese as a foreign language.

Over the last 15 years, Sweden – and indeed, the rest of the world – has witnessed a boom in the teaching and learning of Chinese as a foreign language. In 2014, Chinese became the fifth modern language in Sweden. The result of this is that all upper-secondary schools are required to offer Chinese as a subject. A worldwide interest in teaching Chinese together with the expansion and diversification of online learning environments has also been identified (White & Zheng, 2018; Kan et al., 2018). The learning of Chinese characters presents a major challenge for students with an alphabetic language background; this appears to be even more so the case for students in online courses in Chinese. Various practices and strategies that are useful in the traditional classroom cannot be applied in the virtual classroom. For example, it is difficult for teachers to determine students' written performance in a virtual classroom; consequently, they are unable to provide timely feedback that can help students write Chinese characters in the correct manner. To date, few attempts have been made to evaluate the practices and strategies used in online courses in Chinese characters.

## Purpose of This Study

A few survey studies have investigated the character-learning strategies of learners of Chinese (McGinnis, 1999; Tseng, 2000; Shen, 2005). However, the students who were recruited in their research all learn Chinese in the classrooms in person. Meanwhile, recent developments in distance education have highlighted the need to incorporate the web-based learning environment into this topic. This paper aims to survey students' experiences taking the web-based course in Chinese characters, and the effectiveness of teaching strategies and practices employed in the online environment, with focus on the following three commonly used strategies: orthographic and radical knowledge, visualization of characters and rote learning (see the next section for a review of these strategies). Three research questions will be addressed: 1) Are these three character-learning strategies perceived to be helpful to students from an alphabetic language background who learn Chinese characters via distance education? 2) Are there any other factors (age, gender, etc.) that affect students' perception of these character-learning strategies? 3) What challenges do students in online courses face when learning Chinese characters?

## The Chinese Writing System

Chinese differs from alphabetic languages such as English and Swedish in that the character is the basic unit in the Chinese writing system, also known as a non-alphabetic ideogram (Yan et al., 2013). Every character is a non-linear and visually complex graph, which directly maps on to a syllable or a morpheme. Therefore, Chinese is also referred to as a morphosyllabic language (DeFrancis, 1989). The complexity of the character structures and the lack of graph-phoneme correspondence together contribute to the level of difficulty for students whose mother tongue is alphabetic.

Chinese characters are formed by strokes that can be organized in different patterns. In modern Chinese, there are nearly 30 strokes; however, there is no rule about the number of strokes a character can have or how the strokes can be structured. Some strokes are rather simple to recognize and write, like 一 (héng, horizontal stroke) and 丿 (piě, left-falling stroke), while others are complex, like ㄣ (héng-zhé-zhé-piě, horizontal double turning and left-falling) and ㇇ (shù-zhé-wān-gōu, vertical turning bending and hook). Some have few strokes, like 人 (rén, people, 2 strokes), while others have many strokes, like 餐 (cān, meal, 16 strokes). The most complex Chinese character has 64 strokes (DeFrancis, 1984, p. 75). It is thus difficult for a non-native learner to quickly grasp the graphic configuration of Chinese characters (Shen, 2005).

Chinese characters can be placed in two categories based on their structural complexity: single body characters and compound characters. Single body characters are those that cannot be divided into distinct sub-character components, while compound characters are those that contain two or more distinct sub-character components (Wang et al., 2003). Single body characters are among the earliest characters to have been created in Chinese history, most being pictograms and simple ideograms. Many can be traced back to *jiaguwen* (oracle scripts) or *jinwen* (ancient Chinese script inscribed on bronze objects) and to their original drawing-like character pattern. Although they are few, it is very important that students learn the single body characters since they form the basis of compound characters. For this type of character, the meaning attached to their drawing-like origin can help learners recognize and remember. For example, the oracle bone script of the character 山 (shān, mountain) resembles a drawing of mountains, and the oracle bone script of the character 水 (shuǐ, water) resembles flowing water. Because of the picto-nature of the single body

characters, their earlier scripts greatly helped learners recognize and even remember the characters.

Meanwhile, 90% of Chinese characters are compound characters. They can be combinations of different single body characters, or combinations of two or more radicals. Radicals are the smallest orthographic units within a compound Chinese character, and they have either a semantic or a phonetic function: for example, 女 (nǚ, women) is the semantic radical in the compound character 婚 (hūn, marriage), whereas 昏 (hūn, to faint) is the phonetic radical. The semantic radicals provide meaning cues to the compound characters, but the phonetic radicals may or may not provide helpful pronunciation cues. Some radicals can be single body characters, such as in the case of the two radicals in the example 婚 above.

Many compound characters share the same semantic radical, such as 裙 (qún, skirt), 裤 (kù, trousers) and 袖 (xiù, sleeves). All have the clothes radical 衤 (radical of clothes), as they all relate to clothes or clothing. Other examples are 河 (hé, river), 海 (hǎi, sea) and 湖 (hú, lake): all have the water or liquid radical 氵, as all three characters relate to water or liquid. There are quite a few semantic radicals that have a very strong power of formatting Chinese characters, such as 扌 (radical of hand), 亻 (radical of human), and 心 (radical of heart). Hence researchers believe that grouping compound Chinese characters based on semantic radicals may help learners to recognize or remember them (Xu & Padilla, 2013; Xu & Chang, 2014).

## Chinese Characters: Online Teaching and Learning Strategies

In research on teaching Chinese as a foreign language, there is a large body of work on effective strategies for teaching and learning Chinese characters (Taft & Zhu, 1997; Taft & Chung, 1999; Shen, 2005; Luo et al., 2013; Opitz et al., 2014; Yan et al., 2013; Chen & Yeh, 2014; etc.). Literature covers a number of generally accepted strategies and practices for teaching and learning Chinese characters, and these will be summarized in this section. However, previous research focused solely on teaching Chinese in the traditional classroom; few studies exist on teaching and learning Chinese characters online.

### *Orthographic and radical knowledge*

Learning the orthographic structure and the radicals has proven to be an effective learning strategy for both Chinese children and non-native students (Feldman & Siok, 1999; Wang et al., 2003; Qiu et al., 2006; Shen, 2005; Shen & Ke, 2007; Huang et al., 2014; Lam, 2014; Chen & Yeh, 2015; Kuo et al., 2015; Zhang et al., 2016). Wang et al. (2003) found that beginner-level learners are already sensitive to the structural complexity of Chinese characters. An experimental study by Shen (2000) confirms that radical knowledge greatly helps students to recognize and produce new characters that are phono-semantic compounds. Based on surveys of 95 English-speaking students of Chinese (Shen, 2005), a total of 176 strategies were identified, and the use of radical knowledge was reported to be the most popular cognitive strategy.

Empirical studies ( Craik & Tulving, 1975; Xu & Padilla, 2013) reveal that memory is greatly enhanced when new information is related to what is already known. Xu and Padilla (2013) recruited two groups of students to test the meaningful interpretation and chunking method for learning and remembering Chinese characters. One student group received explicit instruction on orthography and radicals that they followed up with self-study; the second group received instruction on the traditional stroke-order and their learning involved rote memorization. A comparison of the performance of the two groups indicates that students

benefited from the meaningful interpretation and chunking method in terms of memorization and immediate learning (Xu & Padilla, 2013).

Therefore, we hypothesize that *knowledge of radicals and orthography helps students to learn Chinese characters in online courses.*

### **Visualization of Characters**

The complex structure of Chinese characters makes visual processing an important part of reading and the first step in word recognition (Luo et al., 2013). Due to the visual complexity of Chinese characters, visual skills and visual processing have been found to play a more important role in learning how to read Chinese than in learning how to read alphabetic languages. According to Luo et al. (2013), there are two types of visual processing: geometric-figure processing and character-configuration processing. Both are crucial in terms of reading Chinese characters; however, geometric-figure processing is more important for beginners. Stroke analysis is the first step in visual character identification, followed by the analysis of orthographic units. After this comes the linkage between phonology and meaning (Wang et al., 2003). This implies that the demonstration of how strokes are positioned in a character is essential for beginners to recognize and remember the character. Opitz et al. (2014) also found that visual working memory exerts unique influence on learning Chinese characters and suggest enriched visual input to enhance the learning of Chinese characters.

Unlike with traditional classroom teaching, it is much more challenging for teachers to observe students' handwritten characters in online courses; as such, the visualization of characters strategy may be much more relevant for distance-learning students. We believe that the use of visual inputs can assist students in their learning of characters. With the development of technology, videos and pictures can be used effortlessly in the virtual classroom, and teachers can demonstrate how to write characters in the same manner as teachers in the traditional classroom.

Therefore, we hypothesize that *the use of visual inputs will help students to learn Chinese characters in online courses.*

### **Rote Learning**

As a popular study technique in language learning, rote learning (in this case the repeated writing and practicing by hand of characters) is also a method traditionally used in the memorization of Chinese characters among young Chinese school children. Strokes in every Chinese character have a clear order, which is why handwriting practice that employs the correct order is believed to facilitate the learning of Chinese characters (Guan et al., 2011). Rote learning may strengthen the graphic pattern of the character in the learner's brain, and thus help in the recognition and memorization of characters. Previous survey studies (McGinnis, 1999; Tseng, 2000) show that rote learning (here, repeated writing) is the most commonly used strategy among non-native Chinese learners (English speakers and German speakers).

According to Wang et al. (2003), the activation threshold of orthographic units in Chinese depends on the frequency in occurrence of characters and their component radicals in everyday use. It has been found that learners recognize high-frequency characters more quickly and more accurately. This confirms the effect of frequent exposure of characters on learners. In her survey study, Shen (2005) shows that a systematic preview and review of characters also play an important role in language learning. Xu and Padilla (2013) found that although the method of meaningful interpretation chunking is best for enhancing short-term memory, repetition has more of an effect when it comes to promoting long-term memorization.

Therefore, we hypothesize that *repeated hand-writing practice and character-related assignments help students to learn Chinese characters in online courses.*

## Method

A quantitative approach was chosen to test the three hypotheses and to gain insight into how other factors affect students' perceptions of character-learning strategies. A questionnaire was designed for current and former students of the web-based course in Chinese characters at Dalarna University (DU) in Sweden. The questionnaire had three parts. The first part collected background information about the learners, e.g., age, gender, and experiences learning Chinese; the second part concerned their experience with the real-time web-based course in Chinese characters; and the third part established students' perceptions of the usefulness of several character-learning strategies, using 7-Likert scale questions. At the end of the questionnaire, there were two open-ended questions. A pilot study was conducted to check the clarity and phrasing of the questions in the questionnaire.

### *Web-based Course in Chinese Characters*

Sweden's Dalarna University (DU) is well-known in Europe for its pioneering form of web-based education. Indeed, the Department of Chinese at DU has offered web-based courses at various levels to students from Sweden and other EU countries since 2007. The course in Chinese characters, a true-beginner level course, integrates a number of strategies and practices to assist students in their learning of Chinese characters in a synchronous web-based learning environment. The experiences of these students are extremely interesting and relevant in terms of the topic teaching and learning Chinese as a foreign language in an online environment; moreover, their experiences may also contribute to research on distance language education.

The questionnaire was aimed for use with DU students who had taken or who were in the process of taking the web-based course entitled Chinese Characters. This is a true-beginner level course in Chinese that focuses on the Chinese orthographic system; majority of the students are native speakers of Swedish, while a few are from other EU countries, such as Italy and Germany. Each week during the academic term, the teacher hosts a 90-minute seminar (the language of instruction is English) in a virtual classroom, during which time students interact and have active discussions with the teacher about Chinese characters. At the beginning of the course, the teacher presents the origin and development of the radicals, chunks and characters. Furthermore, the teacher introduces the four major character categories (pictograms, ideograms, associative compound and phono-semantic compound) using plenty of examples. Visual illustration of the strokes, the order of strokes, components and configuration patterns of some Chinese characters in picture- and video-form comprises a large proportion of the study material. The teacher often demonstrates how to write Chinese characters in the virtual classroom, and students practice writing characters during the seminar with the teacher providing immediate feedback. In addition to the scheduled online seminars, students enrolled in this course are also expected to complete a weekly assignment that mainly consists of repeated hand-writing practice and character-related exercises.

### *The Demographic Distribution of the Respondents*

The questionnaire was emailed to more than 300 students, and 65 completed the questionnaire, with a response rate of roughly 22%. Some were true beginners at the time they took the course in Chinese characters, while others had already acquired a certain level of Chinese. They were aged between 18 and 70. Most were studying Chinese for the purpose of working and visiting China or communicating with family members. Although the response

rate was not high, we still obtained valuable information about students' views on learning Chinese characters in a synchronous web-based learning environment.

Of the 65 respondents, 40 were male and 25 were female. About half (54%) belonged to the age group 20-29; 18% belonged to the age group 30-39; 17% belonged to the age group 40-49; and 9% were over 50. One respondent belonged to the age group younger than 19 (2%), however, this group was not included in the statistical analysis as there is only one sample in this group. This distribution corresponds to the age ratio of students taking Chinese at DU; as such, the respondents can be considered representative. Nearly 74% of respondents had no prior experience of learning Chinese characters in a campus learning environment, which meant that their first experience of learning Chinese characters was in a web-based course.

**Reliability of the Scale**

We used SPSS to measure the reliability of the questionnaire, with regards to the 17 Likert-scale statements. The Cronbach's Alpha of the scales is 0.927, indicating high consistency of the scales. The Inter-Item Correlations are all positive and the Item-Total Correlations are all larger than 0.30. This indicates that the items are highly consistent, in other words, the scales are very reliable.

Table 1  
*Reliability of the Likert-scale statements in the survey*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.927	0.928	17

**Analysis Instrument**

To draw our conclusions, we adopt sign-tests to calculate whether the statements in the questionnaire were statistically significant. The Z-values in the sign-tests were calculated using the following formula

$$Z = P_{obs} - 0.5 / \text{square-root of } (0.5 \times 0.5) / n^*$$

where  $P_{obs}$  = number of answers with the value of either 1, 2, or 3 (i.e. positive attitudes to the statements) /  $n^*$  and where  $n^*$  = the total number of answers except value 4 (i.e. neutral attitude to the statements). Whenever the Z-value of a statement is larger than 1.64, then it can be said with confidence that the statement is supported by the respondents with statistical significance.

**Findings**

**The Significance of the Hypotheses**

To test the hypotheses regarding three character-learning strategies, two to four indicators were formulated for each hypothesis (i.e. variable) for measuring purposes. These indicators were then reflected by one or several statements in the form of Likert-scale questions in the questionnaire. Table 2 displays the variables and indicators, as well as 15 key statements. The computed Z-value of each statement is presented in Table 2. The threshold of the standardized score (Z) is 1.64 and is positively correlated to the level of support by the respondents.

Table 2  
Z-values Result of the Statements

Variables	Indicators	Statements	Z-values
1. Orthographic and radical knowledge	Structure of the characters	Helps with the memorization of the meaning of the characters	5.85
	Origin and development of the characters	Helps with the memorization of the meaning of the characters	5.44
2. Visualization of characters	Teacher's demonstration in the online classroom	Important to beginners	3.20
		Important to higher level students	2.88
	Students' demonstration in the online classroom	Important to beginners	0.28
		Important to higher level students	0.92
	Using pictures in the online classroom	Helps with the recognition of characters in written form	5.85
		Helps with the memorization of characters	5.01
	Using video in the online classroom	Helps with the recognition of characters in written form	5.71
		Helps with the memorization of characters	5.58
3. Rote learning	Repeated hand-writing practice	Helps with the recognition of characters in written form	6.47
		Helps with the memorization of characters	7.26
		Helps with the learning of the structure of characters	7.31
	Character-related assignments	Helps with the recognition of characters in written form	6.92
		Helps with the memorization of characters	6.26

The Z-values for all but two statements are larger than 1.64, meaning the respondents agree with these statements with statistical significance. The only exceptions are the two statements corresponding to the indicator about the importance of students' demonstration in the virtual classroom. Therefore, it can be stated that on the whole, the respondents support our hypotheses that the three character-learning strategies (orthographic and radical knowledge, visualization of characters and rote learning) help students to learn Chinese characters in web-based courses.

A comparison of the Z-values of these three hypotheses shows that the statements under the third hypothesis have the highest Z-values (over 6). In other words, statements concerning the rote learning strategy received the most support from respondents. The statements corresponding to the other two strategies also received generally strong support, with some of the related statements receiving a Z-value between 5 and 6.



### ***The Demographic Evidence of the Hypotheses***

To further investigate the influence of other factors on the learners' views of character-learning strategies, group analysis based on demographic factors of age, gender, and campus language-learning experience is conducted. Since the total number of our responses was relatively small, we chose to use non-parametric analysis tools.

The Kruskal Wallis test was used to compute the effect of age groups. The results show that for the statements concerning rote learning, there is no statistically significant difference among age groups. However, significant variations can be observed for some of the statements regarding the other two strategies.

In terms of the hypothesis concerning orthographic and radical knowledge, the different age groups have slightly varied views on the statements about the origin of characters and development knowledge. From the mean ranks of different age groups, the younger students between 20 and 29 had the highest rank, meaning they supported this statement most, while older students over 50 supported this statement least.

The same trend can also be observed for two of the statements under the hypothesis regarding visualization of characters (Table 3): students' opportunity to demonstrate how to write the characters stroke-by-stroke in the online classroom is considered important to both beginners and higher-level students. The youngest group (age 20 to 29) lends the strongest support to both statements. As to the statements concerning the use of pictures and videos, the strongest support comes from the age group 40-49, but the more senior group (50 and older) offers the least support. The mean ranking of the other statements shows almost the same pattern: the senior group (over 50) recorded the highest mean ranking (least support) followed by the age group 30-39. The age group 40-49 and the youngest age group 20-29 recorded the lowest mean ranks (most support). This further indicates that the listed learning strategies are more valued by the younger students and the students in the age group 40-49.

The Mann-Whitney U test was used to test the differences between responses to the statements of the two gender groups (Table 4). The results show that there is no statistically significant difference between the opinions of the two gender groups to most of the statements, but for all statements concerning rote learning, gender difference is statistically significant with the p-values smaller than 0.05. The mean ranks of these statements show that female students support them more than male students. There are three statements that show a significant difference between male and female students: one is about students having opportunities to demonstrate writing characters online, and two others are about videos that help students recognize or remember characters. Female students also show more support for these statements. Although other statements show no significant differences between male and female students, their mean ranks also indicate that the female students support those statements more than the male students do.

Table 3  
*Kruskal Wallis test result of statements concerning the visualization strategy*

Statements	Age groups				
	p-value	20 - 29	30 - 39	40 - 49	Over 50
		Mean rank	Mean rank	Mean rank	Mean rank
Structure knowledge helps with the memorization of the meaning of the characters.	0.419	27.41	28.95	21.95	34.75
Origin and development knowledge help with the memorization of the meaning of the characters.	0.024	22.48	32.30	28.10	41.92
Teacher's demonstration is important to beginners.	0.13	22.93	38.30	23.35	37.75
Teacher's demonstration is important to higher levels.	0.129	23.59	32.25	27.20	38.33
Students' demonstration is important to beginners.	0.023	21.20	34.60	33.80	34.58
Students' demonstration important to higher levels.	0.05	21.88	33.05	34.75	32.42
Pictures help with the recognition of characters in written form	0.009	24.63	36.25	19.15	40.25
Pictures help with the memorization of characters.	0.062	24.57	33.30	22.60	39.67
Videos help with the recognition of characters in written form.	0.019	24.91	35.55	19.50	39.50
Videos help with the memorization of characters.	0.015	25.20	33.75	19.20	41.67
Handwriting practice helps with the recognition of characters in written form.	0.725	26.89	31.90	24.85	27.42
Handwriting practice helps with the memorization of characters.	0.256	27.13	33.05	20.75	31.25
Handwriting practice helps with the learning of the structure of characters.	0.728	29.13	24.20	25.35	29.00
Assignments help with the recognition of characters in written form.	0.846	28.32	29.60	24.50	25.17
Assignments help with the memorization of characters.	0.588	27.36	32.45	23.15	27.17

Table 4  
Mann-Whitney U test of gender

Statement	P-value	Mean Rank	
		Male	Female
Structure knowledge helps with the memorization of the meaning of the characters.	0.144	30.47	24.30
Origin and development knowledge help with the memorization of the meaning of the characters.	0.114	30.70	23.95
Teacher's demonstration is important to beginners.	0.082	31.00	23.50
Teacher's demonstration is important to higher levels.	0.547	29.05	26.43
Students' demonstration is important to beginners.	0.014	32.29	21.57
Students' demonstration important to higher levels.	0.133	30.61	24.09
Pictures help with the recognition of characters in written form.	0.231	30.95	24.93
Pictures help with the memorization of characters.	0.901	28.21	27.68
Videos help with the recognition of characters in written form.	0.046	31.42	22.86
Videos help with the memorization of characters.	0.027	31.79	22.32
Handwriting practice helps with the recognition of characters in written form.	0.035	31.41	22.89
Handwriting practice helps with the memorization of characters.	0.001	33.44	19.84
Handwriting practice helps with the learning of the structure of characters.	0.030	31.33	23.00
Assignments help with the recognition of characters in written form.	0.033	31.59	22.61
Assignments help with the memorization of characters.	0.040	31.47	22.80

### ***The Challenges of Learning Chinese Characters in a Web-based Learning Environment***

The open questions gave students the opportunity to comment on the challenges they have experienced learning Chinese in a web-based learning environment. Most students describe the challenge of remembering meaning, pronunciation, and the graphic pattern of the characters. Some describe this challenge separately, explaining, for example, how hard it is to remember the meaning of the characters or how hard it is to “remember how to write them from memory.” Several other students, meanwhile, talked about the combination of pronunciation and meaning, stating the challenge of how “to match the sound, meaning, and written form of a character;” the most difficult aspect of learning Chinese characters, they felt, was the ability “to understand how characters are built (radicals, phonetic, meaning) in order to memorize them and guess the meaning of the new ones.”

A second frequently mentioned challenge was that of distinguishing between similar characters. Many students stated that there are too many characters and that they are similar

graphically. One student wrote: “for us in the West they look alike. We have to learn to identify them from the start.” Other students were of a similar opinion, e.g. “the small stroke change makes a totally new character and meaning,” it is challenging “when two characters are too similar.”

Knowing how to use the characters correctly was also noted as a challenge. One student claimed that this is because the formation of words (with two or more characters) is not rule-based, and “it may be dangerous (tricky) to remember something when you do not know the circumstances where it is used.” Another student expressed a similar thought: “I find it tough when we learn characters that we cannot use easily in our normal speech.” Some students also commented on the difficulty of long-term recall of characters.

## Discussions

This study was set up with aim of investigating the strategies used by students to learn Chinese characters in a web-based course. The initial objective was to investigate how different character-learning strategies are perceived by learners in two different learning environments. The results of the survey show that the three strategies – orthographic and radical knowledge, visualization of characters and rote learning – are found to be helpful and important to students in the web-based course; therefore, the hypothesis that the three strategies are useful to students studying Chinese in a web-based learning environment is confirmed.

Although the overall results of the survey imply that the web-based learning environment does not affect the character-learning strategies of students, further analysis of their responses reveals two interesting patterns. First of all, the traditional strategy rote learning receives the strongest support by distance-learning students compared with the other two strategies. This is in line with findings from previous studies (McGinnis, 1999; Tseng, 2000): that rote learning is recognized as being the most commonly used strategy among native English and German speakers studying Chinese in classroom courses. This finding appears to suggest that “drawing” the graphic symbols by hand is best for memorization even in the web-based learning environment. Due to digitalization, pen and paper have largely been replaced by the keyboard. Moreover, there have been great developments in terms of software and apps for learners to practice their writing of Chinese characters on various digital devices. Many of these we recommended our respondents to use in the online course. However, despite this technology offering such convenience and flexibility in terms of the learning of characters, it does not seem to affect the character-learning process at a fundamental level. The second important finding is that the writing demonstrations in the virtual classroom, as part of the visualization strategy, receives the least support. As Table 2 shows, distance learners respond to the statements on students’ writing demonstration in the online seminar with the lowest *Z* values. Though they do show support to the statements concerning the teacher’s writing demonstration, the corresponding *Z* values are much lower than the other statements in the survey. This observation does not entirely contradict findings from previous studies (Wang et al., 2003; Luo et al., 2013; Opitz et al., 2014) about the importance of graphic and visual strategies; however, they do suggest that the writing demonstration may not be as helpful and effective in the online learning environment as in the traditional campus learning environment. In the web-based course, initially both the teacher and students used the mouse to “draw” the character for the purpose of demonstration. Using a mouse to draw a character is very different from using a pen to write a character. Therefore, it is often very challenging for the teacher of a web-based course to deliver a visual presentation that sufficiently covers all the crucial and subtle stroke and spatial information. Furthermore, it is just as difficult, if not more so, for students to practice or to ask questions. This is a main

source of frustration that comes with learning Chinese characters online. Subsequently, the teacher made use of a high-tech writing pad or placed a whiteboard in front of the webcam for their writing demonstrations. However, it is not economically viable for students to purchase such tools just for this course. This explains why the students' character writing practice is not well supported, whereas the teacher's writing, comparatively speaking, is (with statistical significance) in the virtual classroom. This observation unveils a limitation of the online course in Chinese and points to a need for improvements to educational technology. Nevertheless, the online course made good use of images and videos to provide students with visual input, a factor that the respondents to the survey appreciated.

The second research question in this study sought to determine the effect of other factors (i.e. age, gender, previous learning experience) on learners' perceptions of these strategies. The results indicate that age plays a very important role. Among the four age groups ranging from 20 to 50 and older, learners from the 20-29 age group offer the strongest support for statements concerning the writing demonstration by the teacher and students in the virtual classroom. They considered students' writing demonstrations in the virtual classroom helpful for the learning of characters for both beginner and high-level students: this differed significantly from the other three age groups. A possible explanation for this finding may be the fact that this group of students are "digital natives (Prensky, 2001)." They are most likely to be skilled users of digital tools and able to use the computer mouse to write Chinese characters on the screen. As such, they benefit from this type of in-class activity. Meanwhile, learners from other age groups do not support this practice as much as the age group 20-29. Findings show that the most senior group (50 and above) lend the least support to almost every statement under the visualization strategy. Besides the practice of demonstrating character writing in the virtual classroom, they were also not as enthusiastic about the use of pictures and videos. This finding comes as no surprise, as they began using computers and other IT (information technology) tools much later in life compared to the other age groups. For many, digital competence is a challenge due to both biological and psychological factors.

One unexpected finding is the response of the age group 40-49 to the use of pictures and videos. Their support was stronger than that of the age groups 20-29 and 30-39. Though difficult to explain, it may have something to do with the respondents' basic education. The basic education of the 20-29 learners and most of the 30-39 learners was integrated with IT. The basic education of the other two age groups, meanwhile, included little IT integration. Therefore, the use of images and videos may appeal to them. While many of the respondents from the 50 and above age group struggled with technical issues when working with digital files (this according to students' own reports or the experiences of instructors), respondents from the 40-49 group were much more digitally competent and may therefore have found images and videos stimulating and made best use of them. However, considering the small number of respondents in the four age groups, these findings are preliminary. A further study with a larger number of respondents is needed to investigate how learners from different age groups evaluate the various character-learning strategies and practices in a web-based course in Chinese.

As for the part gender plays in this study, a larger number of female learners (38% of the respondents in this study) than male learners support the statements. This is consistent with other findings that show that females tend to choose the value that corresponds to stronger support on the Likert-scale whenever they agree with a statement. A more relevant observation for the purpose of this study is that female learners are more supportive of the statements about the use of videos for character-learning (visualization strategy) and all statements about rote learning than male learners with statistical significance. Females are likely to be more patient and attentive to repetitive exercises and homework. This is consistent

with previous findings (Bidjerano, 2005) that indicate that females prefer learning strategies that they can regulate themselves.

The third question in this study related to the challenges that confront students learning Chinese characters in web-based courses. The greatest challenge reported was the memorization of meaning and pronunciation, and the memorization of and ability to distinguish between graphic patterns over time. These difficulties derive mainly from the nature of the Chinese writing system, i.e. the lack of rules for positioning the strokes in a character, the large number of form-like characters and the limited pronunciation clues provided by the graphic symbols. This finding is in line with existing literature (Shen, 2005; Xu & Padilla, 2013; Xu & Chang, 2014). As such, the indication is that students in a web-based learning environment face the same challenges as their campus counterparts in terms of the learning of Chinese characters.

## Conclusion

This study was designed to investigate the perception of Chinese learners on strategies for teaching and learning Chinese orthography in a synchronous web-based learning environment. It has found that generally speaking, the three common strategies (orthographic and radical knowledge, visualization of characters and rote learning) reported in previous studies are also recognized as helpful and important for distance-learning students, as the challenges that they experience result mainly from the nature and traits of the Chinese characters, just as is the case for students in traditional classrooms. Surprisingly, rote learning is perceived as the most effective strategy used to learn Chinese characters by learners in web-based learning environments. Information technology may have drastically changed education in many aspects, yet several traditional and seemingly “outdated” methods and practices remain viable even in the digital age. According to this study, various other practices and methods, such as character-writing demonstrations, represent a limitation of the web-based Chinese character course. This study also demonstrates that age and gender can affect strategy preferences; however, we cannot come to any firm conclusion on this since the number of respondents, in terms of both age and gender, was low. Further studies are therefore to be recommended that can examine these factors more closely.

This study adds to the growing body of research in the fields of both distance education and teaching Chinese as a foreign language. It is the first attempt at research on learners’ perceptions of character-learning strategies in a web-based learning environment. Findings from this study may have some pedagogical implications that may interest instructors of web-based courses in Chinese. One weakness of this study is the relatively low number of respondents who completed the survey; as such, a large-scale survey study is to be recommended so that the various observations provided here can be validated.

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## Appendix: Questionnaire

<b>Part one: Background information</b>
1. Your gender Male /female
2. Your age (tick the age group you belong to) Younger than 19 / 20-29 / 30-39 / 40-49 / over 50
3. Have you ever learnt writing Chinese characters by hand before you took the Chinese character course(s) in Dalarna University? Yes / no. If yes, where?
4. Have you ever learnt to write Chinese characters in a campus course? Yes / no. If yes, where?
<b>Part two: Online lectures of Chinese characters at Dalarna University (please value the importance or effectiveness and tick the applicable number on a scale from “extremely important/effective” to “not important/effective at all”)</b>
1. Do you think it is important to learn how to write Chinese characters stroke by stroke by hand?
2. Do you think it is important that the teacher demonstrates how to write a Chinese character stroke by stroke by hand during the online lectures of Chinese character I?
3. Do you think it is important that the students are given opportunities to practice writing characters by hand during online lectures of Chinese character I?
4. Do you think it is important that the teacher demonstrates how to write a character stroke by stroke by hand during the online lectures of Chinese character II?
5. Do you think it is important that the students are given opportunities to practice writing the characters by hand during the online lectures of Chinese character II?
6. Do you think the equipment (such as whiteboard or draw etc.) in our online lecture is effective when the teacher or students demonstrate writing Chinese characters?
<b>Part three: Your opinion of the following statements (please tick the applicable number on the scale from “totally agree” to “totally disagree”)</b>
1. The repeated hand-writing practice helps me to remember the characters.
2. The repeated hand-writing practice helps me to recognize the characters when I see them in written form.
3. Writing Chinese characters by hand helps me to learn the structure of the characters.
4. Learning the structure of Chinese characters helps me to remember the meaning of the characters.
5. Learning the origin and development of the Chinese characters helps me to remember the meaning of the characters.
6. Using pictures to demonstrate the structure and / or development of the Chinese characters during the online lectures helps me to remember the characters.
7. Using pictures to demonstrate the structure and / or development of the Chinese characters during the online lectures helps me to recognize the characters when I see them in written form.
8. Using videos to demonstrate the structure and / or development of the Chinese characters during the online lectures helps me to remember the characters by heart.
9. Using videos to demonstrate the structure and / or development of the Chinese characters during the online lectures helps me to recognize the characters when I see them in written form.
10. The weekly assignment of the Chinese character course(s) helps me to remember the characters.
11. The weekly assignment of the Chinese character course(s) helps me to recognize the characters when I see them in written form.
<b>Part four: Open-end questions</b>
1. What is the most difficult part when learning Chinese character?
2. What do you think is most important when learning Chinese character?