The use of romanized Chinese by first- and second-grade pupils: challenges in learning pinyin

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Abstract

The challenges in learning pinyin, the romanized Chinese orthography, faced by 5-to-7-year-olds, have received little attention. This study represents an attempt to better understand learning an alphabetic writing system from the viewpoint of the alphabetic principle, in the context of the Chinese language, by examining both reading aloud and spelling, with a particular focus on spelling.

To detect the challenges, a pinyin syllable-type test (STT) was developed, in which syllables were classified into seven spelling types guided by the alphabetic principle, where there is a letter–sound correspondence. Syllables of all the lengths under each type of spelling pattern were given to two age groups, 6-year-old first-grade pupils and 7-year-old second-grade pupils, at the start of their school year. The sample consists of a total of 192 pupils.

In spelling, the STT reveals that challenges appear when the spelling type departs from the alphabetic principle. The results show that the hardest type of spelling is not the type containing the longest syllables, but a type one-half of that length, for which the correspondence between letters and sounds is abridged, but explicitly taught. In contrast, the latter type poses no problem in the reading-aloud test, where the results show little variation between the spelling types.

Comparing the students' performance on the STT shows an order of challenges among the seven types emerging in the first grade. This order is confirmed in the second grade in some types but not others. The pupils' raw data reveal not only what is challenging but also why it is so. Along with an indication of the influence from the local speech, the data also point to the effect of the teaching method, which is more or less uniform all over China. Thus, there is a possible application of the findings to a larger population.

Chapter 1 Introduction to the research

The aim of this study is to investigate the challenges, if any, 5-to-7-year-old Mandarin-speaking children face in learning pinyin[1], the romanized Chinese orthography.

1.1 Statement of the problems

The challenges that children aged from 5 to 7 face in learning pinyin have not been made explicit, owing to a lack of empirical research (Fan 2005; Wei 2006). Pinyin is taught at every primary school in China, because with it children take two years less to learn the Chinese characters than without it, and it helps to promote the standardized Chinese language (Dai & Liu 1985; Liu 2005). Considering that every child in China learns pinyin at primary school, and most start from pre-school (Li 2008), identifying what challenges there are and why these challenges occur, could be helpful in understanding better how children learn the alphabetic writing system in a Chinese context.

So far, children's learning of pinyin has not been inspected from the viewpoint of the alphabetic principle. By this principle, there is a correspondence between a grapheme and a phoneme. In theory, one grapheme represents one phoneme and, vice versa, one phoneme represents only one grapheme. Ideally, each grapheme should be a single letter. In the real world, this principle is adapted to practicality. For example, the English grapheme *sh*, consists of two letters that usually represents a single phoneme [ʃ]. In the case of pinyin, the romanized Chinese

[1]Pinyin is not a language, but the word is often capitalized in research papers. Here we follow the style of Merriam-Webster (2003), where it is treated as a common noun. Putonghua refers to standard Mandarin, a language, and so it is capitalized here.

writing system, the correspondence between graphemes and phones has often been misunderstood (Lü 1996; Wang 2005).

The traditional Chinese writing system is usually regarded as meaning-based and logographic (e.g. Sterling & Robson 1992; Veltman 1992), although more precisely it is a morphographic writing system (DeFrancis 1984, 1989; Mattingly 1992; Perfetti & Zhang 1995; Read 2016, personal communication). However, pinyin is sound-based, designed according to the alphabetic principle (Veltman 1992; Wang 2005; Zhou 1961, 1964, 2003).

Because of the role of rote learning in the teaching of the Chinese characters, the enduring emphasis is on memorization as being the key to mastering pinyin (Cao 1983; Ha & Wei 2000; Zhou 1961). This indicates that the principle of the alphabetic writing system has not been fully recognized (Wang 2005). Rather, it has been overshadowed by the mechanism of teaching the Chinese characters, where mostly rote learning is involved. Hence, taking the alphabetic point of view allows the possibility to draw a sharper line around the challenges that pupils have to face.

Killingley (2004: 9) pointed out that: "As speech is a continuum of sound, any attempt to represent it in writing is incomplete". Pinyin writing is no exception. Just like English-speaking adults, who are surprised to find that the sound they produce does not always match the spelling of the words (Fromkin 1985), Chinese adults would also be surprised if it were pointed out to them that the pinyin writing system is not that transparent (Wang 2005). In fact, people who learn Chinese as a foreign language are affected by the discrepancies between the spelling and the sound, when attempting to pronounce Chinese characters according to pinyin writing (Bassetti 2007; Wang 2005).

Almost a hundred and forty years ago, in analysing the alphabetic writing system, Henry Sweet, the English pioneer phonetician and founding father of applied linguistics (Sweet 1877, 1884, 1899, 1972), pointed out that the "perfect alphabet would evidently be one in which every symbol bore a definite relation to the sound it represented" (Sweet 1877: 108; see Henderson 1971: 228). However, the "perfect" alphabetic writing, where there would be a consistent one-to-one correspondence between the letters and the sounds, so that a writer could predict the spelling of a word given its pronunciation, and a speaker would always know the pronunciation of a word given its spelling (Treiman 1993), is hardly ever achieved. Given that the practice of teaching pinyin at school is discordant with the principles that pinyin's original design follows (Yin 1993), it is important to see what children do when this explicit teaching contradicts the alphabetic principle. It is likely that pupils will still find it challenging in dealing with discrepancy between the letters and the sounds. "The process of learning new alphabets and new systems of writing implies the establishing of various visual associations. But these associations may be of different kinds, and some may be much easier to establish than others" (Sweet 1899: 36).

Charles Read (1970, 1973, 1975, 1986, 2009), a pioneer in modern research into children's spelling, of English emphasizes that the problem is in the first step: one must grasp the alphabetic principle and learn to analyse syllables into their component speech sounds: "While that analysis may seem transparent to people who have mastered it, it is not self-evident and in fact poses difficulty to many learners" (Read 2009: 261). For young children, learning to spell in the alphabetic writing system is largely an attempt to represent the sounds of words, and, in most cases, it is not a rote attempt to reproduce a memorized string of letters (Carraher & Rego 1983; Read 1971, 1986; Treiman 1993, 2004).

So far, as Read & Treiman (2013) point out in their research into English, research with children in other cultures and learning languages other than English is still relatively scarce (Read & Treiman 2013: 205). If learning to spell is a "creative" learning process, where children attempt to represent the speech and try to induce the principle, and not just attempt to reproduce memorized strings of letters (Read 1986), how would Chinese children spell under the situation that every spelling pattern is taught explicitly in a fixed sequence? To date, there has been little research focused on this area. Studies on children's learning of the English language have shown that the qualitative analysis of spelling errors is of the utmost importance for the investigation of the causes of spelling problems (Frith 1979). However, data from Chinese children are scarce. Only by knowing how children spell can one understand what might be challenging for them.

Pinyin 拼音 literally means "to piece sounds together". It is regarded as, arguably, the world's easiest alphabetic writing system to master (Newnham 1971). However, this remark was made by a linguist who is familiar with more than one alphabetic writing systems.

While research in English finds that reading and spelling are not the same thing, but for young children it is "reading by the eye and writing by ear" (Frith 1979), no observation has been made on young Chinese children. Researchers who do look at difficulties in learning pinyin point out that the teaching method, orthographical rules, and the load on memory pose problems (Cao 1983; Yin 1993; Zhou 1961, 1964), but these points are made on adults' experience and on observation of older pupils. More importantly, what method, which rules, and what load on memory pose problems? To date, little is known. To be more specific, which rule is more challenging than another? Or are they all equally challenging? No known research has addressed such an enquiry; and yet the answer to this question is necessary for the design of the curriculum for the beginner learners, and for the understanding from the educationists' point of view in order

to provide a more efficient teaching practice. These unknowns raised some questions to be addressed for the present research. The following section explains the rationale for attempting the present empirical research.

1.2 Rationale for the research

The present thesis does not argue the truth of a notion; rather, it presents empirical results. These results were collected to answer a research question: what is challenging about learning pinyin for 6-year-old Mandarin-speaking Chinese children?

This investigation is relevant to teachers in at least two ways. First, teachers may want to know what aspects of learning pinyin poses difficulty from the children's perspective, and particularly why it poses difficulty, so that they can develop teaching strategies with better focus, to the ultimate benefit of the children (Treiman 1993; Nunes & Bryant 2009). Secondly, it would be helpful for them to know what to expect from the children (Treiman 1993). Only when teachers understand why children make certain errors are they able to design instruction to best help them (Treiman 1993: vii). As this is an investigation set in the school, this study is particularly motivated by consideration of its usefulness for education. For a start, little is known about what influence the teaching method may have on children, when the children try to apply the various types of explicitly taught letter–sound correspondence.

The significance of this investigation is in the understanding of the alphabetic principle in the application of the pinyin orthography. Pinyin, the culmination of centuries of attempts at romanizing Chinese, was designed on the alphabetic principle (De Francis 1984; Wang 2005; Zhou 2003). However, based on this principle, the same sound can be represented by any arbitrary symbols: by different forms of Chinese characters, by different Roman letters, or by a

combination of different symbols or Roman letters. The comparison of pinyin writing system with other systems may be illuminating.

The following six forms (not including the IPA) for the six selected Chinese syllables (*ji*, *qi*, *xi*, *zhi*, *chi*, *shi*) in Table 1.1 may serve to illustrate the endeavours to romanize Chinese for the past hundred years. Here, ZY stands for zhuyin fuhao, used in Taiwan to phoneticize the Chinese characters (which is not actually Roman, but nevertheless alphabetic in principle); W–G stands for the Wade–Giles phonetic system, familiar in the West for earlier transcriptions of Chinese; MPS2 stands for Mandarin Phonetic Symbol Second Style for Chinese speakers, used in Taiwan, too; Yale stands for the phonetic writing system developed in 1943 by George Kennedy at Yale University; PY stands for pinyin used in China and internationally; and TY stands for tongyong pinyin, another phonetic system using roman letters in Taiwan. Finally, IPA, standing for the International Phonetic Alphabet, is an internationally acknowledged linguistics transcription.

Table 1.1 The six forms of the six syllables

ZY	W–G	Yale	MPS2	PY	TY	IPA
ㄐㄧ	chi	ji	ji	ji	ji	tɕi
ㄑㄧ	ch’i	chi	chi	qi	ci	tɕʻi
ㄒㄧ	hsi	syi	shi	xi	si	ɕi
ㄓ	chih	jr	jr	zhi	jhih	tʂɻ
ㄔ	ch’ih	chr	chr	chi	chih	tʂʻɻ
ㄕ	shih	shr	shr	shi	shih	ʂɻ

These syllables in the six systems, on the one hand, show that there is a similarity (or heritage) between some forms of phonetic system; on the other hand, they indicate how varied

the symbols can be for the same sound. These systems also show the matter of choice in representing the characteristics of certain phonetic features. For example, in order to avoid the difficulties faced by the beginner trying to read a system that uses certain roman letters and combinations of letters in such a way that they no longer carry their expected conventional values, Yale uses *jr*, *chr*, and *shr* to represent *zhi*, *chi*, and *shi* in pinyin, because these combinations of letters will elicit a near-correct pronunciation from an unprepared English speaker.

Considering that pinyin is taught explicitly, from the sounds of the letters to the blending of syllables, using the initial and the final to compose each syllable, it might be expected that children would use pinyin as they are taught, especially since pinyin has only one form of spelling, with no variants at all. However, so far, there is no empirical study focusing on how children spell. The current study is in answer to the calls for such an investigation (Wei 2006), and thus begins to fill the "vacuum" (Fan 2005) in knowledge about what difficulties children have to overcome.

Studies in languages such as Arabic (Aljelajel 2006), Dutch (Niski 1978), German (Castrup 1978), French (Gill 1980), and Spanish (Temple 1980), as well as in English (Read 1970, 1973, 1975, 1986; Treiman 1993, for example), have shed light on the understanding of "children's creative spelling" (Read 1986), which is influenced by speech sounds in a way that is not represented in the spelling, and that most adults are not aware of (Read 1986; Fromkin, et al. 2003). Because adults have learned spelling so well, they tend to forget how spelling deviates from speech. As the design of the present study evolved, it became clear that the key to identifying and understanding the difficulties is through the observation of how children use

pinyin, in their spelling and in their reading aloud: the two main uses of the pinyin orthography. This, therefore, has become the focus of the study.

1.2.1 Why focus on children's spelling?

The natural way to know what challenges pupils face in learning a writing system is to see how they use it: that is, how they write in it and how they read aloud in it. However, reading aloud requires one-to-one sessions and thus more time. Besides, unless recording equipment is included, the pupil's speech sound will not be kept. Spelling, on the other hand, can take place in a classroom and with more pupils doing the activity at the same time, thus needing less time and room occupancy and hence less intrusion and disturbance to the school's regular teaching schedule. Also, because writing yields a durable and tangible product, and because the process of writing can be more directly observed than that of reading aloud, it gives us an opportunity to observe children's logic in detail and at various levels (Read 1986, 2009). Spelling provides a window on children's representation of spoken language and their cognitive development (Frith 1985; Treiman 1993), different from and in some ways clearer than the window provided by reading (Read 2009).

1.2.2 The significance of looking at pupils at the start of the school year

The time that the pupils face the challenges is most likely at the at the beginning of the primary school, because, once they have learned the Chinese characters, they do not need to use pinyin. There are practical reasons for studying a group of children who are at the transition from preschool to primary school. Pinyin is taught in preschools in most parts of China (Wang & Gao 2011; Wu 2007). The difference in teaching pinyin between preschool and primary school is in the intensity. Preschool is a whole-year period starting on 1 September and ending on 31 August

the following year. Pinyin teaching may begin at the start of preschool, but many preschools begin it only in the following March, depending on how much preparation the teachers think the children need. The aim of teaching pinyin at preschool is to give the children good preparation for by the end of preschool, some children are already using pinyin to represent the characters that they do not know (see Rosie's pilot paper in Appendix II-2). Therefore, the notion that pinyin is learned in two months in primary school (Perfetti 2003: 18) is oversimplified, as learning has already taken place in the preschool.

Because the teaching of pinyin has started before children enter primary school, information gathered at the beginning of school seems more important than information collected at any other time, since it tells teachers what children already know and which parts are likely to cause problems at school. That is to say, difficulties that arise for children at this point in time are more crucial than at any other time and can be readily observed. Also, information about challenges in learning to spell in pinyin is particularly useful, given that first-year pupils are encouraged to write what they speak, by using pinyin correctly.

Considering that information collected from those who have already finished one year's learning at primary school is useful, older pupils of 6 to 8 years old were included in this study. More specifically, the inclusion would show up differences between pupils who only learned pinyin less intensively in the preschool and those who learned it intensively and have practised it for one more year at primary school. Moreover, including slightly older and more experienced children potentially gives richer information and a wider range of performance.

1.3 Organization of the thesis

The thesis is organized into nine chapters. Chapter 1, the present chapter, introduces the problems, and explains why the empirical research was carried out among 5-to-7-year-old pupils. It is unavoidable to have a separate chapter devoted to introducing pinyin orthography, because the analysis of the syllables and the classification of the spelling types require some familiarity with the orthography. Thus, a separate chapter, Chapter 2, came into being, which describes the pinyin orthography, what school pinyin is, and how it is taught at school. The language features that the participants use in this study is briefly described at the end of the chapter. Chapter 3 reviews the literature on difficulties of learning pinyin, paying attention to the research methods. Where necessary, methods used in researching spelling difficulties in the English language are discussed. Chapter 4 presents the research questions, the methods adapted for the present investigation, the methodological issues concerned in the design of the syllable-type test (STT), and the limitations of the study. The results are reported in Chapters 5, 6, and 7. Chapter 8 discusses the implications of the results. Chapter 9 draws conclusions with suggestions for future research. The appendices provide the textbook that the pupils used and samples of a pilot and the testing papers. Raw data in reading aloud and pseudo-pinyin spelling are also provided here.

Chapter 2 Pinyin orthography and its teaching in school

Pinyin, which was introduced in 1958, was designed to represent the standard Chinese language. As such it is necessary to briefly introduce the Chinese language and its relationship to pinyin before the introduction of the pinyin orthography and its teaching in school.

2.1 The Chinese language

The Chinese language, also known as the standard Chinese language, and called Putonghua in China, is defined as the common speech. The northern dialect is its basis and it takes the typical modern vernacular writing for its specified grammar; it uses Beijing pronunciation as the standard.

Within the Chinese language family, seven main dialects exist: Mandarin, Wu, Yue (Cantonese is the well-known name), Min, Hakka, Xiang, and Gan (Zhou 1964, 2003; Duanmu 2007). Each dialect in turn consists of many sub-dialects (Duanmu 2007). Mandarin, a northern dialect, is spoken by two-thirds of the Chinese population in various forms (Sheridan 1990). Given that no vernacular form of Mandarin exactly represents the standard Chinese language, pinyin is used as a tool to learn to speak it in China.

Among the distinctive phonetic features of the Chinese language, the first to note is that it is tonal. Generally speaking, there are four tones in standard Chinese. Secondly, there is no consonant cluster in any position of a syllable or word. Therefore, there is no syllable that is like an English word such as “speak”, for example, which has consonant cluster “sp” in the initial position. Thirdly, each syllable or word always ends in a vowel or in one of the two nasal consonants ([n] or [ŋ]).

Regardless of which dialect is spoken, the written form is the same. For example, 字, meaning “Chinese character”, is spelled as *zi* in pinyin. The meaning of a *zi* is clear when written as a Chinese character; but it is not so clear out of context, if the *zi* is transcribed into pinyin syllables, because of the many homophones in the language (Duanmu 2007).

In discussing pinyin, as in the analysis of spoken Chinese, a syllable such as *zi* is not referred to as a word, because the English term “word” has misleading connotations. Every Chinese syllable carries meaning, and is hence a morpheme. However, unlike the typical English word, which is fairly clear in meaning, the meaning of a Chinese syllable is often not clear enough until it is combined with one or more other syllables. Take the English word “school” for example. The Chinese equivalent for it is “学校” in Chinese characters. The pinyin equivalent is *xuexiao*. The first character, or morpheme, 学 means “study; learn”, and the other character 校 means “the particular building for students to study; school”. Consequently, there are two morphemes, and two syllables, for the one English word “school”— 学校 *xuexiao*; that is, *xue* for 学 and *xiao* for 校. Only when the two syllables are written as one unit, the unit of word, can its meaning be unambiguous. In fact, writing in pinyin syllable by syllable, or *zi* by *zi*, or morpheme by morpheme, is called the *first level* of pinyin writing, and the writing in the unit of word is called the *second level* of pinyin writing. Both the terms *syllable* and *level of writing*, will be explained further in Sections 2.2.1 and 2.2.2.

2.2 The Pinyin orthography

The word *pinyin* is an abbreviation for *hànyǔ pīnyīn* (汉语拼音). *Hàn* (汉) means the Chinese Han people, *yǔ* (语) means a language, and so *hànyǔ* means the Chinese (Han) language. *Pīn* (拼)

means piece together or assemble, and *yīn* (音) means sound. Hence, pinyin means spelling the sound. *Hànyǔ pīnyīn* was designed to represent a standard form of Chinese, known as Putonghua in China and as Mandarin internationally. Note that, here, tone marks are included; but they are often omitted for simplicity.

2.2.1 The levels of pinyin writing

There are two levels of usage in the pinyin system. The first level is described in the Scheme of Pinyin (*Hànyǔ pīnyīn fāng'àn*).

At the first level, pinyin spellings are written in the unit of syllable, in order to correspond to individual characters; for example, *pīnyīn* will be written as *pīn yīn*, with a space between the two syllables to indicate two characters: 拼(*pīn*) and 音(*yīn*). Take the two-character word 学校, meaning school, as another example. If the word 学校 is written in the first level of usage of pinyin writing, namely, in the unit of syllable, it is spelled *xue xiao*. If it is written in the second level of usage, that is, in the unit of word, it is spelled as *xuexiao*; there is no gap between the two syllables.

In the pupils' textbook, pinyin is usually written on the top of the corresponding character. The second level treats pinyin as a phonetic written language (Zhou 1986), by which there are rules to distinguish words, and so pinyin syllables are written with spaces at the word boundary; hence the spelling *pīnyīn*, or *pinyin* without tone marks. However, the concept of word for the Chinese language is considered by scholars to be too complex and subtle for children (e.g. T'ung & Pollard 1982; Zhou 1986), and so the second level is not taught at school. The present study focuses on how pinyin, at the level of syllable, is taught at school and what is taught in greater detail, in particular, the pinyin letters, initials, and finals, along with the conditional rules for

writing certain kinds of syllable. The issues concerning the application of the concept of word to Chinese are first briefly discussed below.

2.2.2 Why a meaningful spelling is called a syllable not a word

A Chinese character is the smallest meaningful unit, called *zì* (字). Each *zì* corresponds to a morpheme, and each morpheme has one syllable. So, each syllable carries a meaning. There are about 5000 Chinese characters in everyday use, and over 50,000 if the rare ones are included (Zhou 2003). However, there are only about 1300 distinct syllables in the Chinese language, even including tones (Duanmu 2007: 5). If we restrict consideration to just the 5000 frequently used Chinese characters, each pinyin syllable corresponds to 4 *zì* (字) on average, with some corresponding to as many as 40 *zì* (Bassetti 2009). If we admit the more rare characters, page 817 of the Chinese dictionary (Beijing Foreign language Institute 1980), for example, shows the syllable *yǐ* in third tone has eighteen characters attributable to it—a quite ordinary and below-average number. This means that a pinyin syllable can be quite ambiguous in meaning without a context.

In the previous section, we introduced the two levels of usage in the pinyin spelling system, where the second level treats pinyin writing as a written language (Zhou 1986), in which there are rules to distinguish words. Thus, pinyin is written in the unit of word by combining syllables together. By the combination, the meaning will become much clearer. However, it has always been a hot debate as to how to define a word (Bassetti 2005; Duanmu 2007; Zhou 1986), because the concept of word as used in European languages does not exist in the Chinese language (Zhou 2003). Zhou Youguangin, the main designer of pinyin, asks “What is a Word in Chinese?” (Zhou 1986: 17), pointing out that there is as yet no definition that is reasonable in

theory and useful in practice: “Most Chinese still think of their language as consisting of characters rather than words” (T’ung & Pollard 1982: 2). That pinyin is not yet an independent working orthography is attributed by some linguists partly to the difficulty of defining word in the Chinese language and partly to the large number of homophones (e.g. Duanmu 1993: 6). Yet, there is intuitive understanding in spoken Chinese of how syllables (or characters) should be said together. For example, 中华人民共和国 (the People’s Republic of China) is said in the form of *zhonghua renmin gongheguo* (中华 *zhonghua*: China, 人民 *renmin*: people, 共和国 *gongheguo*: republic). However, in school pinyin, the above would be written as *zhong hua ren min gong he guo*, which corresponds to the seven Chinese characters.

Following this explanation, details of the pinyin writing system are now given.

2.2.3 Pinyin letters

Pinyin adopts the 26 Roman letters, the same as in English, as its script, although the letter *v* is exceptional and is not taught in school pinyin. In Table 2.2, the letter names are given first in pinyin and then in IPA. However, the letter *v* is exceptional and is not taught in school pinyin.

Although separate letters have names, their names are not taught in school. Instead, pinyin teaching starts with the sounds of initials and finals so that a child is shown how a pinyin syllable is composed right away. It is a common phenomenon that a person who has learned pinyin does not know the names of the letters. However, people are ready to tell you how to pronounce the initials and finals. And because each initial is pronounced with a vowel attached to it, in reality, the sounds of the initials have become the names of their own. So, in effect, the names of pinyin letters are the name of the initials and finals—unlike English, whose letter names, as well as the sound, are taught to the children.

Table 2.2 Pinyin letters

Letter	Aa	Bb	Cc	Dd	Ee	Ff	Gg	Hh	Ii	Ji	Kk	Ll	Mm
Name in pinyin	a	bei	cei	dei	e	ef	gei	ha	i	jie	kei	el	em
Name in IPA	[a]	[pei]	[ts^{h}ei]	[tei]	[ə]	[ef]	[kei]	[xa]	[i]	[tɕie]	[k^{h}ei]	[el]	[em]
Letter	Nn	Oo	Pp	Qq	Rr	Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz
Name in pinyin	nei	o	pei	qiu	ar	es	tei	u	vei	wa	xi	ya	zei
Name in IPA	[nei]	[o]	[p^{h}ei]	[tɕ^{h}iou]	[ar]	[es]	[t^{h}ei]	[u]	[vei]	[wa]	[ɕi]	[ia]	[tsei]

2.2.4 Initials (声母) and finals (韵母)

The *initial* 声母 is a term used in the pinyin class to refer to the sound that begins a syllable. There are twenty-one of them: *b, p, m, f, d, t, n, l, g, k, h, j, q, x, zh, ch, sh, r, z, c,* and *s*. Initials are consonants. In the table of initials (Table 2.2), the top symbol of each cell is in the pinyin alphabet, and the symbol in the corresponding bracket indicates its sound represented in the IPA (Lin 2007).

Table 2.2 Initials in pinyin

	Bilabial		Labio–dental	Alveolar		Retroflex		Alveolo–palatal		Velar	
Plosive	b [p]	p [p^h]		d [t]	t [t^h]					g [k]	k [k^h]
Nasal	m [m]			n [n]							
Liquid				l [l]	r [ɻ~ʐ]						
Affricate				z [ts]	c [ts^h]	zh [tʂ]	ch [$tʂ^h$]	j [tɕ]	q [$tɕ^h$]		
Fricative			f [f]	s [s]		sh [ʂ]		x [ɕ]		h [x]	

All Chinese consonants are listed in Table 2.2, except one, *ng* [ŋ], which is a nasal consonant and is articulated in the velar position. This is because, as in English, *ng* occurs only in the finals (韵母), and not in the initials.

Pinyin finals are the parts that end the syllables. In the official table (Table 2.3), thirty-five finals are listed. There are an extra four finals left out for the neatness of the table, but are introduced in the official orthographical rules (Section 2.2.5 (1), (2), (3)). In each cell, the first is the pinyin alphabet, and the second is the IPA (Beijing Foreign Language Institute 1980).

Table 2.3 Finals in pinyin

	i [i]	u [u]	ü [y]
a [a]	ia [ia]	ua [ua]	
o [o]		uo[uə]	
e [ə]	ie [iɛ]		üe [yɛ]
ai [ai]		uai [uai]	
ei [ei]		uei [uei]	
ao [au]	iao [iau]		
ou [əu]	iou [iəu]		
an [an]	ian [ian]	uan [uan]	üan [yan]
en [ən]	in [in] *	uen [uən]	ün [yn]
ang [aŋ]	iang [iaŋ]	uang [uaŋ]	
eng [eŋ]	ing [iŋ] *	ueng [ueŋ]	
ong [uŋ]	iong [iuŋ]		

* These are pronounced as [iən] and [iəŋ] when becoming a syllable on their own (Howie 1976; Chao 1968; Wang 1957).

Looking at the finals, it could seem that the pinyin system is phonemic, because the sound (or phone) symbolized by each vowel letter often changes slightly depending on its neighbouring sounds. For example, the letter *o* represents three different sounds shown in finals *o* [o], *uo* [uə], and *ong* [uŋ]. Similarly, the letter a represents five different sounds: [ʌ,ɑ, a, æ, ɐ] (Duanmu 2007: 39).

2.2.5 The orthographical rules for writing syllables

In order to make full use of the available 26 Roman letters without adding new ones, great care was taken to keep the system simple while adhering as close as possible to the international norms of Roman alphabetic spelling (Zhou 1964). As a result, pinyin uses the same 26 letters as

English, although the letter *v* is used only when spelling foreign terms. Mostly, just one letter stands for one phoneme. Only five diagraphs (*zh, ch, sh, ng, er*) are used, each representing one phoneme. A diacritic (umlaut) is adopted to represent the unique sound *ü,* a high front rounded vowel (like German *ü*), which the letter *u* does not represent, and one letter *i* is used to represent the phonemes [i], [ɿ], and [ʅ]. Which pronunciation applies is always clear from the context, and the rules are explained below:

(1) The letter *i* represents three different sounds (or phonemes). It is pronounced as [ɿ] in the syllables *zi*, *ci*, and *si*, and as [ʅ] in the syllables *zhi*, *chi*, *shi*, and *ri*. It is pronounced as [i] in all the other syllables, such as *yi*, *ji*, or *ni*. However, the two finals [ɿ] and [ʅ] are not listed, because these two sounds only occur in these six syllables, as exceptions.

(2) A third final that is not listed in the 35 finals is *er*, a retroflex final. It either stands for a syllable on its own (*er duo*, 耳朵: ear) or is put at the end of a syllable to signal a retroflection of the pronunciation of the whole syllable (*zuir*, 嘴儿: mouth). When it functions as a retroflection to the syllable at the end, only the single letter *r* is kept. As a result, we have *huar* (花儿), *zuir* (嘴儿), and so on.

(3) The fourth *ê* is not listed in the table of finals. On its own, it is only used to annotate an exclamation, such as the sound made for a sigh. This circumflex symbol and the *ê* are not taught at school. What is more, the sound *ê* would be written as *e* in the finals *ie* and *üe*. Like the letter *i*, *e* represents more than one sound.

There are also a few other conditional rules explained below:

(4) Conditional rules for marking syllable boundaries, using *y* and *w*.

(4.1) If a final starting with an *i* sound becomes a syllable on its own—that is, there is no initial in front of a syllable—then the letter *y* precedes the *i* in the case of *i*, *in*, and *ing*, but takes the place of *i* in the case of *ia*, *ie*, *iao*, *iou*, *ian*, *iang*, and *iong*. Therefore, the syllables that are formed with only these finals would be written as follows: *i* → *yi*, *ia* → *ya*, *ie* → *ye*, *iao* → *yao*, *iou* → *you*, *ian* → *yan*, *in* → *yin*, *iang* → *yang*, *ing* → *ying*, *iong* → *yong*. Because of this rule, *y* stands for no sound in the syllables *yi*, *yin*, and *ying*; but stands for the sound *i* in the other syllables: *ye*, *ya*, *yao*, *you*, *yan*, *yang*, *yong*.

(4.2) The finals started with the *u* sound are preceded by *w* if they are syllables in themselves. So, the syllables would be written as *u* → *wu*, *ua* → *wa*, *uo* → *wo*, *uai* → *wai*, *uei* → *wei*, *uan* → *wan*, *uen* → *wen*, *uang* → *wang*, and *ueng* → *weng*, with *w* standing for no sound in the case of *wu*, and for the sound *u* in the other cases.

(5) Some conditional rules that govern the omission of the umlaut on the letter *ü*. This letter is still written as *u*, although the two sounds are distinctively different: [y] versus [u]. This was out of concern of the qwerty keyboard, which pinyin uses, and which does not have the letter *ü*.

(5.1) The letter *y* is added to the front of syllables formed by the finals starting with *ü* when there is no initial in the syllable; at the same time, the umlaut is omitted. Thus, the syllables *ü*, *üe*, *üan*, and *ün* will be written as *yu*, *yue*, *yuan*, and *yun*, respectively. So, in this case, *y* does not stand for a sound but rather functions as a syllable boundary.

(5.2) When the finals starting with *ü* are preceded by the initials *j*, *q*, or *x*, the umlaut is also omitted; hence, we have the spellings *ju*, *qu*, *xu* (not *jü*, *qü*, *xü*); *jue*, *que*, *xue*; *juan*, *quan*, *xuan*;

and *jun*, *qun*, *xun*. The initials that appear with finals containing *ü*, with the umlaut retained, are only two, namely *l* and *n*, and only four syllables exist: *lü*, *lüe*, *nü*, and *nüe*.

(6) When there is an initial preceding the three finals *iou*, *uei*, or *uen*, the middle vowel letter is omitted and the finals are written as *iu*, *ui*, and *un*. Therefore, *iou*, *uei*, and *uen* become only theoretical forms of spelling; in reality, the three forms will not occur after applying Rules 4.1 (*iou* → *you*) and 4.2 (*uei* → *wei*, *uen* → *wen*) to the three finals. Thus, the spelling *gui* should be read as *guei*, *niu* as *niou*, and *lun* as *luen*. Vice versa, the syllables read as *guei*, *niou*, and *luen* should be written as *gui*, *niu*, and *lun*. This means that the original one-to-one correspondence between letters and sounds becomes a two-to-three correspondence.

The exact spelling of the syllables involved in the application of Rules 4, 5, and 6 are detailed in Table 2.4.

Table 2.4 Spelling of syllables involving i, u, and ü

i		**u**		**ü**	
i	yi	u	wu	ü	yu
ia	ya	ua	wa	üe	yue
ie	ye	uo	wo	üan	yuan
iao	yao	uai	wai	ün	yun
iou	you	uei	wei		
ian	yan	uan	wan		
in	yin	uen	wen		
iang	yiang	uang	wang		
ing	ying	ueng	weng		
iong	yong				

(7) When denoting Chinese characters, *ng* can be written as ŋ to shorten the spelling. Note that this rule has never been taught at school, but mentioned here in order to give a complete introduction to the pinyin writing system.

(8) *The tones*. The tone refers to the intonation pattern when people pronounce the syllables. A syllable has different meanings if it is pronounced in different tones. Putonghua has four basic *tones*, indicated as *ā, á, ǎ,* and *à* in the case of *a*, respectively representing the first, second, third, and fourth tone. There is also a neutral tone, which does not require adding a tone mark, and the syllable with this tone is spoken swiftly and softly. For example, with *nǐmen* and *xièxie*, the tone mark (or tone-graph) is not marked above the second syllable *men* and the second syllable *xie*. The tone-graph is marked above a vowel. When the syllable contains more than one vowel, the tone-graph is marked above the main vowel that has a wider opening of the mouth, for example *háo, sóu*. If the tone is marked on the vowel *i*, the dot on the top of the letter is replaced by the tone mark, such as *tī, dí, nǐ,* and *lì*. In this thesis, where necessary, the tone is marked either as in *ā, á, ǎ,* and *à* , or by 1, 2, 3, 4 at the end of the syllable (*a*1, *a*2, *a*3, *a*4). Otherwise, the tone mark is omitted.

These are the rules for spelling syllables in pinyin in the original design, which can be found in the Chinese dictionaries. Following the rules, we can see that there are some particular types of syllable in the pinyin writing system in relation to the correspondence between letters and sounds. They are: (1) two-to-three type, where letter–sound correspondence is that two letters correspond to three sounds, e.g. *ui—uei*, *iu—iou*; (2) wuyi type, where *w* stands for *u* and *y* stands for *i* , e.g. *wen—uen* , *you—iou* ; (3) w0y0 type, where *w* and *y* do not represent sound, e.g. *wu—u, yin—in,* (4) yu type, where *y* does not stand for sound and at the same time *u* stands

for the sound of *ü*, e.g. *yue—üe* , *yuan—üan*, and (5) jqx type, where *u* stands also for *ü*. For instance, *jun*, *quan*, *xun* stands for the sound of *jün*, *qüan*, and *xün*. If we add the spelling type of one-to-one letter–sound correspondence and the type of two-to-one letter–sound correspondence, we would then have seven types of spelling in the pinyin writing system.

The next section introduces how pinyin is taught at school according to the national curriculum plan (Yuwen Jiaoxue dagang 2010).

2.3 The teaching of pinyin at school

School pinyin is not identical to the official form of pinyin described above. It is important to note that few people, Chinese or foreign, know the letter names in pinyin (Zhang 2007). This is because pinyin teaching starts with the teaching of initials and finals. As a result, it is the names of the initials and finals that are known. In addition, the rules that are taught differ from the official orthographic rules set out in the original design (introduced in Section 2.3.5). In fact, there is little mention in the teaching of pinyin at school that there are conditional rules in spelling in pinyin (Yin 1993; Zhang 2007).

2.3.1 The teaching of initials, finals, and blending syllables

The "hudu" method of teaching initials

In China, the government provides a guide for every subject taught in primary and secondary schools. Pinyin teaching is no exception: there is an official guide for the method of teaching pinyin at school (Zhang 2007). The method of teaching initials is called the "hudu" (呼读) method (Zhang 2007). The meaning of "hudu" (呼读) literally means "read aloud loudly". In this

method, the sound of a consonant initial is pronounced with a vowel attached to it, just as the character was designated to remind people of the consonant sound which is embodied in the character. As a result, each consonant is pronounced as a syllable. Table 2.5 lists the twenty-one initials in the official order with the designated character (Xinhua Zidian 1987: 612). The sound of the designated characters in pinyin and in IPA, as well as the corresponding IPA for the sound of the initial, is provided. Note that children are not taught to read the corresponding characters when learning pinyin. These characters are only printed in the official pinyin tables to function as reminders of the sound feature of each consonant. However, it has been so commonplace to teach the initial consonant with a vowel attached to it that eventually these characters became the names of the initials (Zhang 2007).

The significance of the "hudu" method in teaching initials in pinyin gives rise to the phenomenon that, although pinyin was designed according to the alphabetic principle where there is grapheme–phoneme correspondence, the initials in the "hudu" method are pronounced as syllables. Theoretically, children are taught the initials and finals by their sound; however, in practice, a consonant initial is pronounced with a vowel attached to it, and will be pronounced exactly like the character accompanying it (see Table 2.5). For example, *x* is pronounced as *xi* (希 /ɕi/) (Zhang 2007); a letter-name, in effect.

Table 2.5 Initials and their designated characters

Initial	**b**	**p**	**m**	**f**	**d**	**t**	**n**	**l**	**g**	**k**	**h**
Corresponding sound in IPA	p	P^h	m	f	t	t^h	n	l	k	k^h	x
Designated Chinese characters	玻	坡	摸	佛	得	特	讷	勒	哥	科	喝
Pinyin for the Chinese character	bo	po	mo	fo	de	te	ne	le	ge	ke	he
IPA for the Chinese character	puə	p^huə	muə	fuə	tə	t^hə	nə	lə	kə	k^hə	xə
Initial	**j**	**q**	**x**	**zh**	**ch**	**sh**	**r**	**z**	**c**	**s**	
Corresponding sound in IPA	ʨ	ʨ^h	ɕ	tʂ	tʂ^h	ʂ	ʐ	ts	ts ^{h}	s	
Designated Chinese characters	基	欺	希	知	蚩	诗	日	资	雌	思	
Pinyin for the Chinese character	ji	qi	xi	zhi	chi	shi	ri	zi	ci	si	
IPA for the Chinese character	ʨi	ʨ^{h}i	ɕi	tʂl	tʂ^{h}l	ʂl	ʐl	ts ɿ	ts ^{h}ɿ	sɿ	

The teaching of finals

The finals (Table 2.6) are taught in the same way as the initials, using the sounds of the designated characters, which in turn become the names of the finals. Therefore, the finals are not taught letter by letter or sound by sound, but as a whole final, such as *a, ei, ai, an, ang*, and so on.

Table 2.6 Finals and their designated characters

	i 衣 [i]	u 乌 [u]	ü 迂 [y]
a 啊 [a]	ia 呀 [ia]	ua 蛙 [ua]	
o 喔 [o]		uo 窝[uə]	
e 鹅 [ə]	ie 耶 [iɛ]		üe 约 [yɛ]
ai 哀 [ai]		uai 歪 [uai]	
ei 欸 [ei]		uei 威 [uei]	
ao 熬 [au]	iao 腰 [iau]		
ou 欧 [əu]	iou 优 [iəu]		
an 安 [an]	ian 烟 [ian]	uan 弯 [uan]	üan 冤 [yan]
en 恩 [ən]	in 因 [in]	uen 温 [uən]	ün 晕 [yn]
ang 昂 [aŋ]	iang 央 [iaŋ]	uang 汪 [uaŋ]	
eng 亨[eŋ]	ing 英 [iŋ]	ueng 翁 [ueŋ]	
ong 轰 [uŋ]	iong 雍 [yŋ]		

Teaching the blending of the syllables

The blending of the initial and the final into a syllable is taught as soon as the single finals (*a, o, e, i, u, ü*) and the first four initials (*b, p, m, f*) are taught. Thus syllables such as *ba* (similarly *bi, bo, bu*), *ma, pa*, and *fa* are ready to be blended by adding one initial to one final. However, because of this “hudu” method in teaching initials, what might seem straightforward to teachers in blending the initial and the final into a syllable might not be so to children. For example, the syllable *ba* is not blended by *b* + *a*, as the eye sees it, but

by *buo* + *a* by the ear, because *b* is pronounced as *buo*. Further, blending can be made in two ways when there is a medial in the syllable (see the following Section 2.3.2).

2.3.2 The method of teaching the orthographical rules

It was believed that children would not understand the rules as they were designed and, after many methods had been tried, the present teaching method has been uniformly used all over China since 1978 (Cao 1983). Today, this method is still adopted (Wang & Yang 2009). Also potentially important, with less explanation about letter–sound correspondence but using a 'recognize-as-a-whole approach' (Ling 2011; Tang 1986; Yu 1981) is that the way pinyin is taught at school contrasted with the original way the rules were structured (Yin 1993).

First, *y* and *w* are introduced to the students as initials, which turn the 21 initials (Table 2.5) into 23. This is to cope with the rule involving *y* and *w*. Once *y* and *w* are treated as initials, the nine syllables where *y* and *w* do not represent a sound (*yi*, *ye*, *yin*, *ying*, *wu*, *yu*, *yue*, *yuan*, *yun*) are taught by the recognize-as-a-whole method; a rote-learning method (Yin 1993).

Note that the recognize-as-a-whole method is a way to get around teaching certain kinds of syllable. Usually, for example, when teaching a syllable like *ping*, the teacher will first introduce *p* as the initial of the syllable and then *ing* as the final of the syllable, and then the teacher will blend the two parts together to produce the pronunciation of *ping*.

In contrast, when teaching the syllable *ying*, there is no explanation about which part is initial or which part is final; rather, the syllable is presented and pronounced as a whole.

Second, only 24 finals are taught: *a, o, e, i, u, ü* (first set of single vowels, also called single finals), *ai, ei, ui, ao, ou, iu, ie, ue, er, an, en, in, un, ün, ang, eng, ing, ong*. The remaining 11 finals in the original design (*ia, iao, ian, iang, iong, ua, uo, uai, uan, uang, üan*) are learned by utilizing what is taught in the first set of single-vowel finals, namely those involving *i, u,* and *ü*. When coming across syllables containing *i* and *u* (called medials) in the finals, teachers either adopt the method of "three consecutive blending", such as *j + i + a = jia,* or *g + u + an = guan,* or more often adopt the stepwise method, in which they would first blend the initial and the final first, and then use what is obtained to blend the other. For example, *j + i = ji* → *ji + a = jia* or *g + u = gu* → *gu + an = guan*. There are benefits and drawbacks in this treatment, as Yin (1993) points out. Although there are 11 more finals in the original scheme of pinyin than the 24 finals treated in the school, the structure of the syllables is simple, which is initial plus final. For example, in the case of the syllables *jia* and *guan,* it is initial plus final: *j + ia* and *g + uan,* with only two parts to blend: initial and final. Although fewer finals are needed, teaching *jia* by the present school method, that is, *j + i + a = jia* or *j +i = ji* → *ji + a = jia*, makes the structure of the syllable seem more complicated (Yin 1993).

Third, the seven syllables *zhi, chi, shi, ri, zi, ci,* and *si,* which are considered difficult to analyse between the initials and finals, are taught in the recognize-as-a-whole method; that is, they are presented as whole syllables without the process of blending. Another nine syllables, *yi, ye, yin, ying, wu, yu, yue, yuan, yun,* where the rules for *y* and *w* and umlaut *ü* are involved, are also taught in the recognize-as-a-whole method (see Wang & Yang 2009: 21, 23; or Appendix I Lesson 3, 8, 9, 13, 14, 15,16). There are both advantages and disadvantages in teaching this way. On the one hand, this treatment

reduces the analysis and simplifies the teaching, but on the other, students are burdened with rote learning (Yin 1993). This method gives people an even stronger impression that learning pinyin is a matter of memorization or rote learning.

Apart from these three differences deviating from the original design of the pinyin writing system, the three phonetically spelled finals *uei*, *uen*, and *iou* are not taught as such. Instead, only their abbreviated forms *ui*, *un*, and *iu* respectively, are taught. This is because, as the conditional Rule 6 prescribes, the spelling of them only uses the abbreviated forms; the original three finals will never appear in the actual spelling (see Section 2.2.5).

In addition, and more interestingly, the spelling of the vowels in some finals is abbreviated in the original design, but this feature is not generally known to the public. For example, *in* is pronounced as *ien*, and *ing* as *ieng* in standard Chinese—Putonghua. It may be speculated that this is for both linguistic and political reasons. Linguistically, it keeps the spelling simple; politically, the sound of *in* is pronounced as it is spelled in certain areas of China, the Shanghai area in particular, but not northeast China, which is what Putonghua is modelled on. The main designer of pinyin, Zhou Youguang, is from the Shanghai area.

Table 2.7 is a summary for the differences between the original design of pinyin (Scheme of Pinyin) and the treatment at school (see Appendix Lesson 1-19).

Table 2.7 Summary of school pinyin and the original pinyin

<table>
<tr><th>Elements</th><th>School pinyin</th><th>Original scheme of pinyin</th></tr>
<tr><td>Initials</td><td>b p m f d t n l
g k h j q x
zh ch sh r z c s
y w
(23)</td><td>b p m f d t n l
g k h j q x
zh ch sh r z c s
(21)</td></tr>
<tr><td>Finals</td><td>a, o, e, i, u, ü;
ai, ei, ui, ao, ou, iu, ie, üe, er,
an, en, in, un, ün,
ang, eng, ing, ong

(24)</td><td>
<table>
<tr><td></td><td>i</td><td>u</td><td>ü</td></tr>
<tr><td>a</td><td>ia</td><td>ua</td><td></td></tr>
<tr><td>o</td><td></td><td>uo</td><td></td></tr>
<tr><td>e</td><td>ie</td><td></td><td>üe</td></tr>
<tr><td>ai</td><td></td><td>uai</td><td></td></tr>
<tr><td>ei</td><td></td><td>uei</td><td></td></tr>
<tr><td>ao</td><td>iao</td><td></td><td></td></tr>
<tr><td>ou</td><td>iou</td><td></td><td></td></tr>
<tr><td>an</td><td>ian</td><td>uan</td><td>üan</td></tr>
<tr><td>en</td><td>in</td><td>uen</td><td>ün</td></tr>
<tr><td>ang</td><td>iang</td><td>uang</td><td></td></tr>
<tr><td>eng</td><td>ing</td><td>ueng</td><td></td></tr>
<tr><td>ong</td><td>iong</td><td></td><td></td></tr>
</table>
(35)
</td></tr>
<tr><td>Recognize-as-a-whole syllables</td><td>zhi, chi, shi, ri, zi, ci, si
yi, wu, yu
ye, yue, yuan
yin, yun ying
(16)</td><td>0</td></tr>
</table>

2.3.3 The purpose of teaching pinyin at school

Pinyin has been in the national curriculum for primary education since 1 September 1958. The purpose of teaching pinyin is to accelerate the acquisition of standard Chinese and to use pinyin to denote the sound of characters that have not previously been learned. Thus, it has become a tool to learn the characters. Research shows that pinyin reduces the time for children to learn characters by two years (Dai & Liu 1985; Ding et al. 1983). The teachers would tell the children of the significance of learning pinyin in helping them to learn the Chinese characters (Li 2008).

In the first-year textbook, each character to be taught has pinyin symbols printed above it, indicating its pronunciation like this:

pin yin
拼 音.

A page from the pupils' textbook below may help to illustrate how it is done. (This lesson gives pupils an idea of how the pictograph origins of some of the Chinese characters have evolved).



Figure 2.1 Pinyin printed above the characters in the textbook

Once children have learned to decode pinyin, they can not only teach themselves the sound of a character by looking at the pinyin on top of it (Figure 2.1), but also use pinyin to represent the sound of a character they have not learned. In China, the

characters in a Chinese dictionary are ordered in two ways: one is pinyin so that people can look up the characters according to alphabetic order, and the other one, called the radical index, is arranged according to the number and the order of their strokes (Appendix II). When students come across a character which they do not know how to pronounce, they can look it up according to the strokes. In the circumstance where they know the sound and how to spell it in pinyin but do not know the character, they can find the character in the dictionary by looking up the corresponding pinyin. As has already been mentioned, there are 417 syllables (Sangwu Yinsh Guan 1987), which expand to about 1300, once tones are added (Duanmu 2007). This number implies that there are many homophone characters under one syllable. Therefore, people would identify the character by looking through the characters with their meanings. Regarding pinyin only as an aid to learn characters, the teachers' instruction manual states the purpose, the method, and the amount of time spent on pinyin lessons. The time was reduced from two months before the year 2001 to 5–6 weeks since 2001, about two hours a day (Wu 2007). As a result, almost all the preschools in China now provide pinyin teaching to give a child a good start on entering the primary school. After intensive training at the beginning of the school year, pinyin equivalents are continuously introduced to the new characters throughout the years at primary and secondary school.

From preschool, pupils would learn how to write the pinyin letters and syllables in pinyin exercise books designed for pinyin spelling and practise them until mastery.

2.3.4 The sequence of lessons in teaching pinyin

Pinyin is taught uniformly in the following sequence of lessons. The first six single vowels are taught in the order of *a*, *o*, *e*, *i* (*yi*), *u* (*wu*), and *ü* (*yu*). From the very

beginning, four tones are introduced with the vowels, on top of which tone marks are placed (e.g. ā á ǎ à). So that syllables with one-to-one letter–sound correspondence can be readily composed, the six single vowels are followed by the consonant initials *b*, *p*, *m*, *f*, *d*, *t*, *n*, *l*, *g*, *k*, *h*, *j*, *q*, *x*. They are pronounced in the same way as the recognize-as-a-whole syllables (in parentheses above and below) are taught. That is, the pupils are taught the names of the initials, or the letter names, to be more exact, although the official names of the letters sound quite different. Afterwards, the rest of initials are taught in the same fashion: i.e. *z* (*zi*), *c* (*ci*), s (*si*) and *zh* (*zhi*), *ch* (*chi*), *sh* (*shi*), and *r* (*ri*), with the first three initials, *z*, *c*, and *s* being called 平舌音 (*pingshe yin*) "the flat-tongued sound" and the second three initials, *zh*, *ch*, *sh*, being called, in contrast, 卷舌音 (*juanshe yin*) "the curled-tongued sound". The letter *r* (*ri*) is also pronounced with curled tongue, and is taught with the second three initials, so that all the "curled-tongue sounds" are categorized together. In fact, the *r* sound can be obtained by the extension of *zhi*, *chi*, or *shi*. Now, all the consonant initials are taught, with the six single-vowels: *a*, *o*, *e*, *i*, *u*, *ü*.

Next, *y* and *w* are introduced with examples of syllables where either they represent sound, as in the case of *you* or *wei*, or they do not but only function as a syllable/character boundary, as in the case of *yi* and *wu*.

Next, the complex finals are taught in the order of (1) *ai*, *ei*, *ui*; (2) *ao*, *ou*, *iu*; (3) *ie*, *üe*, *er*; (4) *an*, *en*, *in* (*yin*), *üan* (*yuan*); (5) *un*, *ün* (*yun*); (6) *ang*, *eng*, *ing* (*ying*), *ong*. The syllables in parentheses are four of the sixteen recognize-as-a-whole syllables, ones that are not formed by blending but taught as a whole. Because the four syllables sound the same as the finals, they are taught together at the same time with the finals.

Put together, the lessons are in the following order (for details, see Appendix I 1-19), except that the order 2 and 3 may be alternated in the preschool (Han 2005; Wang & Yang 2009):

1. *a, o, e*

2. *b, p, m, f* (pronounced with a vowel *e* or *uo* at the end: e.g. *buo, puo, muo, fuo*)

3. *i, y* (*yi*); *u, w* (*wu*); *ü* (*yu*) (*i* is taught with *y* and *yi*, *u* is taught with *w* and *wu*, and *ü is* taught with *yu*, because the individual letters sound the same as the corresponding syllable in parentheses: that is, *i = y = yi*, *u = w = wu*, and *ü = yu*)

4. *d, t, n, l* (pronounced with a vowel *e* at the end: *de, te, ne, le*)

5. *g, k, h* (pronounced with a vowel *e* at the end: *ge, ke, he*)

6. *j, q, x* (pronounced with a vowel *i* at the end: *ji, qi, xi*)

7. *z* (*zi*), *c* (*ci*), finals (*si*) (pronounced as *zi*, *ci*, *si* and taught with *zi*, *ci*, *si* at the same time)

8. *zh* (*zhi*), *ch* (*chi*), *sh* (*shi*), *r* (*ri*) (pronounced as *zhi*, *chi*, *shi*, and *ri* and taught with them at the same time)

9. *ai, ei, ui*

10. *ao, ou, iu*

11. *ie* (*ye*), *üe* (*yue*), *er*

12. *an*, *en*, *in* (*yin*), (*yuan*)

13. *un*, *ün* (*yun*)

14. *ang*, *eng*, *ong*, *ing* (*ying*).

To illustrate how pinyin is taught at the school, the page for the first pinyin lesson is shown here in Figure 2.2 (Wang & Yang 2009: 6; Appendix I). The first three finals, the four tones illustrated with four little children, and the characters are all presented at the same time to the pupils.

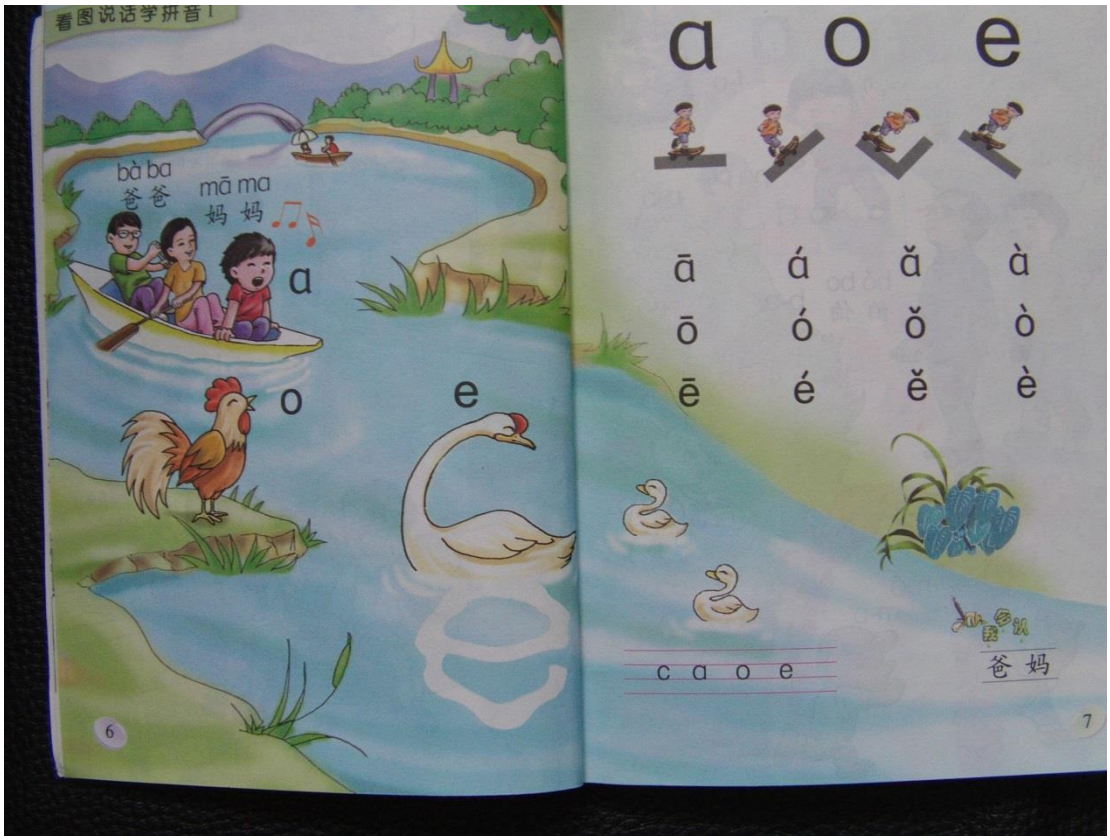


Figure 2.2 A page from the textbook (Lesson 1)

The letter *a* is presented by the shape of the boy's mouth in singing the sound of the letter; the sound the cockerel makes is the sound of the letter *o*; and the reflection of the goose in the water resembles the letter *e*, which is the Chinese name for goose (鹅) in pinyin. What is more, the Chinese characters 爸爸 (daddy) and 妈妈 (mummy) appear with the corresponding pinyin syllables, which are to be learned in lesson 2. Appendix I lists the sequence of pinyin lessons in the textbook used in twelve provinces, and by the children in this study, authorized by the Research Centre of Textbooks of Chinese Language and the Committee of Textbook Compilation of Twelve Provinces, and published by Yuwen Chubanshe (Wang & Yang 2009). It is noteworthy that, while the dialects spoken in the twelve provinces are different, the textbooks used in these provinces are the same. In fact, the textbooks in China are all similar, because the national curriculum is the same (Zhang 2007). In the pinyin class, the teacher would demonstrate how to pronounce the sound, ask the whole class or group of class to follow her, and ask individual pupils to pronounce the initials, finals, and syllables, and then ask the class to copy and practice the spellings in their exercise books. Giving a dictation is the usual teaching practice to make sure that pupils can read, as well as can spell, what is taught in the class. However, the children are not asked to read aloud or to write down characters that go with the pinyin syllables. In spite of this, children would nonetheless have home coaching on writing characters even before learning pinyin.

Because the alphabetic writing system represents the sound system, and because Putonghua, the standard Mandarin, is different, albeit only slightly in some cases, from the various versions of Mandarin, it would be helpful to note the speech characteristics of the pupils in the present study.

2.4 The characteristics of Yingkou speech

Putonghua, the standard Chinese, is not a native language in any region in China. Therefore, it is helpful to consider whether local dialect is a challenging factor in the learning of pinyin. The dialects in the three north-eastern provinces, Liaoning, Jilin, and Heilongjiang, are the closest to Putonghua (Zhou 2003: 161). Yinkou, where this investigation was carried out, is situated in Liaoning province. The local people would say their speech is standard Chinese. However, once people start to learn pinyin, they notice there are some differences between the local speech and standard Chinese. The local speech has the following two characteristics;

(1) It does not make the distinction in the three pairs of initials: *z*/*zh*, *c*/*ch*, and *s*/*sh*, the *z*, *c*, and s being dental, and *zh*, *ch*, *sh* being palatal; only the dental form is used. In the pinyin class, the fricatives *z*/*zh*, *c*/*ch* and affricates *s*/*sh* are distinguished by the positioning of the tongue rather than by other feature of their articulations. The three dental consonants *z*, *c*, and s are called "flat-tongue sound", because the tongue tip does not curl up but is kept flat, as compared to the retroflex sound or "curled-tongue sound" *zh*, *ch*, and *sh*, as these sounds are articulated with the tongue curled back towards the palate (see Table 1.1). In the local dialect, people pronounce the "curled-tongue sound" as the "flat tongue sound". This non-distinction phenomenon is common, as a majority of Mandarin speakers speak Chinese in this fashion (Duanmu 2007).

Only after learning pinyin do people begin to realize that their dialect does not distinguish between the three dental consonants (*z*,*c*,*s*) and the three palatal ones (*zh*, *ch*, *sh*), and begin to make the effort to distinguish them in formal occasions. When effort is

made to make their Chinese more standard, a deliberate shift to the curled-tongue sound can go too far, resulting in “hypercorrection” (Duanmu 2007:24).

(2) The local people pronounce the [r] (*r*) as [j] (*y*) in the syllables *ran* (*yan*), *rao* (*yao*), *re* (*ye*), *ren* (*yen*), *ri* (*yi*), *rong* (*yong*), *rou* (*you*), *ruan* (*yuan*), and *run* (*yun*) but pronounce *reng* (扔) as *leng*. In addition, the same syllable *reng* would be pronounced as *yeng* in the word 仍然 locally, when the syllable means “still” or “as usual” in combination with *ran*. While there are 111 syllables whose initials begins with the sound *r*, there are over 4000 Chinese characters which begin with the sounds of *z* or *zh*, *c* or *ch*, and *s* or *sh* (Sangwu Yinshu Guan 1987). Therefore, it is understandable that there exists “hypercorrection”, with so many syllables to distinguish when speaking in standard Chinese (Duanmu 2007).

Following this contextual chapter, the next chapter provides original analysis on the research methods used in discovering difficulty in pinyin learning and teaching.

Chapter 3 What is difficult about learning pinyin?

Research relevant to the present study and published in Chinese is accessible through Oxford electronic resources, from 1959 (Yu 1959; Zhou 1959, 1961) to the present, with a gap between 1965 and 1980 owing to the Cultural Revolution. There are more articles about teachers' experience of how to motivate children in their pinyin class than articles on empirical research. Most of the articles accord with Ling (2011), who points out the contrast of pinyin letters to the visual form of the Chinese characters, which are often taught to be associated with meaning, and the loss of it in the alphabetic writing.

This chapter first looks at what is difficult in learning pinyin from the teachers' point of view. Where it is relevant, research about learning to spell in English is drawn on as an example.

Learning to read and spell in pinyin would, given its Chinese context, be expected to differ from learning to read and spell in English. For example, the pinyin writing system does not preserve morphological or syntactic information. However, alphabetic orthographies do share one critical characteristic: that is, they are all based on the alphabetic principle which points to the association between symbols and sounds, or grapheme and phoneme (Caravolas 2006: 498).

Research on spelling difficulty in English is extensive, because the English writing system is the most researched one (Adams 1990), with rich empirical data (e.g. Masters 1927; Read 1971, 1975; Treiman 1993). In contrast, pinyin, taught at school only since 1958 and with gaps during the Cultural Revolution, has far fewer data available (Wei 2006). Therefore, wherever there is a study that contains data in it, the data will be presented here. Where there was empirical research, detailed analysis of the method is

given, because of the rarity of such data. This chapter attempts to provide a comprehensive review, as no survey of literature has been conducted on the topic of pinyin, published in either English or Chinese.

3.1 Difficulties in teaching pinyin

Some difficulties in teaching pinyin were noticed in the early years of its promulgation through to the present (Jiang 2004; Li 2008; Ling 2011; Lü 1996; Yin 1993; Yin 2011; You 1985; Yu 1959; Zhou 1959, 1961). Zhou Youguang, the main designer of the pinyin writing system, points out several difficulties in teaching pinyin to young pupils. First, the concept of consonant initials is difficult to teach. Secondly, difficulties in teaching arise from the three main orthographical rules: (1) the syllables starting with *w* and *y*, (2) omission of the umlaut, and (3) the three finals having a two-to-three letter–sound relationship (Zhou 1961). In practice, teachers also found the following difficulties in their teaching, among specific others (Tang 1986; Xu 1984; Xu 1986; Yang 2001; Zhang 1998; Zhang et al. 2005).

3.1.1 The teaching of consonant initials

While each Chinese character corresponds to one syllable, for pinyin the correspondence is with alphabetic letters. That is, the syllable is the basic unit of Chinese writing, but the phoneme is the basic unit of romanized Chinese writing. A Chinese character does not tell one the phonological structure of the syllable, but the meaning. For example, in learning the character 双 (*shuang*), which means a pair, the focus is on the meaning, the visual form, and the sound of the whole syllable, but no analysis of the sound into

phonemes is made. So, one would not know how to pronounce the character by its appearance, especially at the beginning stage of learning.

When written in pinyin as *shuang*, the inner phonological structure of the syllable 双 is shown by the *sh*, *u*, and *ang*. Thus, the learning of a pinyin syllable is focused on the sound, contrary to the traditional learning of the Chinese characters. Thus, learning an alphabetic writing system is an alien development in relation to the traditional Chinese writing system. Chinese speakers can readily segment utterances into syllables (Howie 1976), but the concept of phoneme and phonetic alphabet remains generally unknown (Zhou 1961; Wang 2009). How to teach consonants is, therefore, a problem (Read et al. 1986), as conventional phonological analysis of Chinese is at the level of syllable. The shift from teaching Chinese writing as meaning-based to sound-based is a challenge to teachers as well as to pupils (Zhou 1961; Ling 2011).

Although the term "initial" is taught and used in learning pinyin, the initials are pronounced as syllables. Consequently, these syllables have effectively become the names of the initials (Yin et al. 1992; Zhang 2007). The way of pronouncing initials is called the "hudu" method, meaning that each initial should be sounded loudly.

Great efforts have been made to teach the concept of consonant in the context of Chinese (Zhou 1961), with methods that have ranged from teaching pinyin phonemically to teaching it in an analogical way (Yin et al. 1992). However, consonants are still taught and pronounced as syllables in the pinyin class, which results in difficulties in blending for even the simplest syllables (Cao 1983; Yin 1993; Yin et al. 1992; Yu 1959). For instance, teachers find that it is difficult to teach children to blend *b* and *a* into *ba*, because *b* is actually pronounced as *buo*, the sound for the designated character 玻 for

this consonant initial (Yin et al. 1992). Wang & Gao (2011) provided evidence that children found difficulty in blending initials into finals in pseudo-pinyin syllables. What remains less understood is whether this hudu method has any influence on spelling.

3.1.2 Difficulties in teaching orthographical rules

Zhou Youguang (1961) recognized that the three main orthographical rules can be difficult to teach, pointing out that the task of reforming pinyin teaching is to dilute difficulties, if not eliminate them. The result is that, first, *y* and *w*, designated as a syllable boundary for the finals in the column *i* and *u* (see Table 2.6: table of finals) are termed as initials, so that they can be combined with finals to form syllables. And then, *yi* and *wu* are taught as recognize-as-a-whole syllables right from the start, instead of explaining that *y* and *w* do not represent sounds here but only signal the start of a syllable.

Secondly, the recognize-as-a-whole method also recommended teaching syllables which are formed by the finals alone in the *ü* column of Table 2.4. That is, *yu*, *yue*, *yuan*, and *yun* are taught as whole syllables. This way, the explanation of *y* and *w* as syllable boundaries is replaced by simply remembering the whole syllables, the same as for the cases *yi* and *wu*. Because of the adoption of the recognize-as-a-whole method in teaching *yu*, *yue*, and *yuan*, the teaching of the omission of the umlaut on *ü* is only applied to the initials *j*, *q*, and *x*. Those three initials are the only initials that can be combined with the finals in the *ü* column. The finals in the *ü* column are four, namely *ü*, *üe*, *üan*, and *ün*, which would be spelled as *yu*, *yue*, *yuan*, and *yun* when they are syllables themselves. By reducing to a minimum the occurrence of the umlaut in the orthography, typing on the qwerty keyboard is made easier. This omission is possible because only the initials *j*, *q*, and *x* appear with the four finals.

The letter/syllable pairs *y*/*yi* and *w*/*wu* and the syllable *yu* sound the same as *i*, *u*, and *ü*, respectively, and are taught in the same lesson in the following three categories: initials (*y*, *w*), finals (*i*, *u*, *ü*), and recognize-as-a-whole syllables (*yi*, *wu*, *yu*), to avoid explaining the rule of syllable boundary (Appendix I: 3). Because of this change, pupils are taught to remember the pinyin elements under the three terms: initial, final, and recognize-as-a-whole syllables. While the initials and finals can be combined with each other to form any possible Chinese syllable, the recognize-as-a-whole syllables are fixed, with no further combination needed.

The finals that phonetically would be expected to be spelled as *iou*, *uei*, and *uen* are directly taught as *iu*, *ui*, and *un*. This is because when *iou*, *uei*, and *uen* are combined with initials, the middle vowel is omitted for brevity (e.g. *l* + *iou* = *liu*); as a result, *iou*, *uei*, and *uen* will never appear as their originally designed form. Thus, in teaching the orthographical form *iu*, *ui*, and *un* directly, the explanation of the spelling rule is saved (i.e. *l* + *iu* = *liu* instead of *l* + *iou* = *liu* with *o* omitted); but a one-to-one letter–sound correspondence in them has been changed into a two-to-three letter–sound correspondence.

Zhou (1961) emphasizes that the recommended treatment of these orthographical rules may not eliminate all the problems, but it aims to reduce the difficulty of explaining complex rules to young children. It is expected that the way of "do it first, understand it second" can reduce the difficulty (Zhou 1961: 14). From 1958 to 1978, ten teaching methods were tried, with the aim of finding a good way to teach the orthographic rules (Cao 1983). Although suggestions and experiments for teaching the rules have continued

(Wang 2004; Yin et al. 1992), the present teaching method and the sequence which were established since 1978 remain the same (Cao 1983; Zhang 2007).

While there is agreement among educators that orthographic rules are difficult to teach and learn within the limited time of two months (Cao 1983; Xu 1984; Wei 2006), it is not known which is the most difficult or whether the rules are difficult in equal degree.

3.2 Difficulties in learning pinyin

Difficulties in learning pinyin have been immediately observed as caused by differences between the standard Mandarin and local Mandarin speech, and by the contrast between Mandarin and non-Mandarin dialects (e.g. Jia 1985; Zhou 1964; Xu 1986; Lin 2009).

3.2.1 Spelling difficulties caused by non-Mandarin dialects

In spelling, Cao (1983: 21) stated three difficulties: (1) difficulties in spelling long finals, e.g. *iao*, *ian*, *iang*, *iong*, *uan*, *uang*, *uai*, *üan*, and so on, (2) difficulties in spelling syllables requiring the use of *w* and *y*, and (3) difficulties in memorizing various elements of pinyin.

Although there is little empirical research investigating how these difficulties were caused by memorization, there is some research showing that local dialects are the cause of difficulties in spelling (Cao 1989; Lin 2009).

If memorizing sequences of letters is the only requirement for spelling, then people's dialects should not affect their construction of words (Treiman 1993). However, if people construct spellings from sounds, then their spelling would be affected in different ways depending on what dialect they speak. There are seven main dialects in the Chinese language family, and Mandarin is one of them. Pinyin is designed to help

learning the standard form of Mandarin. The differences between the standard form of Mandarin and local Mandarin are immediately noticed. People who speak a non-Mandarin dialect are the earliest to realize the difficulties caused by their dialect in learning to speak Putonghua. But what about learning to read and spell in pinyin?

A survey by Jia (1985: 40) was conducted in primary schools in Shanghai in October 1983, in response to the opposition view that learning pinyin added to the burden of learning Chinese and that "learning pinyin was equivalent to learning a foreign language".

One important point needs to be made: it was not clear whether the claim—"learning pinyin is equivalent to learning a foreign language"— referred to the speaking of Putonghua, or reading aloud in Putonghua, or spelling in Putonghua. Also, note that Shanghai speech belongs to the Wu dialect, which is unintelligible to Mandarin speakers. Moreover, reading aloud and spelling in Putonghua allows people time and space, but speaking in Putonghua is spontaneous; thus, it requires more effort, particularly for a non-native speaker of Mandarin.

One thousand and sixty-eight pupils, in the first and second grades, selected from ten primary schools, participated in the survey. The pupils represented the good, better, and best schools and were given a spelling test in their classrooms and a reading-aloud test individually. The first-grade pupils were dictated the six single finals (*a*, *o*, *e*, *i*, *u*, *ü*) and the 23 initials in the spelling test. In the reading-aloud test, as well as what they had been dictated in the spelling test, they read all the compound finals and the recognize-as-a-whole syllables.

Also, the pupils were tested in recognizing the four tones and reading syllables aloud. The results showed that 94.94 % of the 718 first-grade pupils achieved 100% correct on spelling the six single finals, and 91.85% achieved all correct on reading them aloud. On the spelling of the initials, 83.70% were 100% correct and 83.23% read them aloud without error. The results were also impressive on reading aloud the compound finals (74.63% all correct), on reading aloud the recognize-as-a-whole syllables (66.10% all correct), and reading aloud the four tones (80.99% all correct). Only on a test for blending all kinds of syllables (55.52% all correct) were the results less impressive.

With the relatively lower proportion of pupils getting all correct in the last-mentioned test, there are echoes of the difficulties in blending syllables observed by other researchers (Cao 1983; Yin 1993; Yu 1959; Zhou 1961). Unfortunately, there is no documentation of even a single error the pupils made either in reading aloud or spelling; therefore, it is not clear what was difficult for the pupils to perform correctly, nor what might have caused the errors.

The 350 second-grade pupils were also tested on "mastering" (i.e. spelling) 400 syllables. Note that there are only 417 syllables in the Chinese language, if syllables for exclamations are included (Shangwu Yinshu Guan 1987). The fact that 400 syllables were tested means that virtually a complete set of Chinese syllables was tested (Duanmu (2007) counted 404 full syllables), which might be equivalent to the complete spellings of the English language. A remarkable 61.4% of pupils spelled all the 400 correct, and 33.4% achieved 90%, leaving only 18 (5.14%) of the 350 pupils getting lower scores. Of these 18 pupils, 13 were 80% all correct, one at 70%, and four achieved below 60%.

The impressive results seem to further indicate that learning to read or spell is not difficult, even in a non-Mandarin-speaking region where the local speech is unintelligible to Mandarin speakers. However, some questions remain: one would like to know what the 10% of syllables (i.e. 40 syllables) that a third of the pupils got wrong were, what types of syllable these were, and in what way these syllables were spelled incorrectly, because the misspellings could suggest where the difficulties lie. Unfortunately, there was no information supplied in the research; nor was there any information provided on the syllables that the residual 18 pupils failed to spell.

Jia (1985: 41) also tested the second-grade pupils to "differentiate" the mirror-image letters (*b, d, p, q*), which was a response to the claim that "the time spent in learning to recognize those four letters would allow pupils to learn at least four hundred Chinese characters". The result was that 94.0% pupils spelled them all right.

The last test in Jia's (1985) study asked the second-grade pupils to "distinguish" (in spelling) the three pairs of initials *zh*/*z*, *ch*/*c*, and *sh*/*s* and finals with sounds represented by *n* and *ng*. Results showed that 88.0% distinguished the initial consonant pairs correctly and 85.4% distinguished *n* and *ng*. These impressive scores seem to further indicate that learning pinyin in a non-Mandarin region is not as difficult as was thought. However, the performance of the remaining 12% to 15% does suggest that some children found challenges in learning pinyin, and especially that dialect (in the case of *zh*, *ch*, *sh*, *ng*) can cause difficulties in learning pinyin. Because there was no information about what syllables the pupils failed to spell, or spelled incorrectly, it is not known what syllables were prone to the influence of the dialect. Consequently, it is not possible to know what types of syllable are likely to cause difficulties. Further, the difficulties that

the first-grade pupils had in spelling might not have shown up in their test, because these pupils did not spell syllables, but only initials and six single-vowel finals. So there remains much to learn about spelling in beginner learners.

With a sharp contrast in the spelling performance on the 400 syllables between the majority and minority from the above research, there are some indicators to be considered for further study of spelling difficulties:

(a) It is possible to test fewer syllables than 400 to find out what is difficult in learning to spell, since the results show that only a minority of syllables cause problems.

(b) Although counting performance can tell people how well the pupils have spelled, the score of performance would not tell people what they did not spell correctly.

(c) the 400 syllables each represent single characters; but one of the characteristics of Putonghua is the retroflex, as in *zuir*, which needs two characters to present the retroflex feature. It is interesting to have information about spelling in this case because the aim of learning pinyin is to learn to speak Putonghua and to use it to write in Putonghua.

(d) Data from younger children who have not fully mastered the pinyin writing system might be most informative on how children learn to spell and on what difficulties they may come across. Further, data from younger children might reveal what researchers previously had not considered in learning to spell.

Therefore, there is a need to see children's spellings. Correct spellings are taught by teachers or adults, but they tell us nothing about how children learn to spell. Incorrect spellings, on the other hand, are revealing, because, quite clearly, they are not learned from teachers or adults (Read 1986). On the contrary, these spellings indicate the

children's own initiative. It is the incorrect spellings that tell us about difficulties that pupils might encounter. Only when we know how children learn to spell can their difficulties be understood better, and most efficient help can be given (Read 1975, 2009; Treiman 1993). That is, in the understanding of pupils' spelling difficulty, it is the information conveyed in their incorrect spellings that is vital.

Perhaps, the difficulties that non-Mandarin-speaking children have to face are better shown by direct comparison between a Mandarin-speaking area and a non-Mandarin-speaking area. A study by Cao (1989) did make such a comparison. Cao's study was conducted in Qingdao, a Mandarin-speaking city, and Shanghai, a non-Mandarin-speaking city. Participants were pupils in the second, fourth, and fifth grades. In reading, the pupils were asked to read a short passage in pinyin. In writing, the pupils were given three tests:

(1) a dictation of ten syllables in pinyin, in the sentence 努力学习汉语拼音知识 *nu*3*li*4*xue*2*xi*2 *han*2*yu*3 *pin*1*yin*1 *zhi*1*shi* (work hard in learning pinyin);

(2) a test of transliteration from pinyin to Chinese characters: writing 10 Chinese characters according to pinyin: *chun*1*tian*1, *zi*4*ji*3, *ping*2*guo*3, *fei*1*chang*2, *xi*3*zao*3;

(3) a test of transliteration from Chinese characters to pinyin: writing ten pinyin syllables according to the characters presented to them: 月 (*yue*4), 多 (*duo*1), 斤 (*jin*1), 黄 (*huang*2), 有 (*you*3), 行 (*xing*2), 船 (*chuan*2), 难 (*nan*2), 只 (*zhi*1), and 去 (*qu*4).

Table 3.1 shows the results reported according to the city.

Table 3.1 Results of pinyin tests in two cities

	Shanghai (at least 60% correct)	Qingdao (at least 60% correct)
Ten dictated syllables (spelling)	65.5%	75.7%
Ten characters to pinyin (spelling)	61.4%	75.4%
Ten pinyin to characters (reading)	95.7%	97.6%

It is remarkable that writing characters from pinyin syllables has similar rates of over 95% for both cities, but spelling in pinyin is far below that level, even in Qingdao, either from dictation or from transliteration. This comparative result shows the contrast between the ease in reading and the difficulty in spelling in both regions. What is also shown is that spelling could pose problems even in a Mandarin-speaking area, because the scores in spelling among the Qingdao pupils were much lower than in reading, and were only about 10 percentage points higher than those in Shanghai (i.e. 75.7% vs 65.5%).

With Jia's (1985) study, Cao (1989) demonstrated that spelling is difficult but reading is not. More clearly than Jia's results, Cao shows that the non-Mandarin-dialect pupils have more difficulties in spelling than Mandarin-speaking pupils, although it is not known what types of syllable (see Section 2.2.4) they attempted and which were difficult. In addition, Mandarin-speaking pupils also found difficulties in spelling. Cao does not provide information on why these syllables were tested, and neither was there any categorization of the syllables. However, it is noticeable that Cao did not choose any syllable bearing two-to-three correspondence between letters and sounds for his spelling test. The following table shows what types of syllable were tested.

Syllable type	Selected syllables
One-to-one	Spelling: nu, li, xi, han, duo, jin, nan, pin (8 syllables) Reading: zi, ji, guo, fei, xi, tian, zao (7 syllables)
Two-to-one	Spelling: zhi, zhi, shi, chuan, xing, huang (6 syllables) Reading: ping, chang (2 syllables)
Two-to-three	Spelling (0 syllables) Reading: chun (1 syllable)
w0y0	Spelling: yin (1 syllable) Reading: (0 syllable)
wuyi	Spelling: you (1 syllable) Reading: (0 syllables)
yu	Spelling: yue, yu (2 syllables) Reading: (0 syllable)
jqx	Spelling: qu, xue (2 syllalbes) Reading: (0 syllable)

The fact that Cao's (1989) study chose twenty syllables in the spelling test, and the test of reading contained only ten syllables plus a "short" unpublished passage, suggests two things. One is that time for doing educational research at schools was restricted. The other is that only certain types of syllable are difficult to learn to spell. What is particularly valuable here is that Cao provided the complete spelling testing items, which is helpful in inferring what the likely difficulties were for the pupils in those two cities. Also, the syllables that Cao tested are helpful in deciding the amount and the choice of testing items for the present study. Unfortunately, as seems to be the case (e.g. Jia 1985) in studies about learning pinyin, only overall statistics were published: there is no record of what syllables were not spelled correctly, nor what kinds of error these students made, and therefore it is not known exactly what was difficult in spelling some syllables correctly, nor why. What is more, because of the difference between the Shanghai dialect and Qingdao Mandarin, perhaps the difficult types of syllable would be different, too. Also, because Jia's and Cao's studies only recruited pupils in the second

grade and above, it is not known how the younger learners, the first-grade pupils, fared in learning to spell.

Difficulties in spelling caused by dialect are also noted in research that was not focused on pinyin, for example, by Zhang & Lin (2002) who studied adolescents who speak Cantonese, and by Shen & Bear (2000), whose children speak Wu dialect. However, it was the study by Lin Mingxian (2009) that provided the first systematic empirical record of errors caused by the southern dialect Min.

In her study, Lin Mingxian investigated how adult speakers of other languages differed in their spelling in pinyin from Chinese third-graders, "who were at a comparable level in the mastery of Chinese characters". The aim was to discover what specific problems they each had in learning to speak Putonghua, so that pinyin could be taught more effectively: as an important tool in learning Putonghua for speakers of non-Mandarin dialects, as well as for speakers of other languages. Fifteen foreign learners of Chinese were compared with 15 third-graders. The adults were aged 18 to 30, and the pupils were 8 to 9. The test was to spell 96 two-character words in pinyin. Lin divided the tests in three slots and administered it to the third-grade pupils across three days, because of the constraints of the school schedule.

The tested Chinese syllables involved all the initials and finals in the pinyin writing system, with 20 kinds of combination of them. The results showed strong influence from the language and dialect they speak every day. The errors that the third-graders made were as in Tables 3.2 and 3.3 (Lin 2009: 48).

Table 3.2 Spelling errors in initials among the third–grade pupils

Initial	Number of misspellings	Error made
s	8	sh
c	9	ch
z	6	zh
sh	7	s
ch	6	c
zh	6	z
r	2	l
n	2	l

It is noticed that only eight (out of 23) initials seem to have caused problems in spelling. As a benefit of Lin's recording of the errors, the "hypercorrection" can be seen once we understand the differences between Putonghua and the southern Min dialect. Learning pinyin is to learn to speak in Putonghua. Standard Chinese has three retroflex consonants *zh* [tʂ], *ch* [tʂʰ], and *sh* [ʂ]. These sounds are a major characteristic of local speech in Beijing (Duanmu 2007). Southern dialects only have their equivalents *z*, *c*, and *s* (see Jia's 1985 study), which are not retroflexed. In fact, even some regions where Mandarin is spoken do not distinguish the retroflex sounds between *zh* and *z*, *ch* and *c*, and *sh* and *s* in their native speech. It is through learning Putonghua via pinyin that many people become aware of the distinction between *zh* and *z*, *ch* and *c*, and *sh* and *s*. So, it is often observed that people either use the un-retroflexed sounds where the retroflexed ones should be used, in accordance with their local dialect, or they may use the retroflex in the place where un-retroflexed sounds should be used, as a result of hypercorrection (Duanmu 2007). Recall that there is no *zh*, *ch*, or *sh* sound in the Wu dialect, and the

pupils tested in the previously reviewed study by Jia (1985) had problems when spelling these three pairs *z* and *zh*, *c* and *ch*, and *s* and *sh*, too. This conflation shows up in Lin Mingxian's study in the pupils' attempts at pinyin spelling (Table 3.2).

In addition, because there is no sound of *n* and *r* but only *l* in the Min dialect—that is, speakers use *l* when it is *n* or *r* in Putonghua—the pupils spelled *l* in the place of these *n* and *r* sounds. The errors made in the finals were also in the sounds which do not exist in the dialect that the third-graders speak—the most obvious one being the *ü* sound, which is pronounced as *i* in Min; see Table 3.3 (Lin 2009: 49). Their errors show what sounds are absent in the Min dialect and what sounds replace them: *ng*, *ü*, *ou*, and retroflexive *er* are replaced respectively by *n*, *i*, *o*, and *e*.

Table 3.3 Spelling errors in the finals by the third-grade pupils

Finals	Number of misspellings	Error made
ü	9	u (1), i (8)
üe	5	ie
üan	6	ian
ün	4	in
er	6	e
ang	6	an
uang	5	uan
eng	8	en
ou	7	o (6), uo (1)
ie	3	ei
o	2	ou

Lin's (2009) study demonstrated that a non-Mandarin dialect is a cause of difficulty in spelling, but it also revealed that all her participants' errors can be explained phonologically. In addition, the research showed other errors such as transposition errors between *ie* and *ei* and *ou* and *uo*.

It seems that only 11 (out of 38) finals caused problems in spelling (Table 3.3). It is further noticed that none of the errors were made on the finals of the two-to-three type. It is striking that neither the research focusing on the Wu dialect nor that on the Min dialect tested this type. This seems to indicate that different dialects might pose different difficulties in learning to spell in pinyin. Considering the number of syllables tested, perhaps the number of testing syllables could be reduced by at least two thirds, if errors only occurred on these recorded 8 initials and 11 finals.

More unexpectedly, because the pupils' erroneous spellings were recorded by Lin, one aspect that was not focused on in her study was revealed. This error is not associated with phonology but orthography, namely, the change of *ü* to *u*. When *ü* is preceded by *j*, *q*, and *x*, the umlaut should be omitted. The umlaut is retained only in two cases: when *ü* is preceded by *n* or *l*. That the *ü* was spelled as *u* (Table 3.3) might suggest that the pupils over-learned the rule. Or the visual similarity between *u* and *ü* might have caused the error. Although only one pupil made such errors, this *ü* might be a difficulty for younger pupils, seeing that Lin's pupils were in their third year of primary school.

Along with the transposition errors, the *ü* seems to accord with the findings in English: the visual shape of the letters affects children's spelling (Ehri 1979, 1984, 1997; Cornelissen et al. 1994; Seymour 1979). It would seem that, whatever erroneous letters the pupils used, the number of letters correspond exactly to the number of sounds. There

is no case where the sound is not represented at all by a letter. Lin's study indicates the importance of providing students' erroneous spellings in understanding what and why difficulties exist. Lin's results further show that, whatever errors pupils made, there was always a correspondence between the errors in the spelling and the sound in the speech. This indicates that learning to spell does not only require memorizing the strings of letters, but also involves exercising the logic of letter–sound correspondence, even under the condition where the correspondence is explicitly taught.

A question arises here. Where does the logic come from? Looking at the textbook in Appendix I and also Section 2.3.3, the logic seems to come from learning pinyin. The one-letter–one-sound correspondence is introduced right from the first lesson.

3.3 The alphabetic principle and learning to spell in English

It may be worth stepping aside to consider research into children's difficulties in learning to spell in English, the most researched language, given that there is little study focused on how children learn to spell in pinyin.

In an alphabetic writing system, the spelling of a word or syllable reflects its sound (Treiman 1993: 144). The strict alphabetic principle is: one consistent symbol per phoneme (Carney 1994: 474). The alphabetic principle, in theory, requires not only that a given phoneme (sound) be represented by a grapheme (a letter or groups of letters) but also that the grapheme involved does not represent other phonemes (Carney 1994: 15). For example, if the letter "i" represents the sound [i], then the sound [i] can only be represented by the letter "i" and no other letters. In English, not only the letter "i" represents [i], it also represents the sound [ai]. Similarly, not only the sound [i] is represented by the letter "i", it is also represented by the letter "e" in "tested", or by the

letter “y” in “city”. In the case of the sound [ai], not only does the letter “i” represent its sound, “ei” (height), or “y” (by) also represents the same sound. English is marked in this respect, but almost all the writing systems based on this principle only loosely match this correspondence (Zhou 1964).

Nonetheless, because there is a correspondence between symbols and sounds, however loosely they match, learning an alphabetic writing system should permit people to spell readily (Read 2009: 262). Read (1970) made an important observation by looking at how 32 two-to-four-year old children spelled even before they could read. In contrast to what adults used to believe, that learning to spell was to memorize strings of letters for individual words, Read found that these children were attempting to symbolize the sounds of words. In fact, the children’s erroneous spellings revealed their attempts to induce the principle of spelling-sound correspondence systematically.

Read’s (1986) term “invented spelling” or “creative spelling” symbolized a new era in adults’ understanding of children’s learning to spell in the alphabetic writing system. Children’s spelling is no longer considered as an activity of merely copying or memorizing but rather of exercising their own logic.

According to Read (2009), at early stages of spelling development in English, “what a learner writes is not merely an imperfectly remembered standard spelling”, but rather “in many instances the result of an active effort, based on the sound of the word, including its syllabic structure, and a partial knowledge of the principles of standard spelling, including letter-names, sound–spelling correspondences, and spelling patterns, as well as, later in development, whatever the learner knows (or supposes) about the history and morphology of the word” (Read 2009: 262).

Smith (1980) suggests that the alphabetic principle is much more useful to spelling than to reading, because "spelling appears to have a phonological component that is absent from reading" (Smith 1980: 48). Byrne (1991, 1998) emphasizes the importance of teaching the alphabetic principle to children in order to improve their reading and spelling ability in English. In detail, as Ellefson et al. (2009) have shown in experiments, children's spelling also reveals, first, how the structure of the spelling is presented by teachers—the teaching effect (also Marsh et al. 1980: 340)—and secondly, what dialect they speak (see also Treiman 2004). Taylor & Martlew (1992) state, particularly, that not only phonetic but also visual and lexical strategies are used in spelling. Moreover, learning to spell and learning to read are not exactly the same (Ehri 1997); children may use opposing strategies in spelling and reading (Bryant & Bradley 1980), because of the evidence of "reading by eye and writing by ear" (Frith 1979).

3.3.1 Children's invented spellings in English

Invented spelling refers to children's own spelling until they master the orthographic rules (Aljelajel 2006). It is an indication of writers' active involvement in their own re-creation of the written language (Wilde 1992: 2). The strongest evidence for the use of a phonological strategy in spelling is collected by Read (1970, 1975, 1986) in preschool children's invented spellings, and by Treiman (1993) in first-grade pupils' spellings. Both of them independently found that children use letter names and letter sounds to represent their oral vocabulary, before they can read and before they are taught explicitly in spelling.

The value of collecting such data lies in the information shown through the window of their spellings. For example, a 4-year-old boy wrote:

TUOS.DAY.NIT.I.WIS.PLAYIG.WITH.LORA.

Tuesday night I was playing with Laura,

AND. I.MAREDRA.WINTS.I.GIT.AGRE.

and I married Laura. Once I got angry

AND.I.FIDI.WITH.HIR.AND.I.LAFFT.IN.

and I fighted with her, and I left in

TO.THE.CCHIN.THAN.AFTR.I.WIL.I.I.

to the kitchen. Then after a while I

MARED.HIR.I.GAN.

married her again (Read 1986: 128).

It is notable how the creative spellers solved the segmentation problem readily and how systematically they use a letter to represent the sound that the name of the letter represents, and then extend their little knowledge of letter names and standard spelling, which may be learned from food packages and public signs (Read 1975; Goodman & Altwerger 1981).

Such early writing has also caught Bissex' (1980) attention, when her son was expressing his dissatisfaction with being ignored by his mother, who was reading at that moment. The son presented his mother with a piece of paper bearing the inscription R U D F (Are you deaf?). Her son was using letter names, for the words which sound the same as the letter names: a sort of creative spelling noted before in Read's (1971) study, e.g. U (you), OVR (over), R (are), and ME (me), in Treiman's (1993, 2007) records, and in Ellefson et. al.'s (2009) experiment.

The rich data collected from children's own initiative writing provides an opening to understand how learning is processed in the child. In addition, the phenomena emerging from the data raise important questions for theory testing. For example, the investigation on "what happened to the "n" of sink" by Treiman et al. (1995) was motivated from the data of children's spelling, including those observed by Read (1975). Read observed that his preschool children often failed to spell anything for the nasal consonants [m], [n], and [ŋ]. These omissions occur when these sounds preceded an obstruent consonant. As many as 35% of the omissions appeared before voiceless stops such as [t] or [p]. Treiman et al.'s (1995) findings indicate that children's spellings show their own phonological representation of the feature of the spoken words, different from the adult's. To Read's children, the sound of "n" in words like "plant" was so nasalized with the preceding vowel and so "acoustically short" (Malecot, 1960: 229) that the letter "n" did not deserve to be expressed. So Read's children's spelling for "plant" was "plat" and for "stamp" was "stap". It is thus not surprising that for Treiman et al.'s children "sink" is "sik" (Treiman et al. 1995:32).

Like Read, Treiman (1993) studied the spellings that 43 first-grade children produced in their own stories. The teacher of Treiman's children would never tell her pupils what correct spelling was, even if her pupils asked her (Treiman 1993: 5). Of these children, 26 attended the class in one term and 17 in the following term. Significantly, Treiman observed creative spellings like those "invented" by Read's preschool children, although her children had already started their schooling. What is more, her study, like Read's (1975), offers a detailed record of data, showing children's understanding of letter–sound correspondence, and showing that spelling requires not only a good visual

memory but also intelligence and linguistic ability. In her study, spellings for the phoneme /æ/ in the words *had* and *brand* had 597 occurrences, with 518 of them spelling it as *a*, 16 omitting it, 12 spelling it as *i*, and ten spelling it in the *a*-and-terminal-*e* pattern. She also recorded one occurrence of the spelling *ai* for /æ/ (Treiman 1993: 310). Could this indicate that the American children pronounced *a* (/æ/) in the word *had* is actually /ei/? If this was the case, then children omitted *a*, because they were using letter names to represent the sound of the word. The letter *h* has the sound of /ei/.

The data from Read (1971, 1975, 1986) and Treiman's (1993) research are valuable, because they are the material for testing theories and for suggesting new theories. However, naturalistic data, namely data collected under no testing condition produced by children who wrote on their own initiative, requires a lot of information to identify what they meant to write. For example, in order to be sure that BER is actually stood for the word "bear", Read (1975) had to figure out what it was intended to be by the picture on the cover of the book, the whole passage the child wrote, and the "little brown creature standing next to a tree" (Read 1975: 16). Similarly, Treiman (1993) found that the words the children dictated to their teacher were not always what they intended to use in their stories (Treiman 1993: 10–11). Naturalistic data are also hard to compare: the spellings produced by a given child may not involve the same words, the same number of words, or even the same time periods as the spellings produced by another child (Treiman 1993: 37).

3.3.2 The logic behind English-speaking children's creative spellings

The following study by Beers et al. (1977) shows much clearer children's creative spellings in an experimental situation. In order to find out whether older children spell

using the strategies apparent in younger children who have not received systematic spelling instruction, Beers et al. gave a spelling test to 46 first-graders, 57 second-graders, 51 third-graders, and 43 fourth-graders studying in various schools in the U.S.A. The test consisted of five common and five uncommon words. One of the most common words is "hat". When Beers et al. saw the children's spellings such as *hait* for "hat", *gait*/*gaet* for "gate", *draip* for "drape", and *riad* for "ride", they first "thought these misspellings were due to the children's misunderstanding of the function of silent *e* and *i* in words like gate and wait" (Beers et al. 1977: 239). However, when they asked the children to explain their spellings, some children said they distinctly heard the extra sound when they pronounced these words. Eight first-graders spelt hat as *hait* because they heard the [i] sound as they spelled. So, Treiman's single occurrence of *ai* (1993: 310) is replicated by as many as eight occurrences in the experimental condition here (Beers et al. 1977: 240).

The logic associated with letter–sound correspondence can also be seen in other spellings. For example, if we look at the records of the errors that children made, we find that none of Beers et al.'s children spelled the low-frequency word "sap" as *saip* (Table 3.4, reproduced from Table 1 of Beers et al. 1977: 240). Unlike *hait* (for *hat*), this notable non-appearance of *saip* in the misspellings might be for a phonetic reason, too. The mouth closure for [p] does not involve the tongue, in contrast to the case for *hat* where the momentary [i] is formed before [t] is pronounced. Beers et al. found eight first- and 12 second-grade pupils spelling *sap* as *sape*. Coincidently, this spelling was replicated by ten first-grade pupils in Treiman's study (1993: 310). A contrasting misspelling is *sat* for *sap*, whose sound *t* has no resemblance to *p* at all, written by eight children who had received formal spelling instruction. This seems to suggest that when spelling unfamiliar

words, children do not spell completely according to sound. In this instance, it looks as though they replaced an unfamiliar word by a familiar one, supplying more evidence that spelling involves visual and lexical as well as phonetic strategies (Taylor & Martlew 1992).

Table 3.4 Record of children's spelling on "hat" and "sap" (Beers et al. 1977)

Vowel	Word Frequency		response	Year 1 (46)	Year 2 (57)	Year 3 (51)	Year 4 (43)
short *a*	hat	high	1. hat	37	56	51	43
			2. hait	8			
			3. none	1	1		
	sap	low	1. sap	33	39	45	43
			2. sape	8	12	4	
			3. sat	3	4	1	
			4. none	2	2	1	

Such detailed information itself is useful to active researchers. It allows them to make their own interpretation and apply it to their own research.

One advantage shown in Beers at al.'s (1977) study is that, under the experimental condition, adults could be more definite about what the children mean to spell. Read (1971) and Treiman (1993), using natural data, had to either discard some of the children's spellings because of ambiguity or make assumptions about what the child meant to spell. "Ultimately, the best way to learn about children's spelling is through a combination of naturalistic and experimental methods" (Treiman 1993: 38).

There are some differences between learning pinyin and learning English. Compared to English, pinyin has only seven types of syllable. Pinyin is also taught explicitly in a uniform way. In addition, the Chinese language has only 404 syllables (417

including exclamations). As Jia's (1985) study shows, at the second month of the pupils' second year at primary school, writing the complete set of syllables in the language is quite manageable. It is rare—perhaps unknown—to find English-speaking pupils drilled to write the complete set of syllable types. But in China, it has been a common practice for many schools to require the pupils to master the 400 syllables in pinyin (Jia 1985; Wu 2007).

One point we might have to highlight again here is that, in the pinyin class, each pinyin initial and final, whether it is a single letter, diagraph (*zh*, *ch*, *sh*), three-letter (*ing*, *ang*, *eng*, *ong*), or one of the sixteen recognize-as-a-whole syllables, is explicitly taught. That is, the corresponding sounds for the initials and finals are fixed by the explicit teaching. In addition, the combination of initials and finals is taught in the logic of addition: 1 initial + 1 final = 1 syllable. To a large extent, teaching the pinyin system is teaching the alphabetic principle: there is a correspondence between letter(s) and sound(s), even though the principle is not mentioned in the teaching.

While it might not be practical or possible to teach every combination of letters in English, every possible composition of the syllables in pinyin is explicitly taught in an analytic way: the 23 initials, 24 finals, and the combination of them, along with the 16 recognize-as-a-whole syllables. For instance, *b* can be combined with *a*, *an*, *ang*, *ao*, *ing*, and any other final that is possible in the language. So, if Read's (1971, 1975) children show creativity because they spelled without formal teaching, then the creative spellings, if observed from Chinese children who are taught formally, might be described as constructive, because their creative spellings are built from the most basic rules by following the teacher's instruction in an unexpected way.

3.4 The logic behind the erroneous spellings by Chinese pupils

Chinese children's "invented spelling" in pinyin has not been the focus of previous studies; but, from the available scattered data, it is not hard to perceive that Chinese children are following the logic of the alphabetic principle like their English-speaking peers do. However, this logic prevails more in the case of pinyin.

3.4.1 The logic shown by children with learning difficulties

In order to understand whether children's learning disability was caused by phonological deficiency, Ha & Wei (2000) investigated the spelling ability of Chinese children with learning difficulties. Their study was conducted in Beijing, where a version of Mandarin close to Putonghua is spoken. They examined 33 pupils from years 1 to 6, with ages ranging from 7 to 12, on three criteria: (1) how they orally blended pinyin initials and finals into syllables; (2) how they read pinyin syllables; and (3) how they spelled pinyin syllables.

To concentrate on letter–sound correspondence in the syllables, the researchers emphasized that tones were not considered in their study.

In the oral blending test, the researchers pronounced the initial and the final and asked the pupils to blend them into syllables. In the reading test, they showed pinyin syllables for the children to read aloud. In the spelling test, they presented six characters and asked the children to provide six pinyin syllables for them.

In the oral blending experiment, only 3 pupils made errors when blending initials with finals, and only four syllables were wrong. In the reading experiment, 14 pupils made errors spreading over 25 syllables. The errors made in finals were all in compound

finals (finals with more than one sound), such as reading *ing* as *in* or *iong*, reading *ue* as *ian*, or *ie*, or *iang*, or *u*, and reading *ei* as *en*, or *ie*. Ha and Wei particularly pointed out that reading *ei* as *ie* should be interpreted as an error of transposition. This error was also recorded by Lin (2009) and was interpreted as such. The errors made in the initials were mainly on letters, which have inversions or mirror images: reading *d* as *p* or *b*, or reading *b* as *d*. This kind of error made in reading inversion letters was also studied by Jia (1985) in normally developed pupils. These observations somewhat reflect what was found among English-speaking children who have reading problems (e.g. Cornelissen et al. 1994).

In the spelling experiment, all the 33 students made errors, which were placed in the following categories:

(1) Inability to spell anything;

(2) Spelling having no resemblance to the correct spelling (e.g. *o* for *er*);

(3) Only part of the syllable given (e.g. *i* for *yi*, and *w* for *wu*, finals for *san*);

(4) Only part of the syllable being correct, resulting in another syllable (e.g. *zan* for *san*, *xi* for *yi*, *wo* for *wu*, and *ci* for *si*);

(5) Part of the syllable being correct, resulting in a non-existing spelling (*lio* for *liu*, and *sr* for *si*).

One notices that Ha & Wei's categories were based on the visual presentation of the syllables, which reflects the fact that, to the two researchers, the first information in learning to read or spell is visual. Moreover, Ha & Wei specifically set out to analyse the childrens' spelling errors only in visual terms. However, one can hardly miss that almost all of the students' erroneous spellings were phonetically plausible substitutes for the

correct spellings, namely categories 3–5. The most obvious ones are the spelling *i* for *yi* and *w* for *wu*; they are phonetically correct but orthographically wrong. To be exact, children were using letter names (*i*, *w*) to represent the syllables (*yi*, *wu*), which sound the same as the letters; a phenomenon caused by the hudu teaching method. The same behaviour has been noted in English (e.g. Ellefson et al. 2009; Treiman et al. 2007).

The error sample *sr* might be an influence from the typical Beijing colloquial speech which has the retroflection sound, namely *r*. Given that Putonghua is not exactly a native language in any region in China, but a standard speech based on Mandarin, the Northeastern dialect, and the accent of Beijing speech, it is possible that any local speech that is different from the standard form of Mandarin would have an influence on the children's spelling. Coincidently, the spelling *sr* is what the Yale scholars used in their system to transcribe the sound of pinyin *shi* (Section 1.2).

Comparing the students' almost perfect performance in the oral blending and the better performance in reading than in spelling, Ha & Wei (2000) concluded that it was a deficiency in memory, not in phonological ability, that caused those students to have difficulty in learning to spell. This conclusion echoes the emphasis that memory is the key in learning to spell (Cao 1983; Wu 2007). Such a conclusion seems to imply that there is no logic in learning pinyin; all that is needed is to rote-memorize the sequence of letters, because all the letter–sound correspondences are taught explicitly. Ha & Wei's (2000) conclusion also shows that children's spelling is not looked at from the viewpoint of the alphabetic principle that there is a correspondence between letters and sounds, but seemed rather that the alphabetic principle was ignored. Therefore, in dealing with the alphabetic writing system, their study seems to have missed the point of the system.

3.4.2 The logic behind common spelling errors

Even Chinese adults are not aware of the discrepancies between the letters and sounds, and they believe that the pinyin writing system is completely straightforward, that there is one-to-one correspondence between letters and sounds (Song 1981; Wang 2005, 2009).

The logic behind students' spelling is incidentally shown in Song's (1981) record of "common errors made in pinyin spelling" among spellers (whose ages were not mentioned). Song (1981: 64) reported that in Henan province, where a version of Mandarin is spoken, it was easy to spell *in* wrongly as *ien* and *ing* wrongly as *ieng*, but dismissed these as misapplication of the spelling rules, in a logic that does not apply in these two cases, because it is "impossible to pronounce *in* or *ing* with *e* ([ə]) inserted" (Song 1981: 64). Song explained in detail that these mistakes were caused by following the logic applicable to the *an*. By adding *i*, *u*, and *ü* to *an*, the finals *ian*, *uan*, and *üan* are obtained. This would be true, if there were no *e* ([ə]) sound in the two finals: *in* and *ing*. But there actually is an *e* in the pronunciation of them although the orthography does not express it. To put it explicitly, *in* has the sound of *i* plus *en*, and likewise *ing* has the sound of *i* plus *eng*.

Only recently was research done to establish that the original designers of pinyin were aware of the presence of the [ə] sound in the Mandarin pronunciation of these syllables, but chose to represent the syllables as *in* and *ing* rather than *ien* and *ieng* for brevity (Wang 2005: 7).

Wang Lijia's (2005) research clarifies, timely for the present study, these discrepancies between pinyin spelling and its pronunciation, which Chinese adults are unaware of. Thus, the *in* in the two syllables *pin* and *yin* looks the same, but the

pronunciation of *yin* is actually *yen*, taking *y* to be pronounced as *i*. That is, the pronunciation of *in* in the syllable *pin* is *in*, but it is *ien* in the syllable *yin*, with *y* functioning as a syllable boundary. In fact, the final in the two syllables *jin* and *yin* does not rhyme; while *jin* is pronounce as it is spelled, *yin* is pronounced as *yen* or *ien*, with *i* equivalent to *y*. Although some researchers have pointed out some discrepancies in the pinyin orthography (Xu 1986; Yang 2001), few mentioned *yin* or *ying* (which should be pronounced as *yeng*). What is interesting is that many people must have heard and spoken the syllable *yin* differently from its spelling, but it seems that few are aware of the discrepancy.

As Beers et al.'s (1977) study showed that children let adults know what they hear in a common word "hat", the Chinese students show adults that there is an *e* sound in the spellings *in* and *ing*. Consider that the sound *e* is explicitly taught in the series of the first three single vowel finals (see Section 2.3.4, also Appendix I: 1). Once the child hears the sound and can identify the sound with the letter, it is logical to add *e* in the syllables *yin* and *ying*. This means that, along with the explicit teaching, children also infer the logic of the pinyin system through the teaching, and construct their own spellings, but in an unexpected way.

Other erroneous spellings for the sound of *in* and *ing* include *yen* and *yeng* (Song 1981: 65). They are faithful annotations of the two syllables spelled as *yin* and *ying*, respectively, according to the pinyin spelling system. Here, it is noticed that the name of the Chinese linguist Lin Yen–Hwei (Lin 2007) would be spelled as Lin Yin Hui in pinyin.

Syllables such as these two, namely *yin* and *ying*, are interesting because the spelling of them might throw some light on how children learn to spell. In the school

pinyin, these syllables are taught in the recognize-as-a-whole method. In this method, there is no further analysis of the components of the syllables such as an initial plus a final, but rather the correspondence is between the spelling of the whole syllable and the sound of the syllable.

Song's (1981) discussion about the misspellings of (*in* for *ien*) indicates that adults believe pinyin to represent the sound of Chinese syllables in a strict one-to-one correspondence between letter(s) and sound(s). What is of concern is that, based on such a belief, students' errors might be misunderstood, and therefore might be given an inappropriate correction by adults.

On understanding the pinyin writing system, Wang Lijia (2009: 41) points out to teachers three pitfalls that he has encountered in his own teaching experience:

(1) equating the letter literally to the sound;

(2) equating the spellings to the sounds;

(3) equating the number of letters to the number of sounds, that is, requiring all-through one-to-one letter–sound correspondence.

Wang (2008, 2009) shows concern about these misunderstandings because they were raised by teachers with years of teaching experience. One concern is that the teachers in Wang Lijia's research were those who taught Chinese to speakers of foreign languages.

It is not clear whether teachers of Chinese-speaking children share the same problems as those who teach foreigners.

Song (1981: 65) also listed "the common errors" such as using *y* for *i*, *w* for *u*, *yn* for *in*, and *yng* for *ying*. If we know that *y* sounds the same as *i*, and *w* sounds the same as

u, perhaps the explanation to these errors are all phonetic. Spelling out the sound abbreviated in the two-to-three type of spelling was another kind of "common error", i.e. *iu* for *iou*, *uei* for *ui*, and *uen* for *un*. These are all exact phonetic transcriptions of the sounds according to the alphabetic principle.

With children's erroneous spelling, the logical spellings from Song's observation have provided strong evidence that Chinese children, like their English-speaking peers, learn to spell by generalizing rules, rather than solely by rote memorization. More important, Song's (1981) discussion give rise to a pedagogical question on how to respond to such spelling errors.

3.4.3 The logic shown by teachers and university students

It is Wang Ling's (2004) study that refers to the original design of pinyin to show that there may be room for reform in teaching pinyin.

In order to put forward suggestions about how to improve the teaching of syllables involving *w* and *y*, as well as the teaching of the three finals *iou*, *uei*, and *uen*, Wang Ling asked her adult students what the *w* and *y* and what the *iu*, *ui*, and *un* stand for. Wang's (2004) study was motivated by her experience in teacher training that many primary school teachers who taught pinyin did not fully understand the nature of the *w* and *y*; neither did they know how the three one-to-one letter–sound correspondences are changed into the two-to-three letter–sound correspondence: that is, *iou* → *iu*, *uei* → *ui*, and *uen* → *un*. The participants were teachers in six primary schools and four secondary schools, students in four higher-education institutions majoring in Chinese, students in four teacher-training schools (secondary), and students in three teachers' colleges (higher education). Altogether, 724 answer sheets were collected.

Wang Ling's test simply comprised 20 characters with pinyin syllables. They are: 文 *wen*, 有 *you*, 推 *tui*, 翁 *weng*, 迎 *ying*, 完 *wan*, 意 *yi*, 修 *xiu*, 月 *yue*, 屋 *wu*, 也 *ye*, 要 *yao*, 尊 *zun*, 为 *wei*,我 *wo*, 军 *jun*, 永 *yong*, 云 *yun*, 雨 *yu*, and 远 *yuan*. She asked the teachers and students to mark the initials, finals, and tones. In particular, she asked the students to mark the finals according to sounds; for example, although the *iu* has only two letters, it contains three sounds *i*, *o*, and *u*. The participants were given answer sheets in the format as shown here (Wang 2004: 69):

			Finals			
Character	Syllable	Initial	First sound (head of the) (medial)	Second sound (body of the) (nucleus)	Third sound (tail of the) (coda)	Tone
文	wen					
有	you					
推	tui					
翁	weng					
迎	ying					

The results were alarming on the syllable boundaries *y* and *w*: for the 16 syllables beginning with *y* and *w*, only five out of 27 primary school teachers were able to restore *w* and *y* to the original (vowel) role. The remaining 22 teachers all put them as initials. The teachers in the secondary schools showed similar results. Perhaps such results should not be surprising because *w* and *y* are explicitly taught as initials in the textbook and in the class to pupils (Wang & Yang 2009). (Note: in the pinyin order, *y* is before *w*, because the teaching sequence is *i* (*y*, *yi*), *u* (*w*, *wu*), *ü* (*yu*).)

The results for the finals (*iu*, *ui*, and *un*) with two-to-three letter–sound correspondence were similarly poor: the majority of the participants were not able to

restore them to *iou*, *uei*, and *uen*. A full 100% of the students in two higher-education institutes failed to restore any of the finals with two-to-three letter–sound correspondence. This perhaps again should not be surprising, because the original three one-to-one correspondences between letters and sounds are only taught in the two-to-three letter–sound correspondence form. However, Wang ling's point is that the teachers and adults should know why the original unabridged spellings were simplified, and the simpler forms are taught directly as a shortcut. Zhou (1961: 14) believes this occurs because the original form (i.e. *uei*, *iou*, *uen*) will never appear in spelling, so it might be just as well to teach the orthographical form directly. This was called the "do it first, understand it later" method (Zhou 1961: 14).

As with Song (1981), Wang Ling (2004: 69) did mention that teachers would simply mark it as wrong when seeing students' un-orthographical but phonetically correct spellings *iou*, *uei*, and *uen*. It seems to confirm that these three finals with two-to-three letter–sound correspondence are likely to cause problems in spelling. However, it would be more informative if the adults' errors were recorded, because it is hard to imagine that all the errors were the same. What would be interesting is to see how the adults allocate the letters in the syllable *ying*.

Wang also found that it was commonplace for the participants to be unable to distinguish the *un* in the syllable *jun* from that in the syllable *zun*—*un* in *jun* is really *ün*, but the umlaut on top of *ü* is omitted according to the orthographical rule, when *ü* is preceded by the initials *j*, *q*, and *x* (see Section 2.2.5 for orthographical rules). This finding coincides with the accidental finding in Lin Mingxian's (2009) study reviewed previously. A methodological concern arises here: because the spelling of the syllables

was provided in Wang Ling's test, and because the adults are so familiar with the pinyin spelling, they might just be led by the orthography. Therefore, it might not be ideal to provide ready-spelled syllables in multiple-choice format to children in order to know how they learn to spell them.

With the surprise of Wang's (2004) results, showing that even college students and primary school teachers are not certain about how the orthographical rules came into being, which echo Wang's (2009) own teaching experience, Wang's (2004) study may also imply that these may be the persistently difficult points for children too. Further, Wang's study showed the orthographical rule for omitting the umlaut on *ü* to be difficult for adults. This was true for children in Lin's (2009) study as well, although the umlaut was not the focus of either study. It is valuable, in addition, that Wang Ling provided the actual testing items, which can be drawn on for the present research, especially with scarce data available. Wang's study underlines the question: which is more difficult, the syllable boundary or the abbreviation or even the orthographical rule concerning umlaut? The question may be refined because within syllables where the rules concerning syllable boundary apply, the syllable boundary functions in two ways: one representing sound, the other not. The answers to these questions are directly associated with the time allocated in the curriculum, with strategies that teachers can take, and with what teachers can expect to be learned.

Most important of all, Wang (2004) approached her questions from the original design of the pinyin writing system, drawing on letter–sound correspondence. Although the alphabetic principle was not explicitly mentioned by Wang (2004), she was following this theoretical principle, because pinyin was so designed. Wang Ling's study, while

showing the telling need not only for teachers to understand pinyin thoroughly but also to better understand children's spelling errors, reinforces the curiosity about whether children learning to spell are guided by the underlying rule—the alphabetic principle—even under the explicit teaching method.

3.4.4 The logic in a rare observation

Here, an interesting observation was made by an inspector who attended one beginners' class in pinyin (Qu 2010). This was the third lesson, in which single finals *i*, *u*, and *ü* were taught, together with *y* and *w* as a consonant initials and the recognize-as-a-whole syllables *yi* and *wu*. This grouping is because *i*, *y*, and *yi* sound the same; *u*, *w*, and *wu* sound the same; and *u* and *yu* sound the same. However, the textbook and the teaching method categorize them according to the pinyin terms: initials (*w*, *y*), finals (*i*, *u*, *u*), and recognize-as-a-whole syllables. What is more, the textbook marks the three categories in three blocks of different colours (Figure 3.1, also Appendix I: 3).

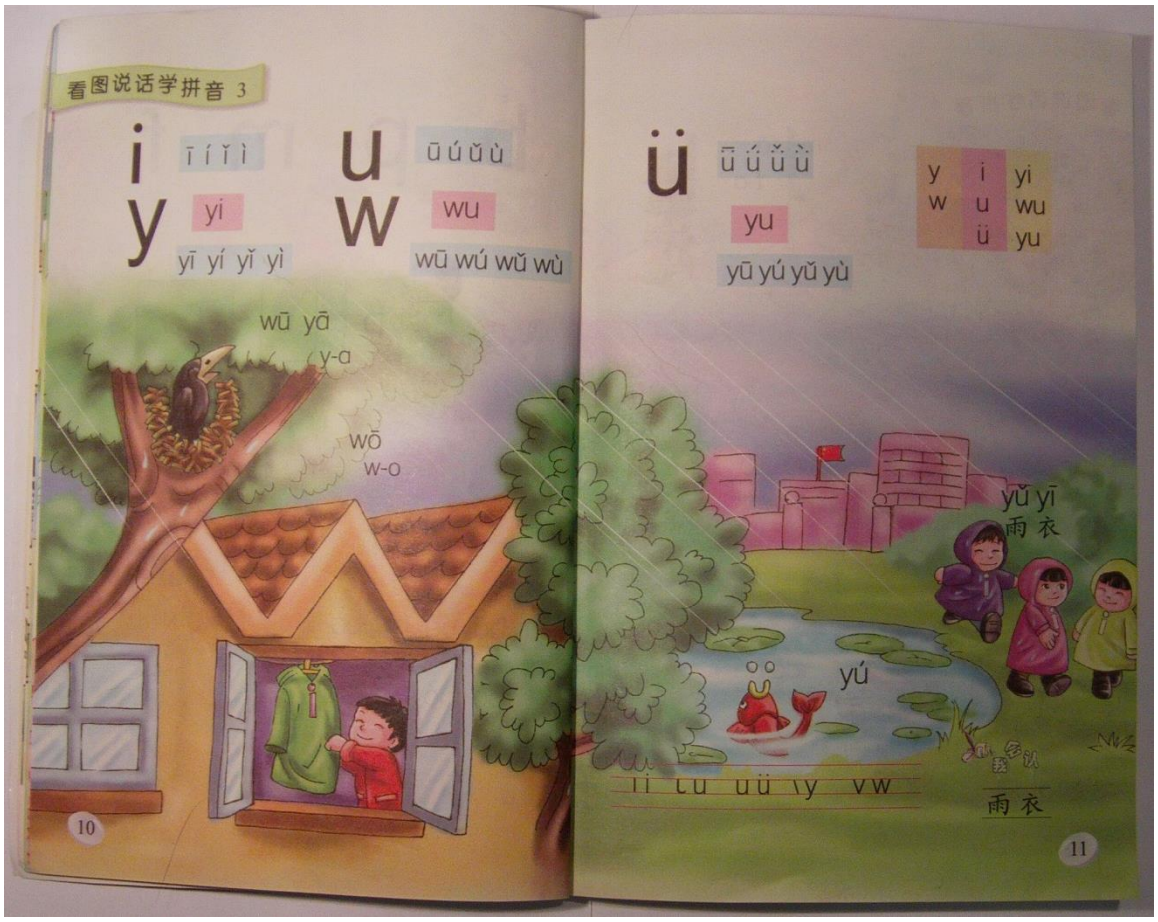


Figure 3.1 A page from the textbook (Lesson 3)

The teacher then asked the children to sort the cards and put them into the three baskets that she brought to the class. The pinyin inscriptions on the cards were what they had just learned: *i, y, yi, u, w, wu, ü,* and *yu*.

There are three categories for the eight elements: initial, final, and recognize-as-a-whole syllables. The three letters *i, u, ü* are taught as finals; the two letters *y* and *w* are taught as initials; and *yi*, *wu*, and *yu* are taught as recognize-as-a-whole syllables. The children were expected to sort the cards according to the categories set out in the textbook, and indeed they did place the cards according to the textbook—except one child, who put the cards according to the sound. The surprised teacher, instead of simply

saying the child was wrong, acknowledged the child's logic and praised his creativity, which pleased the inspector, who wished all the other teachers could recognize children's creativity like this teacher. The inspector further expressed her concern that the present teaching method restricts pupils' logic and discourages their creativity. However, she doubted whether many teachers were able to encourage children in this way because this was the only case in the whole school where a child organized pinyin according to sound.

This observation shows how quickly a child can pick up a principle and exercise his or her own logic. The question is what happens when the pinyin writing is taught first following the logic that the system expects children to develop, on the one hand, but then distorting the logic on the other hand. Would that be where the difficulty is?

3.4.5 Problems of blending in reading and medial omission in spelling

It took sixteen hours for an illiterate Chinese adult farmer to learn to read pinyin initials and finals. The difficulty he came across was to blend them into syllables in reading aloud (Yu 1959).

The cause of the difficulties in blending initials and finals into syllables had been identified with the hudu method and has been well explained by researchers: the consonant initial is taught just as its name, i.e. with a vowel attached to it (see Table 1.3). This means that in theory, a syllable being formed by a blending a consonant with a vowel, is distorted in practice (e.g. Cao 1983; Yin et al. 1992; Zhou 1961). As Yin et al. (1992: 2) point out, the blending of the syllable *ba* by the traditional hudu method, namely *bo* + *a*, will never produce *ba*, "however hard you try".

In order to overcome the unfortunate consequences of the hudu method in teaching consonants, some new methods have been tried (e.g. Yin et al. 1992), and

teachers are recommended to pronounce the initials as lightly as possible so that the vowel attached to it will be reduced to a minimum. However, because of the characteristics of the Chinese language, the hudu method is still the assigned method in the national curriculum for teaching pinyin (Zhang 2007; Wu 2007).

Visual similarity as a source of errors made in reading aloud is also reported by teachers in Wang & Gao's (2011) study. The teachers in their study reported that their preschool children often confused *b* with *d*, or *p* with *q*. Some children were also confused by the nasal sounds in the finals. For example, these children did not distinguish well between *an* and *ang* or between *en* and *eng*.

Teachers also find that teaching the sounds that the dialect does not have is difficult. For example, sounds such as *e*, *eng*, *ang*, or *ing*, are pronounced as *o*/*ê*, *en*, *an*, or *in* in a county in Anhui province (e.g. Xu 1986). The most ambiguous sound is perhaps the *o*, the sound of which is often described as the sound made by a cockerel (Figure 2.2). However, the sound of a cockerel is not uniformly described as *o*. In the sweeping-out-illiteracy class in Shandong province, this *o* sound was introduced as a sound that farmers make when herding cattle, or the sound the soldiers make in the Peking Opera whenever they come onto the stage (Yu 1959). The sound of the designated character 喔 (*wo* [uo] cockerel's crow; equivalent to Cock-a-doodle-doo!) for the letter *o* is more popular, because it is a meaningful syllable in the Chinese language (Yin 2011). The single *o* sound only appears as an exclamation. One class of children was so astonished to find the newcomers, transferred from another school, pronouncing *o* differently from what they were taught that it caused "earthquake in the class" (Yin 2011). Yet, there is no

information on whether ambiguity such as this might cause problems when children learn to spell.

It has not been considered whether the hudu method has any negative influence on spelling, as it does on blending. But in English, the influence from the teaching method has been shown clearly. For example, in the US, spelling is taught from the name of the letter, whereas in the UK, teaching starts with the sound of the letter. By comparing the spellings by children in the US with the spellings by children in the UK, Ellefson et al. (2009) found that the English first-grade children would be more likely than their American peers to spell the pseudo-word pronounced as [wubə] as *wub* because the letter *b* is taught by its sound to children and is pronounced with a schwa as [bə] (which would usually be spelled as *ber*). So, [bə] is associated with the letter *b*. Similarly, the American children would be more likely to spell the pseudo-word pronounced as [waib] as *yb* because it is the letter name ([wai] for *y*), not the sound, that is taught in American schools. The findings suggest that children exercised their own logic. They did so by applying the letter–sound correspondence in their spelling, except not in the way the adults sought. The findings also show clearly that children's spelling can reveal why they spell in a certain pattern. What is more, it seemed that the pupils were indeed influenced by letter names.

Would Chinese pupils also use the letter names to represent the sounds, resulting in the omission of vowel letter(s) like their English-speaking peers? Remarkably, a study that focused on the effects on text processing of different writing systems, rather than on difficulties about spelling in pinyin, seems to have provided an answer to this question, although the study was conducted among adults (Lin 1993).

Lin Shouhua (1993) conducted his research for his doctoral dissertation in the United States. Lin Shouhua gave a pinyin test to six English-speakers who had learned Chinese as a foreign language, and to six overseas Chinese graduates who had learned pinyin in mainland China. He also gave the equivalent test to ten overseas Chinese graduates who had learned *zhuyin*, a phonetic writing system using Chinese-character-like symbols to represent pronunciation of the Chinese characters and taught in Taiwan.

In his vocabulary test in pinyin, Lin asked his participating Chinese graduate adults to circle all the items that were not Chinese in a group of five pinyin spellings. An example was (1) *ja*, (2) *jan*, (3) *jao*, (4) *jian*, and (5) *jung*. The adults were expected to circle all the choices provided except number 4, which is a correct pinyin syllable for a Chinese character. However, Lin was surprised to find that none of the adults chose item (3) *jao*. In fact, all of them thought that spellings with the medial vowel *i* omitted in other testing items, namely, *qan*, *xan*, and *xang* were correct pinyin syllables (Lin 1993: 61). Further, they thought that *yen* was a correct pinyin spelling, too (Lin 1993: 61).

Puzzled by the high proportion of erroneous choices, Lin (1993: 75) asked these adults about their choices in a casual way after the test, but received no satisfactory explanation. This prompted him to ask whether there was an error in the design of the pinyin system with regard to where the medial *i* belonged: does it belong to the initial or to the final?

Fortunately, the author documented the original data, which allows one to check in detail just what errors were made. In Table 3.5, the number of people making the more frequent errors is shown in parentheses; the item number was the original number for

each task, and the A–E were the options for the adults to select what was not a pinyin syllable (Lin 1993: 74, 94).

Table 3.5 Performance of adults on the choice of non–pinyin syllables

Item	A	B	C	D	E
4	da	dan	di	do (4)	dun
6	ja (5)	jan (5)	jao (6)	jian	jung
10	qa (5)	qan (6)	qia	qin	qong
11	ran	rei	ren	run (6)	rong
14	tai	tao	ten (4)	tin (6)	tun
17	xao (5)	xan (6)	xang (6)	xu	xue
18	yan	yen (6)	ying	you	yu

If one pronounces these erroneous spellings in items 6, 10, and 17 according to how the initial is taught—that is, *j* is pronounced as *ji*, *x* as *xi*, and *q* as *qi*—or considers how *yin* is pronounced (which is *ien* or *yen*), then one will get a phonetically correct pronunciation from these erroneous spellings. So, it seems that even adults omit the vowels next to the consonant initials, if the initial is pronounced with the vowel attached to it.

A further question arose. Lin (1993) recorded that seven out of ten adults who did the test in *zhuyin* wrongly chose *qong* as a correct syllable, but this was not noted in the matched pinyin test. If *xang* (item 17C) was considered by all the adults as the correct spelling for the Chinese syllable *xiang*, then it would also be likely that *qong* (item 10E) is considered as the correct spelling for *qiong*.

The erroneous syllables recorded in Lin's paper happen to include all the finals that Cao (1983) claimed to be difficult for pupils to spell if, as we surmise, errors were

made on *qong* but not reported in Table 3.5. These are *iao*, *ian*, *iang*, *iong*. Cao attributed the difficulty to the "length" of these pinyin finals. However, if the length of the *iong* is the cause of the difficulty, then some parts of the final should be missed out; but which part?

There is little information about which part of the final is likely to be omitted apart from the last part, i.e. *g* in *ng*, and this omission is attributed to the local dialect (Lin 2009). Looking at the final alone, according to the research on English language, it should be the middle part (Jenson 1962) or the last part that is omitted (Schiller et al. 2001); the first part is less likely forgotten. But, Lin's data show that it was the medial vowel of a syllable that was omitted. When considering the sound of the initial *x*, the puzzle is solved: in the hudu teaching method, every consonant is pronounced as a syllable that is its assigned name. Thus, *x* is pronounced as *xi*, a uniform practice in pinyin teaching.

Perhaps, this medial-omission phenomenon might also be considered from other aspects. For example, the adults might have become rusty in pinyin, since they only intensively used it in their first primary school year. However, this reason is a bit weak, because the adults' task was not to spell, but to choose from what had already been spelled for them.

Therefore, it seems that the hudu method influences not only blending syllables, but also spelling. This is reminiscent of the findings in English-speaking children who use the names of letters to represent the sound of the pseudo-words *yb* (for [waib]) and *wub* (for [wubə]) (Ellefson et al. 2009). Somehow, it seems that only those three initial consonants *j*, *q*, *x*, whose names match exactly the sound of *ji*, *qi*, *xi*, cause a problem.

Lin's (1993) data strengthen the case for looking at spelling errors more closely, not only with regard to the initials and finals, but also considering the syllable as a whole, including how it is pronounced and how it is taught. Fundamentally, Lin's study directs one's attention to the logic behind the spelling from the viewpoint of letter–sound correspondence, the principle of the alphabetic writing system, just as with learning other languages—English, for example.

Lin's (1993) study has shown that a medial might cause problems in spelling; even adults are likely to omit it. In addition, this medial-omission phenomenon seems associated with certain initials, namely *j*, *q*, *x*. More important, Lin Shouhua's results draw one's attention to how pinyin is taught, as well as how it is spoken. The hudu teaching method seems to have been recognized as a cause of difficulty only in reading aloud.

Due to this medial-omission phenomenon, difficulties found in long finals might need to be considered together with initials, that is, in the context of syllables. In essence, spelling difficulties in pinyin might be looked at from the viewpoint of the letter–sound correspondence, even under the explicit teaching method.

By coincidence, Treiman (1993) recorded that, for the spelling of "quarter" and "queen", the letter *u* was omitted 16 times, the words were spelled correctly five times, and in five instances, *u* was spelled as *w* (Treiman 1993: 326). If the reason for English-speaking children to omit *n* in words like *plant* is because the sound [n] is "short" and becomes one sound bonded with the [a:] in children's representation, then the omission of *u* in the words "quarter" and "queen" might be explained, as shown by Duanmu (2007).

According to Duanmu (2007), the words "coral ([kɔrəl])" and "quarrel ([kʷɔrəl]" are equal in duration of time in articulation and are considered to have equal number of phonemes/sounds, with the difference only in the feature when pronouncing [k] and [kʷ] (Duanmu 2007: 49–50). If this is the case, then how would children spell such words with the [kʷ] sound? They might omit the letter *u* like Treiman's children. In the case of Chinese, it would be interesting to see how children spell Chinese syllables which share the same phonetic characteristics such as *xiong* and *shuang*, under the explicit teaching method. According to Duanmu (2007: 326–327), if these syllables are spelled with *u* ([ʷ]) or *i* ([ʲ]) missing, then they might have been treated as having three sounds (surface sounds which are the natural units of the language) instead of four (underlying sounds, according to a fuller phonological analysis) as the orthography expresses.

The logic built on the letter–sound correspondence, which has been shown in the most common spelling errors made by Chinese children and adults, seems to point to where and why difficulties occur: the discrepancy between letters and sounds. A further question is whether the difficulties are of equal degree.

3.5 The order of spelling difficulty (with English as an example)

Although Cao (1983) asserts that long finals are difficult to spell, along with other elements of school pinyin, such as syllables involving the boundaries *w* and *y*, little is known about whether these difficulties are of equal degree. No comparisons have made

among the different types of syllable. In fact, syllables have not been categorized according to their spelling patterns.

In English, studies have been conducted on how children learn to spell involving conditional rules from the angle of the alphabetic principle. Marsh et al. (1980) conducted a study, which investigates the development of strategies in spelling. Marsh et al.'s study provided evidence that there is development in the acquisition of the types of spelling structure, with one-to-one type easier than those that require more complex rules. Further, within the second grade, Marsh et al. found that spelling performance on longer words was in some cases better than on shorter words, when clear spelling rules provided guidance. Similar cases were reported in Fan et al.'s (1984) study about the rustiness rate in pinyin and in Lin Mingxian's study (2009) about the influence of dialect on spelling.

Moreover, Ehri & Soffer (1999) found that English-speaking children tend to learn words with one-to-one letter–sound correspondence quicker and better than words involving digraphs, where two letters represent one sound such as *ch*. While Ehri and Soffer's children might not have been taught every digraph in the English writing system, Chinese children are explicitly taught all four digraphs that they are expected to use. The only one that is not taught explicitly, namely, *ng*, is taught with the finals that it goes with, namely *ang*, *ing*, *eng*, and *ong*. In spite of this, there is little information about whether these digraphs cause problems. In fact, there is little information about the sequence in learning to spell different types of pinyin syllable.

3.6 Creative pinyin spellings and learning Chinese characters

The adopted term "invented" spelling was probably first used in the context of learning Chinese characters in Shen & Bear's (2000) study. In their study focusing on the

development of orthographic skills of Chinese children, Shen & Bear asked their primary school pupils to write compositions. The pupils were not allowed to check a dictionary or any reference books when they wanted to use unfamiliar characters, but encouraged to guess and to write whatever they want. In the city where the study was carried out, children spent four to six weeks to learn pinyin in their primary schools (Shen & Bear 2000: 202). They found that although first-grade pupils learned only about 500 characters (Shen & Bear 2000: 202), the 200 pupils were quite happy to complete their compositions, which were supposed to be a letter to their favourite person, by using pinyin syllables to substitute for the characters they did not know. On average, 88.7% of the composition was written in pinyin. This potentially means that, without pinyin, the pupils would not be able to write what they wanted to express.

In their dictation test of 36 Chinese characters, which were given in a meaningful context, the first-grade pupils used pinyin 81.4% of the time, on average. In fact, researchers found that the pupils were more comfortable using pinyin than the Chinese characters. Shen & Bear commented that substituting pinyin in their writing demonstrates children's knowledge of symbol–sound correspondence, as well as a knowledge of the written form of the syllables, each containing an initial, a final, and a tone (Shen & Bear 2000: 210). However, children's spellings did show influence from the local dialect Wu: *den* for *deng*, for example. In Wu and other southern dialects, there is no *ng* sound, but only *n*. The researchers also observed that some first-grade children did not write out all three components of the syllable; some children wrote only the initial sound, and others had difficulty writing complete finals or assigning the correct tone (p. 211). Although

children's spelling of pinyin was beyond the scope of their study, they wondered whether the mastery of it reflects a developmental sequence (p. 211).

Although children's creative spellings are not recorded much in the published research, it has been used as an indicator in research about pupils' learning of the Chinese characters in Lin et al.'s (2010) research. Lin et al.'s study shows that preschool children's "creative" pinyin spelling is positively associated with their character recognition a year later at primary school. The number of pinyin syllables tested was only five. Lin et al. considered using pinyin syllables as a predictor for later performance in learning Chinese characters to be a case of "small wins big", given the time saved in testing and the key role pinyin plays in learning the characters.

Because Lin et al. (2010) did not provide any of the children's creative spellings, it is not known what they were like. However, the researchers did provide the five syllables that they dictated to the children. These are: *xia*1 (虾 shrimp), *zi*4 (字 Chinese character), *long*2 (龙 dragon), *che*1 (车 vehicle), and *dou*4 (豆 bean). Each syllable would have several meanings (the character given is only one of them), but their task was focused on phonological representation, rather than meaning. Thus, the children were encouraged to write as accurately as possible what they heard, without emphasizing any particular meaning to the syllables.

It is not known why these pinyin syllables were chosen, but they illustrate characteristics of the hudu method. For example, *x* and *z* are pronounced as *xi* and *zi*, and *ong* and *ch* have a two-to-one letter–sound correspondence. Wang & Gao (2011) report that teachers found that *n* and *ng* caused problems for preschool children in reading aloud: they sometimes could not distinguish the two sounds in reading aloud. It is not

clear whether children see *ng* as *n* (or vice versa), or *ng* sounds similar to *n*, or both. It shows, nevertheless, that these syllables are the ones where creative spellings are likely to be observed.

3.7 Summary of the literature

It is interesting to see how the understanding of pinyin develops, from the idea of simple letter–sound correspondence, resulting in mispronouncing syllables and misinterpreting why some spelling errors occur (Song 1981), to thorough understanding of the nature of this writing system represented by Wang Lijia (2005, 2009). The review of the literature is summarized in the following.

3.7.1 What is known about learning pinyin

It is known through the review of the literature that reading aloud in pinyin seems easy, apart from the problems associated with the hudu method in blending syllables. Learning to spell seems more problematic, with different dialects and vernaculars identified as a cause. Examined closely, pupils learn to spell creatively, whatever the dialect they speak. Moreover, their creative spellings follow the logic, which links the spellings and sounds, though recognized but criticized by Song for different reasons (see Section 3.4.2). Their creative spellings are also associated with visual properties: similarities in the shape of letters, alongside the language they speak, and the hudu teaching method.

However, the known information was obtained by observing students who had at least one year's primary-school education, and whose creative spellings were not observed with a vision of all the spelling types but in a more ad hoc way. For example, Cao (1983: 21) did point out three difficulties in learning to spell, but he did not provide

empirical data, nor pinpoint which elements were difficult. In particular, Cao did not make it clear among which dialects the difficulties were found, nor did he report whether the difficulties were of equal degree.

The lack of information from children who learned pinyin at preschool also means that it is not known what knowledge those children may bring with them on entering primary school, and therefore it is not clear how effective the pinyin taught at the primary school would be. The absence of the theoretical framework on which the pinyin writing system was designed—that is, the alphabetic principle—has left unsettled questions of what challenges children in learning to spell and read aloud in pinyin.

3.7.2 Methods of eliciting spelling data

Two main testing formats are used in researching difficulties children have in learning to spell in pinyin, apart from teachers' own experience in the classroom (e.g. Qu 2010).

(1) Visually transliterating from the Chinese characters to pinyin

The first method is to present the Chinese characters visually and ask the students to write pinyin syllables for them (e.g. Ha & Wei 2000; Lin 2009). This is the most popular way to collect spelling data among older students who can read Chinese characters, as it saves time and resources: many people can do it at different times and in different situations. Since there is no sound input of Putonghua, this is a good way to observe the influence from vernacular, as shown in Lin Mingxian's (2009) study.

(2) Dictating the Chinese syllables/words orally

The other method is to give a dictation (e.g. Jia 1985). This method does not require children's reading ability in Chinese characters. Further, this has been shown to be a good way to observe how learners write according to sound, and a method to observe their application of the alphabetic principle, from the viewpoint of researchers (e.g. Ha & Wei 2000).

Both methods (1) and (2) are commonly used in schools' examinations. An exception is Lin Shouhua's (1993) study, which adopted a multiple-choice format.

3.7.3 The cross-sectional approach

A cross-sectional approach is mostly adopted. This is an economical way to identify difficulties and developmental trend at the same time (e.g. Marsh et al. 1980). It seems that all the available relevant research was carried out in a cross-sectional way. This was probably determined by the fact that, as was mentioned in Section 2.3.3, pinyin is not considered literacy and is allowed to be forgotten as soon as children learn the Chinese characters. The "rustiness" study (Fan et al. 1984) carried out in secondary schools reflected this fact. That is, the focus is on adequacy rather than development towards an ideal.

3.7.4 Data obtained and analysed

All the research about how pupils learn pinyin was conducted in the testing condition. None of the studies used "natural data": syllables or words that children write from their own initiative. In fact, such data in pinyin are not easy to collect, as free production in pinyin is not encouraged, because pinyin is not considered part of literacy (Wu 2007);

learning the characters is the target. The available testing items and the few available data suggest that children's actual spelling can reveal difficulties clearly and precisely under the testing condition, as is shown in Lin Shouhua's (1993) and Lin Mingxian's (2009) studies. This indicates that the testing condition is a practical and possible way to collect children's spelling data.

The analysis of the data was mainly on the performance of correct spelling. Few erroneous spellings were recorded and analysed. In brief, the findings from the available research show that (1) reading aloud is easier than spelling in pinyin and (2) spelling is influenced by local speech and teaching method. The findings also suggest that (3) it seems necessary to consider the syllable as whole, since a syllable is spoken cohesively in speech; (4) just reciting the elements of pinyin and memorizing them is not how children learn to spell: unexpectedly for the teachers, children quickly figure out the logic in the pinyin writing system, as demonstrated in Qu's (2010) observation; and (5) there are some similarities in the way that children create their own spellings between English- and Chinese-speaking children: the logic behind their spellings is similar in some respects. To be precise, both groups of children spelled using letter names to represent the sounds.

The few examples of children's erroneous spellings have given us the first chance to observe their invented spelling (e.g. Ha &Wei 2000; Lin Mingxian 2009; Song 1981). This supports the findings in English: it is the errors that children make in their spelling that tells one how children learn to spell (Read 1986; Treiman 1993). More importantly, the single exceptional case shown in the children's categorization observed by Qu (2010) highlights the viewpoint for understanding children's learning of pinyin—the alphabetic

writing system—not just memorization. This underlying principle is not diminished by the singularity of this child's choice among the choice of a whole class of his peers. However, there is no systematic observation on how children learn to spell.

All the misspellings, recorded by Ha & Wei (2000), by Song (1981), and by Lin Mingxian (2009), indicate the influence from the teaching method as well as from the local speech. More importantly, the dynamic spellings produced under the explicit teaching method call for a greater need to examine children's erroneous spellings from the viewpoint of the alphabetic principle.

3.8 What is needed for the present research

The previous studies have provided evidence for the present research based on the theoretical framework of the alphabetic principle.

The studies reviewed also point to what is needed in terms of data, especially data from children in the first and second grades—those who are actually learning and using pinyin. The absence of data prevents us from understanding children's difficulties at the beginning stage. More important, there is no empirical research on what is difficult in learning to spell from a viewpoint of the alphabetic principle, the principle upon which the pinyin writing system was designed; therefore, the picture of the learning sequence becomes blurred. Moreover, while difficulties caused by southern dialects have been identified (e.g. Lin 2009; Shen & Bear 2000), neither the difficulties caused by the hudu method in spelling nor children's logic in their phonetic transcription have been recognized.

Following the alphabetic logic, there might be a sequence in learning the pinyin writing system, beginning with the principle that, where there is one-to-one letter–sound correspondence, the spelling is easily learned. However, this needs to be tested, as Pattison & Collier (1992) affirm: if theories make predictions about how spelling should develop and what errors children are liable to make, "then spelling data must be collected and compared with the theoretical predictions" (Pattison & Collier 1992: 102). Therefore, more-targeted data produced in the experimental condition would be ideal for the purpose of the present research.

What challenges do Chinese children have in learning to spell? Only children's spelling can tell what difficulties children have and why they have them. It seems that the best way to know what difficulty children encounter in learning to spell is to simply give them the freedom to spell, and not to limit their chance to use their knowledge by a multiple-choice format (e.g. Lin's 1993 study on adults) and consequently restrain our opportunity to observe what they do when they spell.

The review of the literature shows that there is a lack of research on children who have learned pinyin only from preschool. The review also points out that, without the guidance of the alphabetic principle, the understanding of the difficulties in learning to spell in pinyin tends to be sketchy. More important, the belief that rote learning is the key in learning to spell seems to have overshadowed the logic that pupils exercise during their learning process. Therefore, it is the alphabetic principle that the present study should follow in order to understand what causes difficulty in learning pinyin. The research questions to be answered in this study are presented in Chapter 4.

Chapter 4 Research questions and methodological issues

This chapter starts by outlining the research questions, followed by a description of the participants. After describing how the spelling and reading-aloud tests were designed, including the classification of types of spelling pattern and the choice of testing syllable under each type, other methodological issues are discussed, including reliability, validity, and procedures in administrating the tests, and ethical issues. This chapter finishes by discussing the limitations of the research.

4.1 Research questions

The overarching question is: what challenges do young beginner learners have to face in learning pinyin? The following sub-questions evolved after information gathering and preliminary studies:

1. What inference can we draw from the children's strategies as revealed in the seven types of their creative spellings?

2. Are certain syllable types more difficult than others? If so, why?

3. What non-standard spellings do the first- and second-grade pupils create when attempting to spell each syllable type in pinyin from dictation? And why do they make such mistakes?

4. What do those spellings reveal about their partial knowledge of pinyin and the strategies they use to extend that knowledge to unfamiliar examples?

5. What patterns are revealed in their reading-aloud test?

It is hoped that answers to these questions would shed some light not only on what challenges pupils face in learning the pinyin writing system, but also on why they are challenging.

The following sections concern methodological issues. The pupils who took part in the study are described first.

4.2 The participants

The population for this research was children at state schools in Yingkou in Liaoning province of northeast China, where Mandarin is spoken.

In total 142 first-grade pupils from four schools, representing varied social background and achievement, took part in the study. In the city of Yingkou, as in many cities of China, state primary schools are more uniform than diverse in terms of social status or academic achievement. However, diversity has recently emerged as society is becoming more mobile. Table 4.1 shows the characteristics of the sample. The 50 second-grade pupils were from two of the four schools.

Table 4.1 Detail of the number of pupils and their grade

Number of pupils	First grade	Second grade
Boys	71	30
Girls	71	20
Total	142	50

4.2.1 The first-grade pupils

It might be reasonable to consider the first-grade pupils as preschool pupils, because at the time of testing, the new school year had just started. It is the practice for primary schools in Yingkou to set the first few days of the first term as orientation days, when the

teachers introduce the school ethos to the children and familiarize them with the school's regulations and environment, such as how to walk, how to line up when coming and going out of school, and how to listen attentively in the class, as well as getting to know where the places are for doing different activities, and so on. In China, schools start on 1 September. One class of 47 children were tested after they had three days' schooling, for the convenience of the school. The rest of the pupils in other schools were tested on 26, 27, and 28 August. All these children had learned pinyin at preschool. Thus, their knowledge represents what had been gained at preschool. They were named as first-graders for the simple reason that they were already in the primary school registration list, even those pupils who were tested a few days before the term started.

4.2.2 The second-grade pupils

The second-grade pupils came from two of the four schools where the first-graders came from. They had finished their first-year schooling at their primary schools, with one more year of exposure to pinyin than the first-grade children had. Equally, it would be reasonable to label them as first-grade pupils, if the first-grade pupils had been labelled the pre-school pupils. They had learned pinyin in their preschool as the younger participants did. Pinyin was taught again in their first term of the first year at primary school. As mentioned previously, the teaching method and the pinyin content are almost uniform in preschool and primary school in China.

English learning in Yingkou

English is compulsory in primary schools from age 9 (grade 3), and many start earlier than this (Rose & Carson 2014). The participants in this study had some exposure to English teaching at preschool, and compulsorily at Grade 1, aged 6. It is common for

children in the city to learn, particularly, the IPA in after-school special class when learning English even at preschool.

4.2.3 The language used in the tests

The research student ("the researcher") is a Putonghua speaker. She is also a native speaker of the form of Mandarin spoken in the city of Yingkou, where the study was carried out. The language used by the researcher in the administration of the tests was Putonghua.

4.3 The design of the tests

4.3.1 The format of the spelling tests

Margaret Peters (1967, 1970, 1985), an experienced teacher and researcher on English children's spelling difficulties reminds us: "If one wants to know how good a child is at spelling, we can either look at his written work and see how many mistakes he makes (but the judgement we make is subjective) or use a normative test which measures how well the child is performing compared with other children of the same age" (Peters 1985: 96). However, given the fact that children's mistakes would receive immediate correction from the adult at home or the teacher in the class, there is little opportunity "to see how good a child is at spelling" in free writing in pinyin (Shen & Bear 2000). Moreover, there is no normative test for spelling and reading aloud for pinyin. This is because mastering all the syllables is the requirement for the pupils (Zhang 2007).

In addition, Peters (1985:101) reminds us that a normative spelling test tells us too little about a child's spelling. Since spelling is an individual skill, we should find out

more about the strategy a particular child uses in spelling. To do this, Peters turned to the children's own free writing for evidence of their spelling ability. Obviously this cannot be standardized, since what a child writes is different from what anyone else writes. Nevertheless, "The pattern of his errors can be examined and an error profile made" (Peters 1967: 70). However, Peters' pupils were diagnosed as pupils who need special training in her class. For the pupils in the present study, who go to school and receive teaching with others in the same classroom, the challenges to be discovered are not for individuals but for the majority. Moreover, it is rare to find spelling errors in free writing in pinyin because the erroneous spelling will be corrected immediately by the teachers or adults. Importantly, free writing would not provide the opportunity to observe pupils' spelling errors in all the syllables that are required to be mastered.

This pointed to the need to design a test. A test was necessary because it was not the performance of one child compared with another child that was of interest but the performance of the child compared with the objective standard of correctness in spelling. What is more, it would be interesting to see how each child would perform on one type compared with another type of spelling pattern.

From the start, therefore, the objective of this research pointed to the need for an experimental measure of each type of spelling pattern. Consequently, a classification of spelling types in the pinyin orthography was a prerequisite for any comparison. Because all the spelling types have to be compared between themselves, in order to see which type is more easy or difficult than another, all the spelling patterns were given a phonetic analysis, and the choice of syllables was guided by a careful consideration of the issue of familiarity. In addition to the comparison between the pupils themselves on the

performance of different types of spelling pattern, a comparison between the younger and older learners was also planned. This was because such a comparison would add to the information on the development of learning this orthography, which might confirm or cast doubt on the conclusion made on one group alone. Moreover, with the older pupils included in the investigation, the endurance of challenges, if any, would emerge.

4.3.2 The scope of the tests

The design of the test to measure the challenges, firstly, looked at the scope of the pinyin taught at schools, the school pinyin, and how it is taught. Secondly, it looked at the content of the original pinyin, called the Scheme of Pinyin in China, and how it was designed. Because school pinyin is different from the original pinyin, the scope of the test considered both of them.

The testing scope covers both the complete content taught in pre-school and primary schools (see Section 2.3.4) and that of the original pinyin.

Here we recap the content. The content of pinyin taught in preschool and primary school is the same: 23 initials, 24 finals, the combination of an initial and a final to make a syllable, and 16 recognize-as-a-whole syllables.

Table 4.2 sets out the content of the pinyin taught at school: initials, finals, and the recognize-as-a-whole syllables, alongside the original pinyin, i.e. the Scheme of Pinyin for a quick comparison. The exact elements that were focused on in the present study are in bold.

Table 4.2 Comparison of school pinyin and the original pinyin

Category	Content	Number of elements
initials	b, p, m, f, d, **t**, n, **l**, **g**, k, **h**, **j**, **q**, **x**, **zh**, **ch**, **sh**, **r**, **z**, c, **s**, **w**, **y**. (school)	23
	b, p, m, f, d, **t**, n, **l**, **g**, k, **h**, **j**, **q**, **x**, **zh**, **ch**, **sh**, **r**, **z**, c, **s**. (original)	21
finals	a, o, **e**, **i**, u, **ü**; ai, **ei**, **ui**, ao, **ou**, **iu**, ie, **üe**, **er**, **an**, en, in, **un**, **ün**, ang, eng, **ing**, **ong**. (school)	24
	a, o, **e**, **i**, u, **ü**; ai, **ei**, **ui**, ao, **ou**, **iu**, ie, **üe**, **an**, en, in, **un**, **ün**, ang, eng, **ing**, **ong** **ia**, iao, **ian**, iang, **iong**, **ua**, **uo**, uai, uan, **uang**, **üan**. (original)	35 (excluding **er**, ê, **i [ɿ]** , **i [ʅ]**)
Recognize-as-a-whole syllables	**zhi**, **chi**, **shi**, ri, **zi**, ci, si **yi**, ye, **yin**, **ying**, **wu**, **yu**, **yue**, **yuan**, **yun**. (school)	16
	(original)	0

It is noted that the content of school pinyin gives two categories of syllable. One is the non-recognize-as-a-whole syllables, where the syllable is taught by the combination of an initial plus a final to compose a syllable, and the other is the recognize-as-a-whole syllables, which do not require the blending of the initials and finals, but are taught by looking at and memorizing the whole syllable. In contrast, the content of original pinyin is phonetically based.

4.3.3 Classification of the spelling patterns

Pinyin was designed according to the principle for an alphabetic writing system; that is, one symbol in the system corresponds to one sound. It is the alphabetic principle that guides how the pinyin spelling types are classified.

We may recall that there are only 404 syllables, without counting the tones, in the standard Chinese vocabulary (Duanmu 2007: 319). Let us call it 400 syllables for a round number. The types of spelling pattern of the syllables can be classified as follows:

(1) One-to-one type: In this type, one letter corresponds to one sound. Most pinyin syllables are spelled in this way (Zhou 2003). This type sees the two shortest syllables in pinyin, namely *e* and *a*. The longest syllable in this type has four letters. Thus, there are between one and four letters in this type of syllable pattern. For example, *a*, *ba*, *mai*, *tian*.

(2) Two-to-one type: the letter–sound correspondence is two-to-one; that is, two letters corresponding to one sound. Only five diagraphs (*zh, ch, sh, ng, er*) are used in pinyin. The first three diagraphs, *zh, ch, sh,* always appear at the initial position, and they are initials, but *ng* is always at the end of a syllable, and so it is part of a final. For example, *sha, chai, zhan, shuang*. The longest syllables have six letters and involve this type. Just three such long syllables exist, namely *shuang*, *zhuang*, and *chuang*. One syllable *shuang* was selected. The unique syllable *er* is always on its own (see Section 2.2.5).

(3) The two-to-three type is when two letters stands for three sounds. These are the finals *iu*, *ui*, and *un*, representing the sounds *iou*, *uei*, and *uen*, respectively. In the pinyin orthography, the middle letter is omitted when the final is preceded by an initial to

form a syllable**.** For example, *liu*, *sui*, or *sun*. One syllable, *zuir*, was selected in this category for its unique phonetic nature (see Section 2.2.5).

(4) The w0y0 type is the pattern where the letters *w* and *y* do not represent a sound but mark a syllable boundary: these letters only mark where a new syllable starts. This type of syllable is taught in the recognize-as-a-whole method. Only four syllables exist in the whole language: *yi, wu, yin,* and *ying* (Lesson 3, 14, 16 in Appendix I). They were all included in the test.

(5) The wuyi type is the pattern where the letters *w* and *y* do represent sounds: *u* and *i*, respectively. The examples of such syllables are *wei* and *yan*.

(6) The yu type is the pattern where the letter *y* represents only a syllable boundary, while the letter *u* represents the sound of *ü*, whose umlaut is omitted when preceded by *y*. This type of syllable is also taught in the recognize-as-a-whole method (Lesson 3, 13, 15 Appendix I). Four syllables exist, namely *yu*, *yun*, *yuan*, *yue*, and all were selected.

(7) The jqx type stands for the spelling pattern which occurs only when *ü* is preceded by the three initials, namely, *j*, *q*, and *x*; in this case, the umlaut is omitted too, as with the yu type; otherwise, the umlaut is retained. There are only two conditions where the umlaut is retained: when *ü* is preceded by initial *l* and initial *n*. There are only four syllables in the two conditions, and each condition has two cases: *lü*, *lüe*, *nü*, and *nüe*. One syllable *lü* was selected.

Different types imply careful discrimination between what is challenging and what is easier.

4.3.4 Choice of syllables

Having classified the types of spelling pattern, the next thing to consider was what syllable should be included under each type. For example, having determined that there is a type of syllable that has a one-to-one correspondence between letters and sounds, the decision must be made about which syllables to choose. Say, *bi* is a one-to-one syllable, so is *ba*, and *ban*, and *bian*. The researcher with a rigorous attitude would choose all of them, so that the effect of length of the syllable could be inspected.

As Shen & Bear's (2000) study shows, the first-grade pupils happily wrote their composition without knowing how to write the characters, with 88.7% of pinyin syllables on average (Section 3.6). This characteristic of a phonetic writing system grants great freedom to design a test without being constrained to consider whether children have learned certain characters or not. This means that, as long as a syllable is Chinese, people should be able to write it down according to its sound, whether or not they understood it or have heard it before. That is, in theory, although a person may not know what the character/word 罢 (*bà*) or 坝 (*bà*) means, the person should be able to write *bà* for 罢 or 坝, upon hearing the pronunciation of the syllable. Therefore, the pinyin writing system offers a great opportunity to observe how children apply the alphabetic principle in their use of the pinyin orthography.

The difference between the Chinese characters and pinyin orthography could also be illustrated in the English writing system.

Take the words "flour" and "flower" for example. When written down alone in the International Phonetic Alphabet (IPA), an English speaker cannot tell the two words *flower* and *flour* apart, because both of them are written: /flaʊə/.

By looking at /flaʊə/, it is not clear whether it represents the word “flour” or “flower”. However, people who have learned IPA can read aloud and give the pronunciation of /flaʊə/. Equally, those who have learned IPA will be able to write the sound of any English word, even if they do not understand a word of English. Similarly, a pinyin syllable cannot tell people which exact character it represents, and consequently, which meaning it stands for. That is why the meaning cannot be deduced by the look of the pinyin syllable, just the same as the English speaker cannot tell which English word is expressed by /flaʊə/ alone. To get the meaning out of phonetic writing, a context is needed. This is the main reason why the pinyin syllable is not called a pinyin word.

Perhaps there should be no concern about the issues of familiarity, considering the fact that all the elements of pinyin orthography, namely, the initials and finals, are required to be mastered. And yet, in reality, we know that “practice makes perfect”.

It is common sense that the more familiar the word is, the more likely it can be spelled or read aloud correctly. Here are some situations that we can consider. In teaching pinyin, the entire set of initials, finals, and recognize-as-a-whole syllables is the target for the pupils to master. That is, all the elements of pinyin orthography have equal weight in the requirement for mastery. This might be easy to put as an analogy to learning English—all the 26 letters must be mastered.

But, there is no standardized pinyin test, like a “standardized” English vocabulary test, to guide on which syllables are most commonly used; and perhaps there should not be one because, in addition to the mastery of initials, finals, and recognize-as-a-whole syllables, the 400 syllables are required to be mastered as well (Zhang 2007). Thus, the

400 syllables became the standard test themselves three decades ago, as reviewed in Jia's study (1985) in Section 3.2.

Maybe it would be helpful to turn to a standard list of most commonly used characters, but these characters are meant for those who have finished their six-years' primary education. Even if there is such a list to consult for the 5-to-7-year olds, it is for characters not for pinyin. Note that the commonly used Chinese characters need only four hundred pinyin syllables to stand for them—these two are different writing systems. The former system is a meaning-based morphemic system, whose characters embody meaning in their visual configuration; the latter is sound-based phonetic system, which does not carry meaning in the visual letters. While the former system needs thousands of characters to code their meaning, the alphabetic system for pinyin needs only 25 letters, which are further compiled into 23 initials and 35 finals, to code their sounds. Just like the English language, which has tens of thousands of words, but only 48 IPA symbols can symbolize all the sounds of the language.

As matter of fact, the totality of Chinese characters, numbering about fifty thousand, is represented by the four hundred syllables; hence pinyin syllables are called phonetic characters (*pinyin zi* in Chinese). Because the purpose of this study was to investigate what challenges that 5-to-7-year-old pupils might face in learning pinyin, the consideration for the present investigation is to make sure that the syllables to be tested contain as many varied combinations of initials and finals as possible, including the elements that caused difficulty for children in the pilot studies.

Although there is no standard pinyin test, there is the standard textbook for children, which is uniformly used all over China. Consequently, this became the main

source when considering the choice of syllables. Having consulted their textbooks, with the issue of familiarity in mind, and with information gathered from preliminary studies, 38 syllables out of 400 were selected. These syllables, containing the above seven spelling types, included a complete range of possible lengths in pinyin spelling.

Table 4.3 shows the content of the spelling test, with the targeted initials and finals in bold. Paired with the spelling test, a reading-aloud test was also constructed.

Table 4.3 Spelling and reading-aloud tests

Type of syllable	Test items
1. One-to-one (8 test items)	***xi, gua, ji, re, zi, jia, tian, lü*** (spelling) rǎn, rú, guǒ, zi, nuò, liáo, luàn, nǚ (reading aloud)
2. Two-to-one (8 test items)	***zh****i*, ***ch****i*, ***sh****i*, ***er***, *yo****ng***, *qi****ng***, *xio****ng***, *shua****ng*** (spelling) shì, ér, zhī, shi, róng, guāng, niáng, zhuàng (reading aloud)
3. Two-to-three (7 test items)	*h****ui***, *z****ui****r*, *q****iu***, *x****iu***, *s****un***, *z****un***, *zh****un*** (spelling) shuì, niú, dùn, ruì, xiù, qiú, miù, lùn (reading aloud)
4. wuyi type (4 test items)	***w****o*, ***y****ou*, ***w****en*, ***w****ei* (spelling) wén, wài, yàn (reading aloud)
5. w0y0 type (4 test items)	***y****i*, ***w****u*, ***y****in*, ***y****ing* (spelling) yì, wǔ, yìn, yǐng (reading aloud)
6. yu type (4 test items)	***y****u*, ***y****ue*, ***y****un*, ***y****uan* (spelling) yú, yuè, yǔn, yuan (reading aloud)
7. jqx type (3 test items)	***j****un*, ***x****un*, ***q****uan* (spelling) jù, xuě, qū, qur (reading aloud)

To better understand what poses problems in learning to spell in pinyin, a more stringent test, a pseudo-pinyin syllable spelling test with eight syllables in the first three types of spelling was constructed (Table 4.4). These syllables were comprised with pinyin initials and finals in impossible combinations in the pinyin writing system; thus, they are non-Chinese. Similarly, the longest syllables were designed to match the longest in the real pinyin syllables.

Table 4.4 Pseudo-pinyin spelling test

Type of syllable	Test items
1. One-to-one	fì, tuǎi
2. Two-to-one	gióng, zhiā, luǎng, shiòng
3. Two-to-three	nuì pún

Note that, although the spelling patterns were identified and classified into different types, the testing material was not actually dictated to the pupils according to the types, but rather mixed up in the form of dictating all the syllables embedded in the meaningful context, just as any common dictation would be carried out in their classes regularly. It was hoped that this way would make the testing more familiar and interesting to the pupils. In addition, a test like this would provide an extra reinforcement and practice on these syllables. The tests were piloted among pupils aged 4 to 18 years old.

The more specific considerations in the design of the investigation—reliability, validity, and the choice of adaptation of approaches are discussed in the next three sections.

4.4 Reliability

Reliability concerns whether a result will be obtained again under the same situtations by the same participants, which is also called "test-retest reliability" (Field 2005: 666).

Cohen (2007) and Cohen et al. (2011: 199) regard reliability, essentially, a synonym for dependability, consistency, and replicability over time, over instruments, and over groups of respondents. They point out that, while some features such as height can be measured precisely; others, such as musical ability, cannot (Cohen et al. 2011: 199). Cohen et al. (2011: 199) further state that, for a certain research to be reliable, similar results would be found, if the research were to be carried out on a similar group of respondents in a similar context. Seen this way, reliability fundamentally concerns the extent to which one can generalize to scores collected at another time or on alternative forms of the test (Nunnally & Durham 1975; Oppenheim 2000; Pattison & Collier 1992); that is, whether the results are replicable.

Considering replicability, it might be worthwhile to consider the nature of the spelling activity. Peters (1967) pointed out, when comparing spelling to reading skills, that while reading can be flexible, flexibility in spelling is not acceptable. One either can spell a word correctly or cannot. Particularly, spelling does not vary according to occasions (Peters 1967: 64). Suppose that a spelling produced by a person is correct or wrong in one classroom, it would be expected that the spelling produced by the person would be the same in another classroom, or at home, or in the teacher's office, or in the street. Although the environment of the spelling produced is not the same, the person is the same. That the human being's spelling would not change according to the environment is fundamentally important in collecting data of such a kind. In contrast, if a

piece of ice is placed in a different environment such as in the street or in a classroom, the change in temperature will melt it at a different rate. Even if the piece of ice is placed in the same environment, a change in temperature will affect its physical properties. In other words, physical objects do not have their own mind, and can be controlled completely by human beings. In contrast, spelling performance would not change whether it is in the summer or winter, or whether it is on a clean paper or a used paper, unless some serious health problem occurs. By the same token, Peters' collection of the 505 incorrect spellings of the English word "saucer", by 967 ten-year-old children, were not and could not be produced in the same seat of the classroom, or the same classroom of the school, or on the same kind of paper, or even under the same teacher (Peters 1970, 1985). Realizing that people are not as static as objects in physics research; we might still find results could differ. Further, differences can also provide a valuable information about what was investigated (Riege 2003).

Giving children a dictation is the most common practice at school to obtain information on how well the children have learned to write and spell in general and for a particular purpose. Moreover, a dictation task is not only valid (see Section 4.5) but also closer to what is the ultimate purpose of spelling instruction. A dictation task naturally suits the aim of the present study. A particular virtue of a dictation task is that children are less likely to choose the correct answer by chance alone. Given four choices, that chance is 25%; for open dictation, a correct answer purely by chance would be unknown in practice. In theory, the probability would be 1/25 X 1/25 if there are only two letters in the syllable, or $1/25^6$ if there are six letters in the syllable—far lower than the 25% chance—even if we grant that the participant knows that there are six letters in the

syllable. Other factors being equal, a reduction in the play of chance alone will lead to an increase in reliability. Most important of all, an open-ended task allows participants freedom to think. Their thinking will shape their answers, and these in turn will allow testers get some insight into what underlies their thinking.

High reliability requires low measurement error and high repeatability, as seen by Nunally & Durham (1975: 311). In the present study, low measurement error is answered by asking the child to spell the word, rather than providing a list from which the correct option might be picked at random. High repeatability of spelling in a dictation test comes from the human context. Children are taught how to spell and rewarded when they spell correctly. Once they have learned a correct spelling, they would spell it correctly. This is as true of principles of spelling as it is of particular syllables. A child who can spell a syllable correctly will thus spell it correctly again and again on different occasions and in different circumstances. On the other hand, a child who has not properly learned how to spell a syllable will make various guesses, or a consistent guess, which will probably be wrong.

To assert reliability in the present study is therefore to claim that a child who can spell a syllable correctly will do so consistently and that a child who does not know the correct spelling will generally get it wrong (perhaps occasionally right by luck).

It is easy to extract statistics from data, from example, by scoring 1 for correct spelling and 0 for a wrong spelling, and summing the scores for each individual over the 38 test items. Cronbach's α can be calculated for such scores (Field 2005), and the result looks respectable (Table 5.3 Section 5.1.1). However, spelling scores were only the

quantitative part of the research, and the reliability check given by α is considered weaker than the prima facie reliability of the produced spelling, as discussed above.

Statistics are important, but they are only a tool for the purpose of research. As the biologist Medawar (1941) pointed out, mathematical treatment alone cannot create new empirical facts; it is the raw data that all the mathematical analysis is based on that are the most important facts. For that reason, collecting data from children performing in an open-ended testing format became the fundamental task.

4.5 Validity

Validity concerns whether a test measures what it purports to measure (Robson 1993). In the case of present study,which was mainly to find out the challenges when children learn to spell in pinyin, examining the children's spelling and reading aloud seems the natural thing to do (see Read 1970; Treiman 1993; for example).

There are two ways to observe how children spell: in their natural writing material and in a test condition. It is rare to see children's "creative" pinyin in their natural spontaneous writing, unlike the writing of their English-speaking peers (see Treiman 1993). This is because their "creative" spelling would be corrected immediately by their teachers (see Shen & Bear 2000, Wu 2007). More important, natural writing may not provide the information that an investigator aims to observe. Woore (2006) shares his experience that as a method for obtaining data in examining children's errors, elicited spelling in a test is one of the most valid, reliable, and practical methods in educational research (Woore 2006).

The testing format was also given consideration. There are advantages and disadvantages in both the closed-end and open-ended testing formats. The closed-ended

format gives the researcher an easy job to do when totalling the results; all that is needed is yes or no, A or B, or A, B, C, D, E; there is a limit that is pre-determined.

In the open-end format, the researcher does not need to design the distractions, but the determination of responses is left with the participants; it is the participants doing the test who determine how many answers there are, and there is no limit in the response (Robson 1993; Oppenheim 2000). For example, if we say /fɪʃ/, we do not know how English children would spell it. Most might spell it as *fish*, as it should be, or they might spell it as *fis*, *fs*, *fsh*, *is*, or even "*ghoti*", as Bernard Shaw jokingly but pointedly remarked (Holroyd 1993). We recall here that Peters, the researcher who "broke the myth" of how children learn to spell, recorded 64 entries for only one word *sour* in her study on English children's spelling difficulties (Peters 1967). This means that, by choosing the open-ended format for the present research, there is a lot of work to painstakingly record every response that the children give. The more children, and the more syllables given, the more variations there are to record.

There are other considerations in choosing a dictation as a spelling test: it is familiar to the children and straightforward to do. The dictation test is the kind most often used in schools (Peters 1967; also Section 4.3.1). In the present case, it seemed the appropriate way to test pinyin, because pinyin is a phonetic transcription of the spoken Chinese. Evidently, there is also educational value in choosing the dictation format. In doing a spelling test, the children gain extra practice on spelling, which accords with educational purpose and school work. Besides telling people whether they can spell a certain syllable or not, children's spellings provide information beyond right or wrong: they tell us how they actually spell; and from the detail of their errors one can learn a

great deal. The value of this lies especially in helping educators to design instruction to help children to spell correctly (Treiman 1993: 3).

Also, because the aim of the study was to find out what poses problems in learning pinyin, the children in this study were asked to spell the test items freely without any confinement, such as multiple-choice format.

Content validity refers to the extent to which the measure reflects the specified domain of content sampled. For the present study, the results from the preliminary studies and the pupils' textbook naturally became the main source of consultation in the choice of content, which resulted with 52% of the initials, 58% of the finals, and 75% of recognize-as-a-whole syllables tested in the spelling test. The rest of the initials, finals and recognize-as-a-whole syllables were selected for the reading-aloud test. It would be nice to have included 100% in each test, but hard decisions had to be made to keep the test at a length that would not tire the children, and to keep the study within the resources of the researcher. Especially with information gathered from the preliminary studies and pilots, including the entire 400 syllables was deemed impossibly demanding, and an unreasonable target for the researcher, schools, and the 5-to-7-year-old pupils alike. Dictation is considered the kind of test, which "would be most valid." (Peters 1967: 61). A spelling test itself represents its content validity (Nunnally & Durham 1975).

While content validity is concrete and of practical importance in a spelling test, construct validity is abstract and represents an underlying theoretical construct that a test purports to measure (Nunnally & Durham 1975). The underlying construct for the spelling test, along with the other two tests, is the alphabetic principle, where there is a

correspondence between letters and sounds. It is the principle on which pinyin spelling was designed (Zhou 1964).

As has been known for a long time, a spelling test is the most valid form for examining pupils' spelling difficulties (Cahen et al. 1971; Nunnally & Durham 1975). With more than one syllable of each type, including all the various lengths of syllable and in some cases all the syllables of the type included, strong validity is deemed to be supported.

4.6 Choosing the cross-sectional approach

For reasons of time and resources, the testing programme uses a cross-sectional rather than a longitudinal approach. Although the focus of this study was to investigate the difficulties facing young children, 5-to-6-year olds, who learned pinyin at preschool, the information from older pupils who learned it for one more year, at school, allows analysis of the difference in performance as learning progresses. For example, the performance from the older pupils might indicate which kinds of difficulty are temporary for the younger ones and which kinds persist. Although a longitudinal study would provide more accurate information for progression, that is not the purpose of this study. Even when progression is the focus, a cross-sectional study is more often than not adopted by doctoral students because of the limitation of resources to serve this purpose (Gorard 2001; Robson 1993; Verma & Mallick 1999).

By doing a cross-sectional study, not only does the method make it instant and obvious to identify a problem, and easier to ascertain its cause and determine a remedy (Verma & Mallick 1999), it also yields, in the present case, information equally interesting and valuable for understanding the difficulties and development in learning

pinyin for young children, with the merit of economy. Another reason to choose a cross-sectional approach for this investigation is that children do not learn pinyin in just two months in their primary school but start to learn it well beforehand. So it is more important to find out what knowledge they have already gained upon entering primary school.

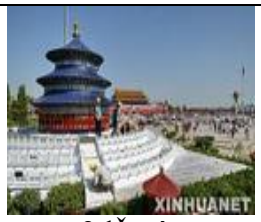
4.7 Administration procedures of the tests

4.7.1 The pinyin spelling test

The researcher, after being introduced to the children in the whole class by their teachers, explained that they were going to write some pinyin syllables in a dictation. The children were asked to pay attention to the sound of the syllables.

The 38 syllables, of seven types, were dictated to the children in 23 meaningful contexts after combination of the syllables. The type was associated with the context randomly. Strictly speaking, meaning is not necessary for a phonetic transcription—which is what pinyin is about—but it made the text more natural, just like the spelling test given to them in the class by their teacher. Table 4.5 is an example of the test paper of the pinyin spelling.

Table 4.5 An example of test paper of the pinyin spelling.

 1 zì (Chinese characters)	 2 yǔ yī (raincoat)	 3 lǚ yóu (travel)	 4 jī huì (opportunity)
 5 rè (hot, heat)	 6 zhǔn (accurate)	 7 quán jūn (all the army forces)	 8 yīn yuè (music)
 9 ěr wén (hear of)	 10 wéi zuǐr (bib)	 11 yǒng (silkworm)	 12 xióng (bear)
 13 shuāng (frost)	 14 xī guā (watermelon)	 15 wō sǔn (asparagus)	 16 wū yún (dark cloud)
 17 xiū jià (having a holiday)	 18 zhī chí (support)	 19 qiū tiān (autumn)	 20 shì qing (business)
 21zūn xún (following advice)	 22 yīng (eagle)	 23 yuǎn (far).	

Pictures were chosen with two aims: (1) to indicate the place to write and (2) to make the test more interesting. Care was taken to make sure that the syllables to be dictated would not be guessed simply by looking at the pictures. The only picture that is obvious is the water melon (xigua). However, there is no difference between the local speech and the standard form in these two syllables, so spelling would be unaffected by whether it was guided by the local speech or prompted by the picture. One hundred and forty-five pupils received the testing papers printed in black and white. A class of forty-seven pupils had a dictation on a white sheet of paper.

Instructions were as follows, given orally in Putonghua: Have you learned pinyin? Now I am going to dictate some pinyin. Let's write as many pinyin as you can. There is no right or wrong answer in this task. Whatever you write is correct.

Every single syllable or two syllable word was read aloud first, then said in a context, and then repeated twice. This was done following the format of a spelling test in the English language. When there was a request, repetition or explanation was readily given.

The syllables were read aloud in the unit of word, so the meaning of each syllable has become much clearer than if presented as an isolated syllable. For example, if only the syllable *yin* is read aloud, the pupils can allocate whatever meaning they want to the syllable, which has scores of meanings, if not hundreds. However, if *yinyue* is read aloud to the pupils, there is only one meaning—music. This is similar in English. If we give a pupil a dictation and read aloud the word "music", the meaning would be very clear to them. So the sentence of "we like music" would be redundant. We recall here that there is no alternative spelling for the same sound in pinyin orthography, such as "flower" and

“flour” in English. That is to say, whatever the meaning the syllable would be still spelled the same. The following were the syllables in the context.

1. zì (the Chinese character). Context: zi is the Chinese character that you write every day.

2. yǔyī (raincoat). Context: We wear a raincoat on a rainy day.

3. lǚyóu (travel). Context: people like to travel to see Tian’anmen square in Beijing.

4. jīhuì (opportunity). Context: there is always an opportunity to correct mistakes.

5. rè (hot, heat). Context: it is hot now in the summer.

6. zhǔn (accurate, accurately). Context: he shot the target accurately.

7. quánjūn (The armed forces). Context: The armed forces include the navy, army, and air force.

8. yīnyuè (music). Context: we like music.

9. ěrwén (hear of). Context: they heard of the news on the TV.

10. wéizuǐr (bib). Context: babies use bibs.

11. yǒng (silkworm). Context: silkworms produce silk.

12. xióng (bear). Context: it is a toy bear.

13. shuāng (frost). Context: we can see frost on the tree branches.

14. xīguā (watermelon). Context: we have a lot of watermelon in the summer.

15. wōsǔn (asparagus). Context: asparagus is common in the market.

16. wūyún (dark cloud). Context: there are dark clouds before rain comes.

17. xiūjià (having a holiday). Context: people like to go to the seaside to have a holiday.

18. zhīchí (support). Context: the people in the picture were saying: “we support you!”

19. qiūtiān (autumn). Context: autumn is one of the four seasons of the year.

20. shìqing (business). Context: people do business and discuss business.

21. zūnxún (follow). Context: when you see a doctor, you follow the doctor's advice.

22. yīng (eagle). Context: Eagles fly high in the sky.

23. yuǎn (far). Context: people can see a far-away place with a telescope.

The pinyin spelling test was dictated by the researcher to two whole classes, to small groups, or to an individual, as convenient, in accordance with the school timetable and the arrangement with their parents. The spelling test lasted about 30 minutes, the pseudo-pinyin spelling test about eight minutes.

4.7.2 The pseudo-pinyin spelling test

Immediately after the spelling test, a pseudo-pinyin dictation was given. The children were asked to write on the same paper as for the pinyin spelling test. The test was introduced as follows: The following words are spoken by an alien. Have you ever heard the language spoken by an alien? The words spoken on this other planet, where the alien comes from, sounds a bit like Chinese, so you can write them in pinyin. But they are not really Chinese words. Please listen carefully and write down the alien words in pinyin. Fifty-one of these first-grade pupils and 13 of the second-grade pupils participated in the pseudo-pinyin test.

4.7.3 The reading-aloud test

The reading-aloud test was given a few days after the spelling test. Sixty-eight children, participating the reading-aloud test according to the convenience of the school timetable, were individually asked by the researcher to read the pinyin syllables on the paper. Of these children, thirty-one children attempted all the syllables; 11 of them were from the first grade and 20 were from the second grade.

In the reading-aloud test, children were asked to read the syllables written on a blank sheet. Their reading was recorded by the researcher on a copy of the sheet they were reading aloud. The reading-aloud test took five to seven minutes for each pupil. Altogether, administering this test took about four hours.

4.7.4 Scoring and analysis of the data

All responses were recorded into SPSS software, to compile the qualitative data. Each of the variations were then tallied by the software. An analysis of the qualitative data, beyond the simplest binary scoring of counting right or wrong, was thus enabled. The number of syllables that the children spelled and read aloud correctly was counted. Comparison of performance of all types of spelling pattern was then made based on the counting measure, within each age group and across the two age groups.

4.8 Ethical issues

Long before the research was conducted, schools were contacted. Consent letters were sent to the head of the schools, through whom parental consents were obtained, and the acceptances were received. The parental-consent and data-protection procedures followed were approved by the Central University Research Ethics Committee (CUREC). The anonymity of the pupil was emphasized.

Efforts were made to make the test more educational and friendly in the presentation of the testing paper, in making the atmosphere in the test relaxed, and in getting across the idea that participating in the test was a revision of pinyin knowledge, rather than some sort of formal assessment. After the test, each child was thanked for his or her contribution to the test, which was acknowledged by a sticker. A particular issue of

concern was how not to interrupt the school schedule, as well as preserving pupils' anonymity. In consideration of the disruption to the school timetable, the spelling test was conducted within their pinyin class and in their classroom as a whole class. However, the reading-aloud test had to be conducted individually. Individual testing was the most time-consuming task. In order to least disturb the school activity, only sixty-eight pupils were asked to take part in the reading-aloud test.

4.9 Limitations of the research

The first limitation is that the children were not randomly selected. It is understood that it is impossible for a research student to obtain a random sample, owing to the resources available (e.g. Goard 2001). However, efforts were made to collect data from as many schools as possible. Of the four schools that took part in the research, we knew that two of them had some local reputation for their academic attainment. Therefore, the scores could be biased towards the higher end. Regarding the qualitative data, this bias might have reduced the number of non-standard spellings. However, in the event, an abundant number of such spellings was discovered. Considering the test format, it was deemed that any school would provide solid information. Moreover, because of the uniform way of teaching pinyin, the data should be applicable to a wider population. However, as the literature discussed in Section 3.2.1 shows, alphabetic writing is influenced by the speech that people speak, and so one aspect of the test might be challenging to speakers of one dialect but may not be so to speakers of another dialect. This means that findings in this study might less be applicable to speakers of other dialects or subdialects.

A second limitation is that the spelling test was given in a meaningful context, not just as a bare list of syllables. Recall that pinyin is a system based on sound but not

meaning, and therefore writing pinyin syllables does not require a meaningful context. However, as we mentioned previously (Section 2.2.2), each Chinese syllable is a morpheme, which has a meaning, albeit that the meaning is unfixed; thus, attaching meaning to each syllable is automatic. In addition, a meaningful context could make a test more interesting to young children, as the meaning is unambiguous. Given these considerations, the test included a context.

A third limitation is the restricted format of the data gathering. Although it is common practice to give students a test to gather data about their achievement or their difficulties, data can also be obtained in natural conditions, where students write what they want to write. That is, ideally, data should be collected in a combination of natural and experimental conditions (Treiman 1993). However, children will always get help for spelling from their class teachers in their free writing (see Shen and Bear 2000), and it is more likely that the children may not write what we aimed to observe; consequently, for the purpose of the present study, a test targeted at all the possible types of syllables seemed the natural solution.

A fourth limitation is that not every initial or final was tested in the spelling. With the ideal of completeness in mind, but considering also the limited resources available, syllable patterns were classified and a representative choice of syllables was made. In this choice, we took into account that testing the initials and the finals that showed no problems for the children observed in the preliminary studies would be a waste of time (also recall the study by Jia (1985) in Section 3.2.1). The aim was to maximize the yield of informative data, given the restraints of the school timetable, the stamina and attention span of the young children, and the time available to the researcher for doing the testing.

A further issue is the balance of representation of phonemes in the test items. The end phoneme [ŋ] occurred in 4 out of the 8 for the two-to-one type. From a phonetic perspective, this is over-representation. The reason for including the four items was to cover as wide a range of finals as possible. We recall here that each final is taught as a whole in school pinyin—the phoneme [ŋ] (*ng*) is not taught as a separate entity. Perhaps the question of better balancing the phonemic constituents of pinyin spelling-test items could be addressed in future research.

Having considered the methodological issues, we now move on to the results of the spelling test in the next chapter.

Chapter 5 Results of the spelling test

To give an initial overview, this chapter starts with the quantitative results, although it was children's spellings that were examined first. Section 5.1 reports the pupils' overall performance on the spelling test. Section 5.2 presents their performance on different types of syllable within each grade and across both grades. From Section 5.3 to Section 5.9, the children's spellings are analysed. The focus is on frequent spellings and those that reveal the logic behind their spellings. It is tempting to speculate about every non-standard spelling; however, realizing that in the study of children's spelling it is not always possible to provide a sure explanation (Treiman 1993), and to keep the discussion at a reasonable length, most of these speculative analyses have been omitted.

5.1 Overall spelling performance

5.1.1 Checking the normality of the data

The normality of the distribution the performance was checked on SPSS (Table 5.1). The results show that spelling scores in the first grade were non-normally distributed, but in the second grade they were normally distributed. To be conservative, both data sets were treated as non-normally distributed data. Consequently, two-tailed non-parametric tests were used in the further analysis. (For completeness, statistics of skewness and kurtosis were also checked. For the spelling scores of Grade 1, the skewness is –0.214 with kurtosis –0.708; for grade 2, skewness is 0.399 and the durtosis is 0.127.)

Table 5.1 Normality tests

Tests of Normality

	Grade	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pinyin spelling scores	1	.102	142	.001	.972	142	.005
	2	.066	50	.200*	.973	50	.299

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Here statistics on correctly spelled syllables were calculated with tone marks ignored, because syllable was our focus. In addition, it is acceptable to write text in pinyin without tone marks (Zhou 1964). Therefore, the distribution was checked on the syllables without considering whether the tone marks were correct or not. In fact, similar results were shown when the tone was counted. In schools, it would be most unusual to ask a child to write a pinyin syllable without a tone. This is because learning the tone marks is part of the content of pinyin, and children would be more comfortable to use a tone mark in writing a syllable than not. As a result, information about children's using tone marks was automatically provided in the raw data from Section 5.3.1 to Section 5.3.9.

Also, Cronbach's alpha α, a gauge for reliability, ranged from 0 to 1, was checked. The value of $\alpha = 0.7$ is considered acceptable, and $\alpha = 0.8$ good (Field 2005). The results are $\alpha = 0.9$ for grade 1 and $\alpha = 0.9$ for grade 2, respectively (Table 5.2).

Table 5.2 The test of reliability

Reliability Statistics

1=grade 1, 2=grade 2	Cronbach's Alpha	N of Items
1	.863	38
2	.851	38

5.1.2 Overall spelling performance

The simplest way of looking at pinyin spelling performance is to count how many syllables are spelled correctly, and this practice was followed here. The maximum possible score is 38: the number of syllables tested.

Figure 5.1 is a graph showing the performance of the first- and second-grade pupils in the spelling test under two conditions: with tones counted and without.

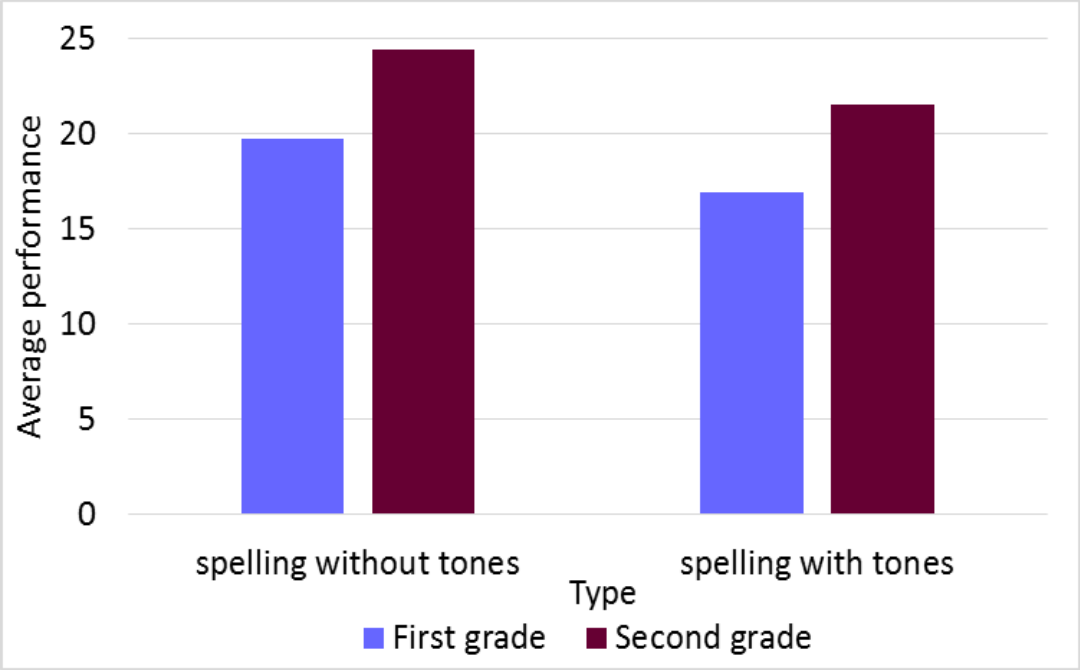


Figure 5.1 Performance of overall scores on spelling test

Mann–Whitney U tests (Table 5.3) show that the second-grade pupils spelled significantly more correctly than the first-grade pupils in the test whether tones were counted ($z = –2.323$, $p = .021$, $r = –0.19$) or not ($z = –2.423$, $p = .015$, $r = –0.20$).

Table 5.3 Test statistics with and without tones between the two grades

Test Statistics[a]

			Spelling no tone	spelling with tone
Mann-Whitney U			1953.000	1978.500
Wilcoxon W			7309.000	7334.500
Z			-2.423	-2.323
Asymp. Sig. (2-tailed)			.015	.020
Monte Carlo Sig. (2-tailed)	Sig.		.015[b]	.021[b]
	99% Confidence Interval	Lower Bound	.012	.017
		Upper Bound	.018	.025
Monte Carlo Sig. (1-tailed)	Sig.		.008[b]	.011[b]
	99% Confidence Interval	Lower Bound	.006	.008
		Upper Bound	.010	.014

a. Grouping Variable: Grade

b. Based on 10000 sampled tables with starting seed 2000000.

The overall scores with and without tone are also compared within each grade, as it was interesting to know whether tone marks are challenging to master for the Chinese children. The overall score without tone marks is significantly higher than that with tone marks in both the first grade ($z = –8.22$, $p < .0005$, $r = –0.69$), and in the second grade ($z = –5.938$, $p < .0005$, $r = –0.50$; Table 5.5). It appears that not only learners of Chinese, who speak other languages, find tones difficult; native Chinese children also find them hard to learn. However, the difficulty might be for different reasons. While the non-Chinese speaker may find it hard to distinguish one tone from another, the Chinese-speaking pupils may find it hard to use the tone marks correctly: either using a wrong mark or using a correct mark but in the wrong position.

Table 5.4 Test statistics on spelling with and without tone marks for both grades

Test Statistics[a,c]

Grade				spelling with tone- spelling no tone
1.00	Z			-8.221[b]
	Asymp. Sig. (2-tailed)			.000
	Monte Carlo Sig. (2-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000
	Monte Carlo Sig. (1-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000
2.00	Z			-5.938[b]
	Asymp. Sig. (2-tailed)			.000
	Monte Carlo Sig. (2-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000
	Monte Carlo Sig. (1-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on 10000 sampled tables with starting seed 1314643744.

The results of the overall scores suggest that the pupils in both grades found spelling in pinyin challenging. The results further indicate that the first-grade pupils had more difficulties in spelling correctly than their second-grade peers did. This is as expected; however, we did not originally know where the first-grade group lagged behind the second-grade group. Our present knowledge is now set out, using a comparison of the seven spelling types within the same grade and between the two grades.

5.2 Performance on the seven spelling types

From now on, tones are ignored in the analysis of the data. Also, the analysis of the two-to-three type does not include the syllable *zuir*, because it was not taught in the school text (Section 5.5.7). It was included in the test as a syllable of singular type, out of the researcher's curiosity.

Figure 5.2 show the average scores in percentage in the pupils' performance on the seven types.

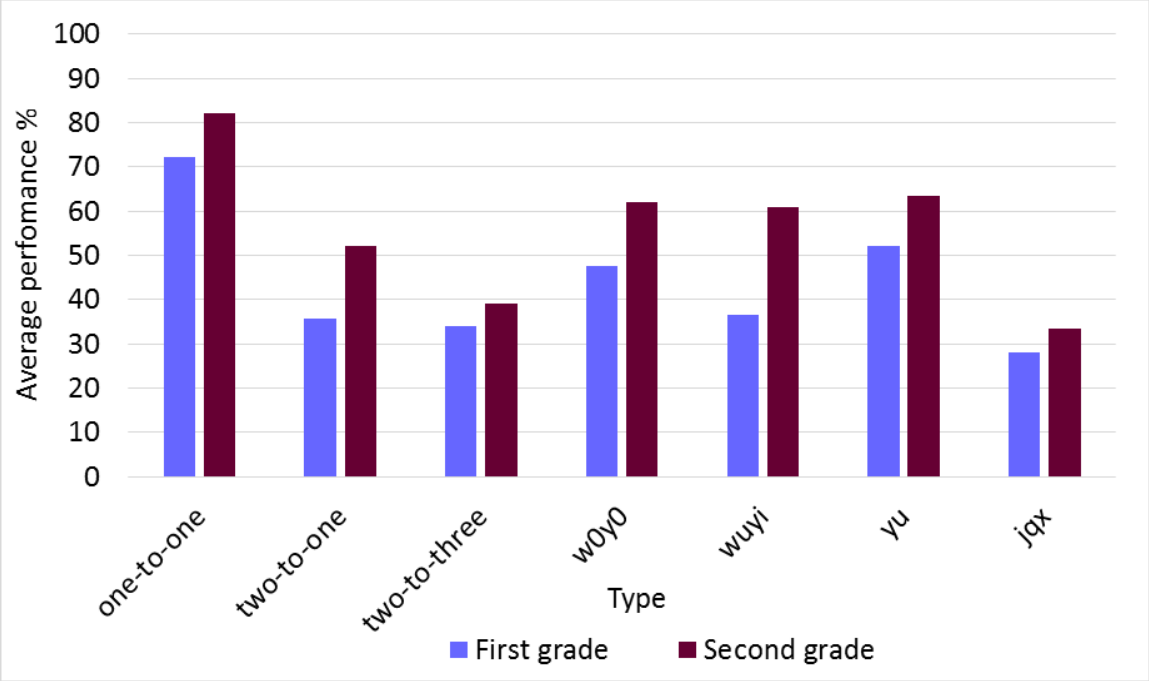


Figure 5.2 average performances in percentage on the seven types of spelling

5.2.1 Performance on the seven types of syllable in the first grade

Here, we reported the performance separately for each grade.

Friedman's tests show that there is significant difference between the seven types (χ^2 (6) = 172.179, p < .0005) (Table 5.5).

Table 5.5 First- and second-grade pupils' results on the seven types of syllable

Test Statistics[a]

1.00	N			103
	Chi-Square			172.179
	df			6
	Asymp. Sig.			.000
	Monte Carlo Sig.	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000
2.00	N			50
	Chi-Square			90.244
	df			6
	Asymp. Sig.			.000
	Monte Carlo Sig.	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000

a. Friedman Test

Wilcoxon tests were used to follow up the findings. Meaningful comparison was made between the following types:

Test 1: one-to-one type compared with yu type.

Test 2: yu type compared with w0y0 type: both types were taught as recognize-as-a-whole syllables, and both *y* in the yu type and *w* and *y* in the w0y0 type do not represent sound, but signifying a syllable/character boundary.

Test 3: w0y0 type compared with wuyi type: *w* and *y* do represent sound in the wuyi type.

Test 4: w0y0 type compared with two-to-one type.

Test 5: wuyi type compared with two-to-three type.

Test 6: jqx type compared with two-to-three type.

Test 7: yu type compared with jqx type. Both types involve omitting the umlaut.

A Bonferroni correction was applied and so all effects are reported with a .007 hurdle of significance.

Table 5.6 shows that the first-grade pupils spelled the one-to-one better than the yu type ($z = –4.691$, $p < .0005$, $r = –0.33$). This suggests that one-to-one type was more easily spelled correctly than yu type. While yu type is taught as recognize-as-a-whole, the one-to-one type is taught analytically. In test 2, pupils spelled the yu type significantly better than the w0y0 type ($z = –3.45$, $p = .001$, $r = –.24$), although both were taught in the recognize-as-a-whole method.

Table 5.6 Results of test 1 and test 2

Test Statistics[a,b,d]

			yu/4 - onetoone/8	W0y0/4 - yu /4
Z			-4.691[c]	-3.453[c]
Asymp. Sig. (2-tailed)			.000	.001
Monte Carlo Sig. (2-tailed)	Sig.		.000	.001
	99% Confidence Interval	Lower Bound	.000	.000
		Upper Bound	.000	.001
Monte Carlo Sig. (1-tailed)	Sig.		.000	.000
	99% Confidence Interval	Lower Bound	.000	.000
		Upper Bound	.000	.001

a. Grade = 1.00

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on 10000 sampled tables with starting seed 624387341.

Table 5.7 shows that, in test 3, the first-grade children spelled better on the w0y0 than on the wuyi type ($z = –3.41$, $p = .001$, $r = –.24$). This suggests that, although both types involve *w* and *y*, it is easier to spell a syllable correctly when it was taught in the recognize-as-a-whole method (w0y0 type) than when taught analytically (wuyi type). Therefore, the challenges in spelling syllables involving *w* and *y* were not of equal degree

as previously claimed (see also Section1.1). In test 4 there is no significantly statistical difference in the spelling between the w0y0 type and the two-to-one type.

Table 5.7 Results of test 3 and test 4

Test Statistics[a,b,d]

			wuyi/4 – w0y0/4	twotoone/8 – w0y0/4
Z			-3.413[c]	-2.155[c]
Asymp. Sig. (2-tailed)			.001	.031
Monte Carlo Sig. (2-tailed)	Sig.		.000	.028
	99% Confidence Interval	Lower Bound	.000	.024
		Upper Bound	.001	.032
Monte Carlo Sig. (1-tailed)	Sig.		.000	.015
	99% Confidence Interval	Lower Bound	.000	.012
		Upper Bound	.001	.018

a. Grade = 1.00

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on 10000 sampled tables with starting seed 957002199.

Table 5.8 shows that there is no significant difference between the wuyi and two-to-three types and between the jqx type and two-to-three types. This suggests that the wuyi type and two-to-three types were of equal degree in challenge, as were the jqx and two-to-three types.

Table 5.8 Tesults of test 5 and 6

Test Statistics[a,b,d]

			wuyi/4 - two-to-three/6	jqx/3 - two-to-three/6
Z			-.396[c]	-.359[e]
Asymp. Sig. (2-tailed)			.692	.720
Monte Carlo Sig. (2-tailed)	Sig.		.696	.725
	99% Confidence Interval	Lower Bound	.684	.714
		Upper Bound	.708	.737
Monte Carlo Sig. (1-tailed)	Sig.		.345	.355
	99% Confidence Interval	Lower Bound	.333	.343
		Upper Bound	.358	.368

a. Grade = 1.00 b. Wilcoxon Signed Ranks Test c. Based on negative ranks.

d. Based on 10000 sampled tables with starting seed 92208573.

e. Based on positive ranks.

Table 5.9 shows that the pupils spelled significantly better on the yu type than on the jqx type ($z = –6.58$, $p < .0005$, $r = –.46$). Although both types involve omitting the umlaut on *u* (*ü*), the result on the yu type is much higher, indicating the bigger challenge of spelling the jqx type correctly. While the yu type is taught in the recognize-as-a-whole method, the jqx type is not.

Table 5.9 Results of test 7

Test Statisticsa,b,d

			jqx/3 - yu/4
Z			-6.583[e]
Asymp. Sig. (2-tailed)			.000
Monte Carlo Sig. (2-tailed)	Sig.		.000
	99% Confidence Interval	Lower Bound	.000
		Upper Bound	.000
Monte Carlo Sig. (1-tailed)	Sig.		.000
	99% Confidence Interval	Lower Bound	.000
		Upper Bound	.000

a. Grade = 1.00 b. Wilcoxon Signed Ranks Test c. Based on negative ranks

d. Based on 10000 sampled tables with starting seed 92208573.

e. Based on positive ranks.

A summary on the comparison is: the one-to-one type is the easiest to spell, followed by the recognize-as-a-whole syllable types. The hardest are the wuyi, two-to-three, and jqx types. Therefore, it seems that not all the types pose equal degree of challenge. Specifically, the w0y0 type was spelled significantly better than the wuyi type, even though both involve *w* and *y*.

5.2.2 Performance on the seven types of syllable in the second grade

The performance by the second-grade pupils was also compared, following up Friedman's tests ($\chi^2(6) = 90.244$, $p < .0005$).

Results show that, unlike the first-grade children, there was no significant difference in their performance between the yu and w0y0 types, but like the first-graders, there was significant difference between the yu type and the one-to-one type ($z = –4.365$, $p < 0.0005$, $r = –0.40$) (Table 5.10).

Table 5.10 Results of test 1 and test 2

Test Statistics[a,b,d]

			yu/4 - onetoone/8	W0y0/4 - yu /4
Z			-4.365[c]	-1.313[c]
Asymp. Sig. (2-tailed)			.000	.189
Monte Carlo Sig. (2-tailed)	Sig.		.000	.209
	99% Confidence Interval	Lower Bound	.000	.198
		Upper Bound	.000	.219
Monte Carlo Sig. (1-tailed)	Sig.		.000	.101
	99% Confidence Interval	Lower Bound	.000	.093
		Upper Bound	.000	.109

a. Grade = 2.00

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on 10000 sampled tables with starting seed 624387341.

Table 5.11 shows that, unlike the first-grade children, they spelled eqaully well on the wuyi and w0y0 types. This indicates, where *w* and *y* involved, it makes no difference in spelling syllables whether the syllables were taught analytically or in the recognize-as-a-whole way—in other words, whether *w* and *y* represents sound or not. There is no significant difference between the two-to-one and w0y0 types, either.

Table 5.11 Results of test 3 and 4

Test Statistics[a,b,d]

			wuyi/4 – w0y0/4	twotoone/8 – w0y0/4
Z			-.107[c]	-.158[c]
Asymp. Sig. (2-tailed)			.915	.875
Monte Carlo Sig. (2-tailed)	Sig.		.945	.879
	99% Confidence Interval	Lower Bound	.939	.870
		Upper Bound	.950	.887
Monte Carlo Sig. (1-tailed)	Sig.		.473	.436
	99% Confidence Interval	Lower Bound	.460	.424
		Upper Bound	.486	.449

a. Grade = 2.00

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on 10000 sampled tables with starting seed 957002199.

Table 5.12 shows that, unlike the first-grade children, there was a significant difference between the wuyi and two-to-three types, with the wuyi type spelled significantly better than the two-to-three type ($z = –4.215$, $p < 0.0005$, $r = –0.42$). Like the first-grade pupils, the second-grade pupils showed no significant difference between the jqx type and two-to-three type (the significance level was corrected to 0.007, see Section 5.2.1).

Table 5.12 Results of test 5 and 6

Test Statistics[a,b,d]

			wuyi/4 - two-to-three/6	jqx/3 - two-to-three/6
Z			-4.215[c]	-2.396[c]
Asymp. Sig. (2-tailed)			.000	.017
Monte Carlo Sig. (2-tailed)	Sig.		.000	.015
	99% Confidence Interval	Lower Bound	.000	.012
		Upper Bound	.000	.019
Monte Carlo Sig. (1-tailed)	Sig.		.000	.007
	99% Confidence Interval	Lower Bound	.000	.005
		Upper Bound	.000	.009

a. Grade = 2.00

b. Wilcoxon Signed Ranks Test

c. Based on negative ranks.

d. Based on 10000 sampled tables with starting seed 92208573.

e. Based on positive ranks.

As in the first grade, there is a significant difference between the jqx and yu types ($z = –3.283$, $p = 0.001$, $r = –0.33$) (Table 5.13).

Table 5.13 Results of test 7

Test Statistics[a,b,d]

			jqx/3 - yu/4
Z			-3.283[e]
Asymp. Sig. (2-tailed)			.001
Monte Carlo Sig. (2-tailed)	Sig.		.001
	99% Confidence Interval	Lower Bound	.000
		Upper Bound	.002
Monte Carlo Sig. (1-tailed)	Sig.		.000
	99% Confidence Interval	Lower Bound	.000
		Upper Bound	.001

a. Grade = 2.00

b. Wilcoxon Signed Ranks Test

c. Based on negative ranks.

d. Based on 10000 sampled tables with starting seed 92208573.

e. Based on positive ranks.

In summary, the second-grade pupils found it easiest to spell correctly the one-to-one type, as the first-grade pupils did. Like the first-graders, the second-grade pupils also performed worst in the jqx type and two-to-three type. However, unlike the first-grade pupils, the second-grade pupils did not find much difference in spelling the following four types: yu, w0y0, two-to-one, and wuyi. The results in the second grade seem to suggest that challenges are not of equal degree in the two grades.

5.2.3 Comparison between the two grades in the different types

A comparison of the spelling performance between the two grades was made.

The Mann–Whiney tests show that pupils in the second grade spelled significantly better than the first-grade pupils on the one-to-one type (U = 1980, p = .016, r = –0.19), the two-to-one type (U = 1826.50, p = .003, r = –0.24), wuyi type (U = 1737.50, p = .001, r = –0.27) and jqx type (U = 2078.0, p = .005, r = –0.17) (see the four-part Table 5.14). These results shaow that, after one more year at school, the second-grade pupils had improved their spelling performance in these four types. However, the results also show they did not differ significantly from the first-grade pupils in spelling the two-to-three, w0y0, and yu types, with the two-to-three type having a lower score than the w0y0 and yu types. It is encouraging to see that after learning pinyin only in the few months at preschool, the first-grade children spelled as well as their older peers in the two types, i.e. w0y0 and yu. This again brought our notice to the teaching method in the two types.

Table 5.14 Tests of the seven types between the two grades

			onetoone/8	twotoone/8
Mann-Whitney U			1980.000	1826.500
Wilcoxon W			7336.000	7182.500
Z			-2.412	-2.937
Asymp. Sig. (2-tailed)			.016	.003
Monte Carlo Sig. (2-tailed)	Sig.		.016[b]	.003[b]
	99% Confidence Interval	Lower Bound	.012	.002
		Upper Bound	.019	.004
Monte Carlo Sig. (1-tailed)	Sig.		.008[b]	.001[b]
	99% Confidence Interval	Lower Bound	.005	.000
		Upper Bound	.010	.002

a. Grouping Variable: Grade

b. Based on 10000 sampled tables with starting seed 92208573.

			two-to-three/6	yu/4
Mann-Whitney U			2442.000	2476.000
Wilcoxon W			3717.000	7832.000
Z			-.526	-.401
Asymp. Sig. (2-tailed)			.599	.688
Monte Carlo Sig. (2-tailed)	Sig.		.598[b]	.695[b]
	99% Confidence Interval	Lower Bound	.585	.683
		Upper Bound	.610	.707
Monte Carlo Sig. (1-tailed)	Sig.		.297[b]	.342[b]
	99% Confidence Interval	Lower Bound	.285	.330
		Upper Bound	.309	.354

a. Grouping Variable: Grade

b. Based on 10000 sampled tables with starting seed 92208573.

			wuyi/4	W0y0/4
Mann-Whitney U			1737.500	2126.000
Wilcoxon W			7093.500	7482.000
Z			-3.334	-1.803
Asymp. Sig. (2-tailed)			.001	.071
Monte Carlo Sig. (2-tailed)	Sig.		.001[b]	.075[b]
	99% Confidence Interval	Lower Bound	.000	.068
		Upper Bound	.001	.082

	Sig.		.000[b]	.037[b]
Monte Carlo Sig. (1-tailed)	99% Confidence Interval	Lower Bound	.000	.032
		Upper Bound	.001	.042

a. Grouping Variable: Grade

b. Based on 10000 sampled tables with starting seed 1993510611.

			jqx/3
Mann-Whitney U			2078.000
Wilcoxon W			7434.000
Z			-2.019
Asymp. Sig. (2-tailed)			.044
Monte Carlo Sig. (2-tailed)	Sig.		.041[b]
	99% Confidence Interval	Lower Bound	.036
		Upper Bound	.046
Monte Carlo Sig. (1-tailed)	Sig.		.021[b]
	99% Confidence Interval	Lower Bound	.017
		Upper Bound	.024

a. Grouping Variable: Grade

b. Based on 10000 sampled tables with starting seed 1993510611.

In summary, the non-significant difference in the w0y0 and yu types between the two grades suggests that the first-grade pupils do not find the two types more challenging than the second-graders. However, because of the lower scores, the non-significant result of the two-to-three type between the two grades seems to suggest that this type could remain difficult for the second-grade pupils after one more year's schooling, indicating that difficulties on this type for the first grade could be persistent. This result therefore seems to imply what the most challenging type is. As the results in the w0y0 and yu types show, it seems that the younger pupils were more able to spell syllables correctly when taught in the recognize-as-a-whole method.

Like certain questions, as above, best answered by categorizing syllables into different spelling types, a close examination of the pupil's raw data reveals why they did so more precisely.

5.3 A closer look at the children's spelling: one-to-one type

We now turn to the raw data, which are extensive. The data in the tables show the frequency and the percentage of each variant for each syllable. On the top of each table is the correct spelling, with the tones in numbers.

The letter *v* in the tables represents the letter *ü*, owing to the fact that the pinyin typing uses the same qwerty keyboard as in English, which does not have *ü* in the keyboard. In addition, it is the letter *v* that is used to output Chinese characters, which have the sound *ü*, in the input of pinyin. The sound *ü* is like the German *ü*, and is quite distinct from the sound usually denoted by *v*.

The tables are laid out by grades, so that comparisons between the two groups of children can be readily made. The tables are provided, because there was a lack of such data in the literature. It is hoped that anyone interested in children's spelling in pinyin could analyse the data for their own purpose.

The focus of the analysis of the data is on the frequent spellings. Particular analysis is given to those spellings that tend to confirm or contradict adults' hypotheses about children's use of pinyin. Where possible influences of local speech or pedagogical practices are revealed in the data, they are pointed out.

The analysis concentrates on the spelling by the first-grade pupils, but the second-grade pupils' spellings are mentioned where they cast light on the pattern. We observed that some spellings appear to involve letter reversals (up/down or left/right), while others

include letters that are written unclearly or incompletely. We will not try to explain spellings that appear to be of those sorts, as they were self-revealing and repetitive. Also, we will try to avoid too much speculation, realizing that some non-standard spellings may not actually be explicable with a reasonable degree of confidence.

The one-to-one type of syllable is that where the correspondence between letters and sounds are one to one, and is taught analytically.

5.3.1 The spelling of *xi1*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	7	4.9	2.00	ci1	1	2.0
	x	5	3.5		x1	1	2.0
	x1	2	1.4		xi	5	10.0
	xi	4	2.8		xi1	42	84.0
	xi1	124	87.3		yi1	1	2.0
	Total	142	100.0		Total	50	100.0

This syllable *xi1* and the following syllable *gua1* were read to the children as one word *xi1gua1*, which means "water melon". *Gua* means "melon" and *xi* here means "foreign", but literally it means "west", indicating that this kind of melon comes from Xinjiang, which was on the Silk Road in the west of China.

One hundred and twenty-four first-grade pupils, 87.3% of the 142 tested, spelled this syllable as *xi*, ignoring the tone mark. (From now on, tones are not discussed unless there is some significance in them.)

Seven pupils spelled the syllable as *x*, to our surprise. This was surprising because no pinyin syllable is without a vowel. So why? Here, if we consider the teaching method in the pinyin class, the hudu method (Sections 2.3.1, 3.1.1), this kind of spelling becomes explicable, because each consonant initial is pronounced as the Chinese character,

designated to remind people of its consonant feature. In this case, *x* is pronounced as *xi*, the pronunciation of the character 西. Also recall that all the initials are taught with the sound quality in the first tone.

The spelling *x*, in effect, a sort of "letter-name" spelling, was also produced by one second-grader. What is insightful, lovely, and amusing is that they considerately added the correct tone mark on top of *x*, which is yet another non-pinyin feature; the tone mark is always put on the top of the finals or vowels. This kind of self-revealing of how children treated this kind of syllable can probably only be observed through a close look at raw data.

The letter-name spellings will come up later in Sections 5.3.3 to 5.3.6, 5.4.3 to 5.4.8, 5.5.1 to 5.5.6, 5.6.1, 5.7.1 to 5.7.2, 5.8.1, and 5.9.1 to 5.9.3. The syllables or the initials of the syllables in these sections sound the same as the letter names, taught in the hudu method. Such spellings are analogue of English spellings in the study of Read (1970), Bissex (1980), and Treiman (1993, 2007), albeit in Chinese.

It is surprising to see seven of the first-graders not writing anything for this syllable, as it seemed the easiest of all the tested syllables, viewed from the scores they got, and the number of letters it involves. Although all the second-graders provided spellings, one spelled it as *ci* and one as *yi*. While the *ci* might suggest the influence of English, as the sound of *xi* sounds very much the same as the name of the English letter *c*; the *yi* is not explainable at first glance. However, if the descending stroke of the *x* is written too short, the result may appear to be a *y*, which was how the spelling was recorded. This seeming replacement of *x* by *y*, while rare, was noted also for *xiu1* (Section 5.5.2), for example.

This syllable exemplifies that a pinyin consonant is pronounced as a syllable, and also, since the syllable and consonant are identically pronounced in this case, children at the beginning stage may use the name of the letter to represent the syllable. And, as it turned out, that is exactly what was found in all the other syllables. Such a phenomenon resembles the behaviour of using letter names to represent words by English-speaking children (Ellefson et al. 2009).

5.3.2 The spelling of *gua1*

Grade	Answer	Frequency	Percent
1.00	0	4	2.8
	g	3	2.1
	ga1	1	.7
	gia1	1	.7
	goa	1	.7
	goa1	3	2.1
	gu1	1	.7
	gua	9	6.3
	gua1	117	82.4
	gua2	2	1.4
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	goa1	1	2.0
	gua	1	2.0
	gua1	46	92.0
	gua4	1	2.0
	gue2	1	2.0
	Total	50	100.0

One hundred and twenty-eight first-graders spelled *gua1* correctly, with eleven wrong or missing tone marks. Three children spelled it as *g*, which perhaps showed that they could not remember the remaining two letters in the syllable.

Four spelled it as *goa*, which is not a pinyin spelling. However, if we pronounce the spelling, we get similar sound as *gua*. There is a tendency that *g* or any other initial is often pronounced as a syllable with whatever vowel is next to it, in this case *gu*. The gliding from *gu* to *a* will involve a sound which is *o*. Actually when *ua* is lengthened, it sounds like *uoa*. Perhaps as the children used *g* to represent the sound of *gu* and

lengthened the syllable a bit, the *o* sound became prominent before writing the sound *a*, and therefore we observed a attempted phonetic transcription of the syllable. We saw one second-grader also spell this syllable as *goa*, accounting for one of the only two variants they made in spelling this syllable. Interestingly, we were surprised to see one first-grader spell this syllable as *ga*, which was a pinyin syllable but was very different from the pronunciation of *gua* if pronounced as it was spelled; but, as we mentioned, *g* is usually pronounced with a vowel next to it, and if *g* was meant to be *gu*, then *ga* would sound exactly as *gua*.

5.3.3 The spelling of *ji1*

Grade	Answer	Frequency	Percent
1.00	0	4	2.8
	i2	1	.7
	j	7	4.9
	ji	7	4.9
	ji1	114	80.3
	ji4	2	1.4
	jin1	2	1.4
	jy	1	.7
	jy1	1	.7
	xi	2	1.4
	yi1	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	ji	4	8.0
	ji1	45	90.0
	ji3	1	2.0
	Total	50	100.0

This syllable *ji1* was presented together with the syllable *hui4* as a word *ji1hui4* meaning "chance or opportunity".

Only four of the first-graders failed to spell this syllable, indicating that it was not difficult. Actually, 138 spelled it correctly, ignoring the tones.

Seven children spelled it as *j*, a true phonetic transcription, influenced by the teaching method described when we discussed *xi*. That is, *j* is pronounced as *ji* in the class. This sort of "letter-name" spelling would appear frequently in the pupils' raw data.

Interestingly, two spelled it as *jy*. The letter *y* is pronounced as *i* in the conditional rule that we will discuss in the spelling type *wuyi* later. Thus, although not orthographic, *jy* is a reasonable phonetic transcription of *ji*.

5.3.4 The spelling of *re4*

Grade	Answer	Frequency	Percent
1.00	0	7	4.9
	le4	3	2.1
	ne	1	.7
	r	4	2.8
	ra4	1	.7
	re	2	1.4
	re1	1	.7
	re2	1	.7
	re3	1	.7
	re4	111	78.2
	ri	1	.7
	ri1	1	.7
	ri4	1	.7
	rue4	1	.7
	ye	2	1.4
	ye4	4	2.8
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	r	1	2.0
	re	4	8.0
	re4	41	82.0
	ren4	1	2.0
	ri4	1	2.0
	ye2	1	2.0
	ye4	1	2.0
	Total	50	100.0

This is a single-syllable word, which means "heat, hot". Apart from the correct spelling by 116 first-graders, the children's spelling showed 9 variants.

Six first-grade and two second-grade pupils spelt *ye* for *re*. In the local speech, the curled-tongued *re* would be pronounced as *ye*.

It is likely that children spelled this syllable as *rue4* (1 child), *ri* (3), and *r* (5) because of the syllabic way of teaching initials, namely the hudu method, as mentioned earlier. The initial *r* is either pronounced as *rue* or *ri*. The spellings *rue*, *ri*. and *r* might suggest the children's phonetically transcribe the sound *re*.

5.3.5 The spelling of *zi4*

Grade	Answer	Frequency	Percent
1.00	0	1	.7
	z4	1	.7
	z4i	1	.7
	zh4	1	.7
	zhi	1	.7
	zhi4	14	9.9
	zhr4	1	.7
	zi	6	4.2
	zi1	2	1.4
	zi2	2	1.4
	zi4	109	76.8
	zr	2	1.4
	zr4	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	iz	1	2.0
	z	1	2.0
	zh	1	2.0
	zhi4	1	2.0
	zi	1	2.0
	zi1	3	6.0
	zi4	42	84.0
	Total	50	100.0

The syllable *zi4* means "Chinese character".

This syllable is taught as a recognize-as-a-whole syllable and has only two letters in it. How many spelling variations would we expect to observe for this? Three perhaps. But see how many variants we have been presented with: eleven in the first grade and six in the second grade, counting the tones.

The most frequent variation from the correct spelling is the spelling *zhi*. There were fifteen first-graders who spelt *zi* as *zhi*. Why did they add an *h* to a two-letter

syllable to make it one letter more? The reason is that, in the local vernacular, people do not distinguish *z* and *zh*. However, when learning pinyin, people become aware of the standard form of pronunciation of the syllables, which are pronounced as *z* in the vernacular but as *zh* in Putonghua, and begin to make effort to distinguish the two. The result of this is that people tend to overcorrect the sound of *z* to *zh*, and vice versa. Thus, we observe this overcorrection in the 15 children's creative spellings.

Considering that altogether sixteen children created this non-standard spelling, and the fact that the local vernacular does not distinguish "the flat-tongue sound" and "the curled-tongue sound", it might be expected that this "hypercorrection" phenomenon (see Duanmu 2007) would show up in other spellings involving those sounds, too. And indeed, we shall see later that the same misspelling tendency holds also for *c–ch* and *s–sh*.

One child spelled this syllable as *zhr4* and two as *zr*. Why? If we try to pronounce *zr*, we will produce *zh*, which is actually called "the curled-tongue *z*", pronounced by curling the tongue backwards. If the sound *zh* is lengthened, then *ri* sound will be obtained, which is the sound taught for the initial *r*. Hence, the spellings of *zr* and *zhr* are the children's creative phonetic transcriptions. This observation is an example of many that would have been lost if the data had been recorded merely as right or wrong.

To triangulate the phenomenon of such hypercorrection, arising from the difference between the local version of Mandarin and the standard Mandarin, the syllables *zhi*, *chi*, and *shi* were also selected.

This single syllable, *zi4*, allows us to appreciate not only the children's logic of phonetic transcription in general but also the logic behind specific misspellings in particular. That is, their misspellings point to the various influences reviewed in the

literature (Chapter 3) and in the information gathering (Appendix II). In fact, the tone marks on the initials seem to confirm that they treated each initial as a whole syllable. More interestingly, the spellings *zr* and *zhr* in the first-grade pupils (although the number is small) are analogous to the Yale pinyin spelling tuned to the English ear (Section 1.2).

5.3.6 The spelling of *jia4*

Grade	Answer	Frequency	Percent
1.00	0	23	16.2
	gia4	1	.7
	j	2	1.4
	ja4	5	3.5
	ji	2	1.4
	ji4	2	1.4
	jia	3	2.1
	jia1	2	1.4
	jia3	1	.7
	jia4	93	65.5
	ju4	1	.7
	xa4	1	.7
	xia4	5	3.5
	zh	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	3	6.0
	j	1	2.0
	jia1	2	4.0
	jia4	43	86.0
	jian4	1	2.0
	Total	50	100.0

This syllable on its own means “holiday”. It was presented in the word *xiu1jia4*, which means “having a holiday”.

One hundred and forty-four children (70% of first-graders and 90% of second-graders) spelled the syllable correctly. Five spelled it phonetically, if we take *j* as *ji* in the spelling *ja*. This *ja* is not a pinyin spelling. Again, this might also be the influence of how an initial is pronounced, which we have mentioned regarding the syllable *gua* in Section 5.3.2. Interestingly, we found *xa* (1 child) and *xia* (5). Here the spelling *xa* is considered

representing the same sound as *xia*, because *x* is pronounced as *xi* in the pinyin class. Previously, we have mentioned that, when concerning the syllables *ji* and *xi* respectively, these two sounds are similar and are taught as one group for their similarity (Appendix I-7: Lesson 6). It appears that the syllables of *jia* and *xia* sound similar to some children.

One first-grader wrote *g* and one wrote *zh*. Possibly, the former was influenced by the (soft) *g* in English, while the rest of the syllable was abandoned. In the latter case, we find using English letter *j* for the Chinese sound *zh* is a common practice among English-speaking learners of pinyin (http://en.wikipedia.org/wiki/Pinyin). The present observation seems to be the first report of Chinese children using the English letter *g* to represent pinyin *j*.

5.3.7 The spelling of *tian1*

Grade	Answer	Frequency	Percent
1.00	0	26	18.3
	dian	1	.7
	dian1	2	1.4
	dian2	1	.7
	t	2	1.4
	tain1	1	.7
	tan1	1	.7
	tian	4	2.8
	tian1	89	62.7
	tian2	2	1.4
	tian3	2	1.4
	tian4	1	.7
	tiang1	3	2.1
	tien1	2	1.4
	tin1	2	1.4
	tirg	1	.7
	tiun1	2	1.4
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	6	12.0
	tean1	1	2.0
	tian	1	2.0
	tian1	35	70.0
	tian2	4	8.0
	tian4	2	4.0
	tin1	1	2.0
	Total	50	100.0

The syllable *tian1* was presented in the word *qiu1tian1*, which means "autumn". *Tian1* alone literally means "the sky". It can be said that the final *ian* has two finals embedded: *i* and *an*. However, the sound *a* here is different from that in the final *an* or in the single final *a*. It is between *a* and *e*, and is expressed as [ɛ] in IPA.

Ninety-four first-graders, 66% of them, spelled this syllable correctly. Two children spelled it as *tien*, a non-pinyin syllable but a fairly faithful phonetic transcription. We note here that the great Chinese linguist Yuen Ren Chao spelled a syllable with the same final in his name as Yuen, instead of Yuan, as it would be spelled in pinyin.

Two children spelled it as *tin*, a non-pinyin syllable but likely an attempt at phonetic transcription of the syllable *tian*, if *n* is to be pronounced as the name of the English letter *n*. This influence from English seems to show in another spelling: *tan*, as well. Although *tan* is a pinyin syllable, the sound is too different from *tian*. However, if *t* was pronounced as the English *t*, which would be *ti* spelled in pinyin, we would pronounce this spelling as *tian*.

5.3.8 The spelling of *lü3*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	8	5.6	2.00	0	1	2.0
	i	1	.7		l	1	2.0
	l	2	1.4		liv3	1	2.0
	li2	2	1.4		lu3	10	20.0
	li3	2	1.4		lu4	1	2.0
	lu	3	2.1		lv2	1	2.0
	lu2	1	.7		lv3	34	68.0
	lu3	36	25.4		nv3	1	2.0
	luy3	1	.7		Total	50	100.0
	lv	5	3.5				
	lv2	1	.7				

	lv3	66	46.5
	lyu	1	.7
	lyu2	1	.7
	lyu3	3	2.1
	ni3	1	.7
	nl3	1	.7
	u	1	.7
	v	1	.7
	vl	2	1.4
	yu3	3	2.1
	Total	142	100.0

This syllable was presented in the word *lü3you2,* which means "travel; tour".

This is the syllable that was spelled the least correctly in the one-to-one type. Here, the letter *v* in the tables stands for *ü,* following the way that *ü* is input on the qwerty keyboard to output the Chinese characters. It was spelled even less well than the syllable that has four letters in its type. To see what makes it so difficult to spell correctly, one needs to look in detail at the errors the children made.

Contrary to the jqx type (Sections 2.2.5, 5.9), which requires omitting the umlaut on *ü,* the syllable *lü* does not belong to that category, because the initial is *l* not *j*, *q*, or *x*. This syllable is simply composed of one initial *l* plus one final *ü*.

We observe 72 first-graders spell the syllable correctly, with two transposition instances of *ül,* and two other versions combining transposition with inversion: *nl* and *ni*, where *n* might suggest the *u* visualized as upside down, and *i* suggest the similar form of *l,* with a dot added. We also observe that as many as 40 first-graders spelled *lu*, suggesting the overriding rule for *ü.*

If only the logic of letter–sound correspondence is considered, then the misspelling of the syllable *lü* as *lu* is not explainable, because the two syllables do not

sound alike. The correct syllable *lü* sounds like *lyü* in German, and the misspelled syllable *lu* sounds like *loo* in English. We recall here that there is an orthographical rule—the umlaut is taken off when it is preceded by initials *j*, *q*, and *x*. Therefore it is likely that children over-applied the rule by spelling *lü* as *lu*, another evidence of hypercorrection. Only this time the reason could not be connected with sound, but rather with visual transformation of a letter. This hypercorrection is observed throughout syllables involving this visual transformation (see e.g. Sections 5.8.1–5.8.4 and 5.9.1–5.9.3).

Another four first-graders spelled the syllable in an extraordinarily logical and analytical way: *lyu*, with one transposed spelling *luy*. As we have just mentioned, when *ü* is preceded by *y*, the umlaut is taken off, and hence *yu* = *ü*. Note this is also Yale's spelling.

5.3.9 Summary

This one-to-one type of spelling was the easiest of the seven types. Looking at the erroneous spellings, we were surprised by the creative but phonetically logical spellings, which seems to show the influence of the hudu teaching method and local vernacular.

Within this one-to-one spelling type, syllable length does not seem to influence the ease of spelling, as exemplified by the syllables *lü* and *tian*, but the orthographical rule involving visual transformation does. This seemed to indicate that spelling involving changing the visual form of a letter could be harder than that only involving letter–sound correspondence.

5.4 Analysis of spelling: two-to-one type

In this type of spelling, two letters, called a digraph, represent one sound. There are five of them: *zh*, *ch*, *sh*, *ng*, and *er*. The syllables in this type contain all the five digraphs. The local speech does not distinguish *z* and *zh*, *c* and *ch*, and *s* and *sh*, using instead *z*, *c*, and *s* when *zh*, *ch*, and *sh* should be used, so that it does not have *zh*, *ch*, and *sh* sounds, in common with many provinces in China (Duanmu 2007). Hence, there is a tendency of hypercorrection in learning to speak Putonghua all over China (Duanmu 2007).

5.4.1 The spelling of *er3*

Grade	Answer	Frequency	Percent
1.00	0	14	9.9
	e	3	2.1
	e1	1	.7
	eer	1	.7
	en	1	.7
	en3	1	.7
	er	20	14.1
	er2	5	3.5
	er3	67	47.2
	r	1	.7
	re	2	1.4
	re1	1	.7
	re2	1	.7
	re3	15	10.6
	rer3	1	.7
	ri1	1	.7
	ri3	4	2.8
	ye	1	.7
	yen2	1	.7
	yr	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	9	18.0
	e	3	6.0
	ei1	1	2.0
	er	1	2.0
	er1	1	2.0
	er2	3	6.0
	er3	14	28.0
	ie3	1	2.0
	ie4	1	2.0
	r	3	6.0
	r3	1	2.0
	re	2	4.0
	re2	1	2.0
	re3	8	16.0
	re4	1	2.0
	Total	50	100.0

This syllable was presented with the other syllable *wen* as a two-syllable word *er3wen2* meaning "hear of". The syllable *er3* on itself means "ear", and the second syllable *wen2* means "hear". This syllable is expressed as [ɑɻ] in IPA, and is taught by the recognize-as-a-whole method, that is, *er* is taught as a separate syllable to be written on its own, without analysis of which part is initial and which part is final. This syllable is a final-syllable. There is only this unique syllable in the pinyin writing, which ends with *r*. It has three tones, and spelled: *er2*, *er3*, and *er4*, but *er4* sounds exactly as *ar4* rather than *er4*.

Ninety-two first-grade children spelled the syllable correctly, accounting for 67% of them, disregarding tones.

Altogether, in both year groups, thirty-one children spelled it in a transposed way: *re*, a syllable we analysed in Section 5.3.4, and which sounds very different from *er*. Since so many children spelled this way (31 out of 58 children), it seems unlikely that this was a form of dysgraphia (which is anyway not recognized or discussed in China). Perhaps the spelling was influenced by the actual pinyin syllable *re* (Section 5.3.4).

The other function of *er* is to be used at the end of a syllable to signal retroflection of pronouncing the syllable, in which case, *er* is spelled as *r* according to the rule (Section 5.5.7).

5.4.2 The spelling of *yong3*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	21	14.8	2.00	0	1	2.0
	iang1	1	.7		eng3	1	2.0
	iang3	1	.7		iong2	1	2.0
	ioig2	1	.7		iong4	1	2.0
	iong2	1	.7		jou3	1	2.0
	iong3	4	2.8		rong3	1	2.0

	iou3	1	.7		y	1	2.0
	iui3	1	.7		yang3	1	2.0
	jiao3	1	.7		yo3	1	2.0
	ong3	1	.7		yong1	2	4.0
	rong3	1	.7		yong2	3	6.0
	y	10	7.0		yong3	32	64.0
	yang	2	1.4		you3	4	8.0
	yeng3	1	.7		Total	50	100.0
	yeo3	1	.7				
	yiong	1	.7				
	yo	1	.7				
	yo3	1	.7				
	yog3	1	.7				
	yong	1	.7				
	yong1	3	2.1				
	yong2	1	.7				
	yong3	66	46.5				
	you	5	3.5				
	you2	1	.7				
	you3	8	5.6				
	you4	1	.7				
	yu2	1	.7				
	yuo	1	.7				
	yvn	1	.7				
	yvn3	1	.7				
	Total	142	100.0				

This syllable *yong3* was introduced as meaning “silkworm”. The *ng* in the *ong*, which represents one sound [ŋ], is the focus here. This is a final-syllable, a syllable made of a final on its own, without initial. The final is *iong* in the original pinyin system. This syllable is also served as a triangulation syllable for the wuyi type of spelling where *y* is pronounced as *i* (Section 5.6.2).

Seventy-two first-grade children spelled correctly, with only four marking the tone wrongly. The spelling *iong* by five first-graders is an exact phonetic transcription. The spelling *yiong* by one first-grader seemed to suggest that *y* was used as an initial.

Two children spelled it as *jo*, one as *jeo*, one as *jiao*, and one as *ioig*. Perhaps the initial letter of the first three spellings were influenced by the IPA in learning English, as the sound of *y* is expressed by [j] in IPA, and the fourth spelling might be a rather confused mixture of pinyin letter, English letter, and IPA. Interestingly, the English word *you* [ju:] is often readily and happily picked up by Chinese learners, with the characteristic Chinese-accent pronunciation [jəu].

Just as two of the first-grade pupils spelled this syllable as *yo*, fifteen of them spelled it as *you*, which was more or less the exact sound of *yo* in English. However, it is hard to believe that the children could not distinguish the Chinese sound *you* from *yong*. What seems more likely is that they might just use *you* to represent the sound of *yong*, because the spelling of the *ng* sound was never taught explicitly and so forgotten. The omission of *ng* is notable also in the spelling of *shuang* (Section 5.4.7) and *qing* (Section 5.4.8).

5.4.3 The spelling of *zhi1*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	15	10.6	2.00	0	2	4.0
	sh1	1	.7		zh	1	2.0
	shi1	2	1.4		zh1	2	4.0
	z	1	.7		zhi	3	6.0
	zh	7	4.9		zhi1	33	66.0
	zh 1on r	1	.7		zhi2	1	2.0
	zh1	1	.7		zi1	8	16.0
	zhi	5	3.5		Total	50	100.0

	zhi1	67	47.2
	zhi2	2	1.4
	zhi3	2	1.4
	zhr	6	4.2
	zhr1	6	4.2
	zhr1on z	1	.7
	zhri	1	.7
	zi	5	3.5
	zi1	13	9.2
	zr	4	2.8
	zr1	2	1.4
	Total	142	100.0

This syllable and the following syllable *chi2* (Section 5.4.4) form the word *zhi1chi2*, which means "support". The syllable *zhi1* alone means "support", too; except that the supporting force for *zhi1* comes from the bottom, and that for *chi2* comes from the middle, as would be indicated by the English word "hold".

In Section 5.3.4, we discussed the hypercorrection in spelling the *z* sound, caused by the awareness of the local speech and the standard form. In order to triangulate the phenomenon of hypercorrection, and triangulate the influence of the recognize-as-a-whole teaching method, the syllable *zhi* was selected in the spelling test in addition to *zi*.

Now we see that 76 first-grade children spelled the syllable *zhi* correctly, and 18 spelled it as *zi*, a likely result of hypercorrection. Besides, seven first-grade children spelled only the initial *zh*, and one child spelled *z*. These two forms could suggest, again, the influence from the teaching method: a consonant initial is taught as a syllable; that is, the sound of *zh* is pronounced exactly as *zhi*, and so is the *z* as *zi* (Section 5.3.4; Appendix I-8–9).

We also found spelling *zhr* by as many as eight children. This spelling should be the attempt to spell the sound phonetically, because if *zhi* is lengthened in pronunciation,

it ends with a distinctive *r* sound. Lovelier still, six children even added a correct tone mark on top of the *r*. We recall here that a tone mark is only put on the top of the vowel of a final.

The spelling *zr* by three children is pure phonetic transcription, too, because it is the true record of the sound *zhi* according to how the sound *zh* is pronounced. All these non-standard spellings (also Section 5.3.5) are what the Yale writing system utilized for learners of Chinese with an English ear (Section 1.2). This kind of creative spelling is another example showing the logic behind the children's spelling.

We found one child who spelled *sh*. In addition, the child marked the correct tone on top of *sh*, clearly showing that here *sh* was intended not as consonant initial, but as a syllable. This, again, indicates the influence of hudu teaching method. However, it seems that the influence from the local vernacular is more persistent than that from the hudu method.

5.4.4 The spelling of *chi2*

Grade		Frequency	Percent	Grade		Frequency	Percent
1.00	0	16	11.3	2.00	0	2	4.0
	c	1	.7		c	2	4.0
	ch	2	1.4		ch2	3	6.0
	ch1	1	.7		cha1	1	2.0
	ch2	7	4.9		chi	3	6.0
	ch4	1	.7		chi2	30	60.0
	chi	10	7.0		chi4	1	2.0
	chi1	3	2.1		chir2	1	2.0
	chi2	51	35.9		chr2	1	2.0
	chi4	1	.7		ci2	3	6.0
	chr	5	3.5		shi2	1	2.0
	chr2	7	4.9		zen4	1	2.0
	chr2on r	1	.7		zhi2	1	2.0

	ci	3	2.1		Total	50	100.0
	ci1	1	.7				
	ci2	12	8.5				
	ci3	1	.7				
	cnr	1	.7				
	cr	6	4.2				
	cr1	1	.7				
	cr1on c	1	.7				
	cr2	6	4.2				
	cui1	1	.7				
	ri2	1	.7				
	shc	1	.7				
	shr	1	.7				
	Total	142	100.0				

This syllable alone means "hold (up)". It was the second syllable in the word *zhi1chi2*, which means "support", discussed above in Section 5.4.3.

Fifty-one first-grade pupils spelled the syllable correctly. Seventeen spelled it as *ci*, indicating hypercorrection caused by the awareness of the difference between the standard Mandarin and the local speech. Phonetic transcription was found in the spelling of *chr* by as many as twelve children and *cr* by as many as fourteen children, with one child adding a tone mark on the letter *r*, as they did to the letter *r* for the previous syllable *zhr*. Eleven spelled it as *ch*, with as many as eight children adding tone marks on the *h*, showing the influence from the hudu teaching method: the consonant initial is always pronounced as a syllable, e.g. *chi*, in teaching *ch* (Appendix I-9).

If we put aside the above 106 first-grade pupils who either spelled correctly or spelled as obvious phonetic transcription, we have 36 children left.

5.4.5 The spelling of *shi4*

Grade	Spelling	Frequency	Percent	Grade	Spelling	Frequency	Percent

1.00	0	17	12.0	2.00	0	4	8.0
	chi2	1	.7		chi2	1	2.0
	chi4	4	2.8		chi4	2	4.0
	chr4	1	.7		sha2	1	2.0
	s1	1	.7		shi	2	4.0
	s4r	1	.7		shi4	39	78.0
	sh	5	3.5		si4	1	2.0
	sh4	3	2.1		Total	50	100.0
	shi	8	5.6				
	shi1	7	4.9				
	shi4	60	42.3				
	shii	1	.7				
	shr	7	4.9				
	shr2on r	1	.7				
	shr4	9	6.3				
	shu4	1	.7				
	si	2	1.4				
	si1	3	2.1				
	si4	4	2.8				
	sr	4	2.8				
	sr4	2	1.4				
	Total	142	100.0				

Shi4 was presented with *qing0*, as a word *shi4qing0*, which means "matter; affair; business; thing". *Shi4* on its own means the same as the word *shiqing*.

Seventy-five first-graders spelled this syllable correctly. Seventeen did not write anything. Of the remaining 58 children, 17 spelled *shr* and six spelled *sr*, with one adding the tone mark on top of the initial *s*, not *r*, to indicate, seemingly, that it was the initial where the sound came from. Just as *zh* is called "the curled-tongue *z*", *sh* is called the "the curled-tongue *s*". This is another example where the children used *r* instead of *h* to mark the feature of retroflection of *sh*.

In the remaining analysis, we will encounter further examples of non-standard spelling influenced possibly by the hudu method. Explicit disussion of this is omitted in some cases to avoid repetition.

We found five first-grade children who spelt the syllable as *chi* and one as *chr*, with one child adding the tone mark on top of *r*. Recall that *zh* [tʂ], *ch* [tʂ^{h}], and *sh* [ʂ] are taught in one group and that *zh* and *ch* are an affricate pair, while *sh* is fricative (Appendix I). This substitution between the three consonants may indicate that the three spellings would show frequently in later syllables involving these sounds.

There was, again, one case, where a child spelled the syllable as *shii*. This could suggest the phonetic transcription of a lengthened *shi* or suggest how the syllable was composed: *shi* +*i* → *shii*, showing that the child knew that there should be an *i* in the syllable (also see Sections 5.4.6, 5.4.7). We recall here again that both *sh* and *shi* are taught with the same sound in hudu method (Sections 2.3.1, 3.1.1; Appendix I-9).

5.4.6 The spelling of *xiong2*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	13	9.2	2.00	0	3	6.0
	x	2	1.4		qiong2	1	2.0
	xang1	1	.7		xia	1	2.0
	xang2	2	1.4		xing2	1	2.0
	xeng2	1	.7		xiong1	1	2.0
	xi	4	2.8		xiong2	25	50.0
	xi4ong2	1	.7		xiong3	1	2.0
	xiang	1	.7		xiu2	1	2.0
	xiao3	1	.7		xong	2	4.0
	xin1	1	.7		xong1	1	2.0
	xin2	1	.7		xong2	9	18.0
	xing2	4	2.8		xong3	2	4.0
	xio	1	.7		xu	1	2.0

	xioig2	1	.7		xuong	1	2.0
	xion2	1	.7		Total	50	100.0
	xiong	6	4.2				
	xiong2	45	31.7				
	xiong3	2	1.4				
	xiou2	1	.7				
	xiou3	1	.7				
	xiu2	5	3.5				
	xiu3	2	1.4				
	xo	1	.7				
	xoing	1	.7				
	xong	4	2.8				
	xong1	1	.7				
	xong2	23	16.2				
	xou	2	1.4				
	xou2	3	2.1				
	xu	1	.7				
	xu2	1	.7				
	xui4	1	.7				
	xvn2	2	1.4				
	xyo3	1	.7				
	xyou2	3	2.1				
	yong	1	.7				
	Total	142	100.0				

Xiong2 means the animal "bear" for this study. This syllable has a compound final, namely *i* with *ong*, but the way to pronounce it should be as one, gliding from the start *i* (called the head of the final) to *o* (called the body of the final), and *ng* (called the tail of the final). Finals with four letters are the longest finals. Three such finals exist: *iong*, *iang*, and *uang*. The *iong* itself entails the rule that, if the final is preceded by an initial to make a syllable, it retains its original form, otherwise changing *i* into *y* when the final is a syllable on its own (e.g. *yong* in Section 5.4.2).

Altogether, only 53 first-graders spelled this syllable correctly, which seems to suggest that this is a challenging syllable. But what errors did they make?

The most common error was to spell this syllable as *xong*. The 28 pupils omitted the *i*. What caused them to omit it? If we pronounced *x* as *xi*, then the sound of *xong* is exactly the sound of *xiong*. We have mentioned the teaching method that *x* is pronounced as *xi* in Section 5.3.1. However, we have not mentioned a teaching method in dealing with finals which have two finals imbedded, in this case *i* and *ong*, in great detail.

It is recommended in the textbook to teach such syllables in the following way (Yuwen 2009). First, combine *x* and *i* to get *xi* (*x* + *i* → *xi*), and then blend *xi* with the other final *ong*: *xi* + *ong* → *xiong*. It is likely that, since *xi* sounds the same as *x*, children might forget there is an *i* between *x* and *ong*. However, there was no report on how this method affects children's spelling.

As many as fourteen second-graders spelled *xong*, omitting the first vowel *i*. This phonetic transcription seems to confirm, at the same time, that the perception of consonant by the children is different from the theoretical concept of consonant, which has no vowel attached to it. This perception, more obviously be seen in the context of the Chinese language, might be reinforced by the teaching method, i.e. the hudu method. A case in the first-graders seems to further confirm how they spelled this syllable: the child marked the tone on *xi4* and then a tone on the final *ong2*, so that his syllable was spelled as *xi4ong2*. It was interesting to see that the children spelled exactly as the adults in Lin's (1993) study, where the first vowel was omitted, a phenomenon caused most likely by the hudu method.

5.4.7 The spelling of *shuang1*

Grade	Answer	Frequency	Percent
1.00	0	22	15.5
	chu1	1	.7
	chuan	2	1.4
	s	2	1.4
	sen2	1	.7
	sh	9	6.3
	shan1	1	.7
	shang1	7	4.9
	shang2	1	.7
	shu	7	4.9
	shu1	1	.7
	shua	2	1.4
	shuan	1	.7
	shuan1	3	2.1
	shuan3	1	.7
	shuang	3	2.1
	shuang1	50	35.2
	shuang3	1	.7
	shung1	1	.7
	shunu	1	.7
	shuuang	1	.7
	su1	1	.7
	su3	2	1.4
	suang	1	.7
	suang1	15	10.6
	suang4	1	.7
	xiao1	1	.7
	xyang1	1	.7
	zhan1	1	.7
	zuang1	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	1	2.0
	chuang	1	2.0
	chuang1	1	2.0
	shu	2	4.0
	shuan1	1	2.0
	shuang	2	4.0
	shuang1	35	70.0
	shuang2	2	4.0
	suan1	1	2.0
	suang1	1	2.0
	sun4	1	2.0
	xuang1	1	2.0
	zhuang1	1	2.0
	Total	50	100.0

The meaning of this syllable is “frost”. The six-lettered syllable *shuang* is one of the only three longest syllables (the other two being *zhuang* and *chuang*) in pinyin orthography, and two parts of this syllable have two-to-one letter–sound correspondence: *sh* and *ng*.

Fifty-four first-graders spelled this syllable correctly, with three wrong tone marks; and as many as 17 children spelled it as *suang*, a possible vernacular influence on the pronunciation of *sh*, or hypercorrection. The influence from vernacular of spelling *sh* as *s* or vice versa has been discussed earlier for the syllables containing *z*, *zh*, *ch*, and *sh*.

The next most common error was to spell it as *shang*, by eight children. We mentioned earlier in Section 5.4.6, when looking at the previous syllable *xiong*, that there are two ways to blend the syllable like this one, which has two finals in one: *u* and *ang*. One way is to blend *sh* and *uang*, and the other is to blend the first final with the initial *sh* + *u*, and then *shu* + *ang*. The second method is recommended in the textbook and therefore more popular, as it is considered more straightforward.

We found one child who spelled *shuuang*, which seems to demonstrate how exactly the syllable was blended, that is, by the procedure: *shu* (for *sh*) + *uang* (also see Sections 5.4.5, 5.4.6, 5.4.7).

While 22 first-grade children did not attempt to spell this syllable, only one second-grader failed to supply a spelling. This could suggest the children’s enthusiasm for spelling in pinyin, particularly in the uncompleted ones. Perhaps the length of the syllable is a challenge for the younger children but not a big problem after one year’s schooling.

Since this is the longest syllable in the spelling test, it is interesting to note the number of variations in the two year groups. More tellingly, the percentage correct in

spelling this syllable, ignoring the tone, increased from 38% in the first-grade pupils to 78% in the second-graders. It seems for the second-graders, syllable length was not as a big problem as omitting the umlaut, as they spelled only 70% correctly on the two-letter syllable *lü* (see Section 5.3.8).

5.4.8 The spelling of *qing0*

Grade	Answer	Frequency	Percent
1.00	0	28	19.7
	chie	1	.7
	ching1	1	.7
	cing4	1	.7
	ging2	1	.7
	p	1	.7
	ping	4	2.8
	ping2	2	1.4
	q	3	2.1
	qag2	1	.7
	qan2	1	.7
	qang2	1	.7
	qeng	2	1.4
	qeng1	1	.7
	qi2	1	.7
	qien1	1	.7
	qieng1	4	2.8
	qieng2	2	1.4
	qieng4	1	.7
	qigni	1	.7
	qin1	1	.7
	qin2	4	2.8
	qina2	1	.7
	qing	20	14.1
	qing1	17	12.0
	qing2	32	22.5
	qing4	4	2.8
	ten	1	.7

Grade	Answer	Frequency	Percent
2.00	0	4	8.0
	jing2	1	2.0
	ping2	1	2.0
	ping4	2	4.0
	qeng	1	2.0
	qien	1	2.0
	qien1	1	2.0
	qieng2	1	2.0
	qin1	1	2.0
	qin2	1	2.0
	qing	9	18.0
	qing0	1	2.0
	qing1	7	14.0
	qing2	15	30.0
	qing3	1	2.0
	qing4	2	4.0
	qying2	1	2.0
	Total	50	100.0

	xi	1	.7
	xing2	1	.7
	xing3	2	1.4
	Total	142	100.0

This syllable was presented with *shi* in the word *shi4qing0*, which means "affairs; thing; business; matter". The zero on the syllable means that the tone is the "zero tone" or "soft tone". Such a syllable is also said to have no tone. In this case, it should be pronounced swiftly and lightly. A zero-toned syllable always appears with another syllable, either in a two-syllable word or in a phrase. The meaning of *qing* in this context is "circumstances". The sound of the final *ing* actually has an *e* sound in it. That is, *ieng* is the sound of *ing* (e.g. Howie 1976).

Seventy-three pupils spelled correctly, but as many as twenty-eight children did not write anything. The remaining 41 children spelled 19 variations.

The most frequent variation is the spelling *qieng*, and the next most frequent is the spelling *qeng* by three children. We have mentioned that *ing* is actually pronounced as *ieng* (also Section 2.2.4). If *q* is taught the same sound as *qi*, then *qeng* might have meant to be *qieng*. So, *qeng* could be regarded as a faithful creative phonetic transcription.

However, the fact that *ing* represents the sound *ieng* is never taught in any books, and therefore hardly known by the majority of teachers who teach pinyin in primary schools or even universities; although it is noted straightaway by English speakers and learners of Chinese as a foreign language (Wang 2005). It is exciting to see that children at this stage have noticed the sound and described it faithfully, showing their insight into the alphabetic writing system.

The reason why the pinyin spelling *ing* is used, but is not made known to the public, is to keep the orthography simple (Zhou 1961). Perhaps for the same reason, Wade–Giles uses *ing*, too. Therefore, as long as people remember the sound of the final, there should be no problem in reading *ing* as *ieng*, since *ieng* is the only sound in Chinese that can be associated with the final. And that was exactly how the children read syllables with *ing* in it in our reading-aloud test (Chapter 6). To our surprise, when it turned to spelling, the sound which was not taught was spelled out. This seems to confirm that the process in spelling and reading-aloud is different (Frith 1979; Read 1986).

The consonant initial *ch* in the spelling *ching* (1 child) sounds almost the same as *q* in pinyin; in fact, Wade–Giles' first and second styles used *ch* to represent the sound of *q*, suggesting the sameness of the two sounds; and English speakers are taught by reference to words like *chair* to learn the sound of *q* in learning pinyin. By the way, *ching* is a non–pinyin syllable. Even *xing* sounds a bit like *qing*, because *j*, *q*, and *x* are all pronounced with the tongue in the similar position (*j* and *q* the same position, with *j* an unaspirated and *q* aspirated, and *x*, aspirated, only slightly different in position, also see Section 5.3.3), as is the distinctly different consonant *c* ([ts]) in the spelling *cing* (1 child). So all the above spellings could indicate attempts at phonetic transcription.

What should be mentioned is that the zero tone is mostly marked by the children as the second tone for this syllable. The reason for this is that the character 情 on its own is pronounced in the second tone, and that is the basic tone for this character. In teaching pinyin, it is a rule that a syllable should be associated with its basic tone. This is another example that shows what pinyin is for at school: it is for teaching the pronunciation of

characters. Some pupils marked it as the first tone, because the first tone and zero tone sound the same, except that the former one is pronounced longer and with more emphasis.

5.4.9 Summary

In the two-to-one type, all the five digraphs: *er*, *zh*, *ch*, *sh*, and *ng* in the pinyin orthography were tested and examined in the preschoolers' spellings. The recognize-as-a-whole method in the spelling *er* showed its effectiveness by the high proportion correct. However, overall the two-to-one type of syllable shows obvious contrast to the one-to-one type in percentage correct. We are shown that two factors in particular have influenced the children's spelling: one is hypercorrection resulting from the awareness of the difference between the standard form of Mandarin and the vernacular, and the other is from the teaching method, i.e. the hudu method, which pronounces the initials as syllables (i.e. *zh* as *zhi*, *ch* as *chi*, *sh* as *shi*, *q* as *qi*).

The full displaying, for example *qieng*, of what is simplified in the pinyin orthography suggests children's insight into the alphabetic writing system: each sound has a symbol to represent it. On the whole, the errors that children made consistently demonstrate that they tried to spell phonetically, which is what the alphabetic principle is about. However, these children were not like those in Read's (1971) studies who were not taught how to read; neither were they like those who were discouraged from spelling words orthographically in Treiman's study (1993). These children were explicitly taught to read and spell in a standard way, and therefore memory work was required, which might be an important factor in understanding their spelling.

5.5 Analysis of spelling: two-to-three type

The two-to-three type of spelling refers to syllables in which the correspondence between letters and sounds is two to three in the finals: two letters representing three sounds. There are three finals spelled this way: *iu*, *ui*, *un*. In theory, they would be spelled *uei*, *iou*, and *uen*, but in orthography they are actually spelled and taught explicitly as *ui*, *iu*, and *un* respectively, each with the middle sound omitted in the abbreviation with the purpose to make writing simpler. In this type, we would come across again and again the phenomenon of hypercorrection when the syllables involve using any of the three pairs of consonant, namely, *z*/*zh*, *c*/*ch*, and *s*/*sh*. Recall that the syllable *zuir* was not included in the two-to-three type in the quantitative analysis, because the uniqueness of this kind of syllable is not taught in the textbook. It was chosen both in the pilots and the main study for a specific research purpose (Section 5.2).

5.5.1 The spelling of *hui*4

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	9	6.3	2.00	h	2	4.0
	eu	1	.7		hei4	1	2.0
	h	4	2.8		hie4	1	2.0
	hei4	1	.7		hin4	1	2.0
	hie4	2	1.4		hiu2	1	2.0
	hiu	1	.7		hiu4	5	10.0
	hiu1	3	2.1		hu4	1	2.0
	hiu4	9	6.3		hue4	1	2.0
	hou4	1	.7		huei	1	2.0
	hu	2	1.4		huei4	2	4.0
	hu4	7	4.9		huen4	1	2.0
	hu4i1	1	.7		hui	2	4.0
	huai1	1	.7		hui1	3	6.0
	hue4	2	1.4		hui4	25	50.0

	huei4	4	2.8		huiu	1	2.0
	hui	4	2.8		uan	1	2.0
	hui1	4	2.8		ui4	1	2.0
	hui3	3	2.1		Total	50	100.0
	hui4	77	54.2				
	huu4	1	.7				
	huui2	1	.7				
	huui4	4	2.8				
	Total	142	100.0				

This syllable was presented with the other syllable *ji* (Section 5.3.3) as a word which means "chance; opportunity". The syllable *hui4* on its own means "come across" in this context.

All the two-to-three finals are taught in the abbreviated form directly in the recognize-as-a-whole fashion, i.e. *ui*, since there is no circumstance when the form *uei*, *iou*, or *uen* appears in the pinyin orthography. Thus logic yields to brevity when a convention can skirt potential confusion.

Eighty-four first-graders spelled the syllable correctly as *hui*, showing the effectiveness of teaching in this final-recognition method.

The most common error was spelling with a transposition: *hiu*, a non-pinyin syllable, by thirteen first-graders, accounting for 25% of the errors made by the remaining 49 children, excluding the nine children who did not give any spelling.

Another arguable phonetic transcription was the spelling of *huui* by five first-graders. In no case is there a doublet in the pinyin system, be it consonant or vowel. However, if *hui* is lengthened at the initial, then *huui* is a logical representation of the sound. In addition, this spelling seems to suggest, again, the process of how this syllable was blended: *hu* + *ui* (e.g. see *shii*, *shuuang*).

Having interpreted this way, we need to remember that finals with two-to-three letter–sound correspondence are taught by the recognize-as-a-whole method, where the final *u* (also Section 5.5.7), *iu* (Section 5.5.2), or *un* (Sections 5.5.4, 5.5.5, 5.5.6) is presented as one whole unit, and it is not explained in the textbook that there are actually three sounds in the final. This abbreviation can be made without ambiguity because, in practice, there is no case when the final (or any other two-to-three type final) would be spelled phonetically as *uei*. Therefore, it is amazing to see children spell in such a way that the detailed phonetic feature was caught exactly as it was theoretically designed, before consistency was partly sacrificed in the interest of brevity. This may show that children have finer logical sense in learning pinyin than adults expected.

5.5.2 The spelling of *xiu1*

Grade	Answer	Frequency	Percent
1.00	0	18	12.7
	pu1	2	1.4
	xao	1	.7
	xao1	1	.7
	xi	2	1.4
	xi1	1	.7
	xiao	1	.7
	xiao1	1	.7
	xiiu1	2	1.4
	xin	1	.7
	xing1	1	.7
	xion1	1	.7
	xiong1	6	4.2
	xiou	2	1.4
	xiou1	15	10.6
	xiu	1	.7
	xiu1	56	39.4
	xiu2	1	.7
2.00	0	3	6.0
	xi1	1	2.0
	xio1	3	6.0
	xiou1	2	4.0
	xiu1	26	52.0
	xiu4	2	4.0
	xo1	1	2.0
	xong1	1	2.0
	xu	1	2.0
	xu1	3	6.0
	xui1	5	10.0
	xui2	1	2.0
	xyou1	1	2.0
	Total	50	100.0

	xiu3	1	.7
	xiu4	1	.7
	xiuo	1	.7
	xong	2	1.4
	xong1	4	2.8
	xou	1	.7
	xou1	3	2.1
	xu	2	1.4
	xu1	2	1.4
	xui	1	.7
	xui1	9	6.3
	xui3	1	.7
	yui1	1	.7
	Total	142	100.0

This syllable *xiu1* and the syllable *jia4* make the word "having a holiday". *Xiu* on its own means "rest" in the context.

Sixty first-grade pupils spelled the syllable correctly as *xiu*. Eleven spelled it as *xui*, which is not a pinyin syllable but most likely a transposition of *xiu*. Interestingly, we saw 13 first-graders spell the previous syllable *hiu* this way. We observed one upside-down image: *xin*.

Another 17 first-graders spelled it as *xiou,* an exact phonetic representation of the sound that *xiu* was designated to represent. It is amazing to see how exactly the children spelled according to the logic of letter–sound correspondence.

Four first-graders spelled *xiu* as *xu*, which superficially appears to have the letter *i* missing. However, as we discussed previously for the syllable *xiong* in Section 5.4.6, the *x* is pronounced as *xi* in teaching the initial. So *xu* is a reasonable representation of *xiu*. Similarly, the spelling of *xou* (1 child) was another form of faithful phonetic transcription, treating *x* as *xi*.

As well as the influence from the vowel next to the initial and the final using the letter name to represent the syllable, we also found two instances which seemed to demonstrate the influence of the teaching process in spelling *xiu*: namely, *xiiu*, which might indicate that the syllable was blended as *xi* + *iu*. Equally likely, it could be interpreted as a phonetic transcription of a lengthened *xiu.*

It is tempting to say that these three children plus those 18 who did not write anything seem to show us that it was not easy to associate the sound with this syllable, although the syllable length is only 3, half that of *shuang*.

5.5.3 The spelling of *qiu1*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	19	13.4	2.00	0	4	8.0
	chun1	1	.7		chun1	1	2.0
	jui2	1	.7		j	1	2.0
	piu1	3	2.1		ju1	1	2.0
	piu4	1	.7		piou1	1	2.0
	piui1	2	1.4		pui1	2	4.0
	pu1	1	.7		q	2	4.0
	pui1	1	.7		qao1	1	2.0
	q	1	.7		qio1	3	6.0
	qi	1	.7		qiong1	1	2.0
	qiie	1	.7		qiou1	5	10.0
	qiiu1	1	.7		qiu1	14	28.0
	qin1	1	.7		qiu2	2	4.0
	qiou1	16	11.3		qo1	1	2.0
	qiu	5	3.5		qo2	1	2.0
	qiu1	54	38.0		qu	1	2.0
	qiu2	4	2.8		qu1	3	6.0
	qiu3	2	1.4		qu2	1	2.0
	qiu4	1	.7		qui1	5	10.0
	qiui1	1	.7		Total	50	100.0
	qiun2	1	.7				

	qiuo1	1	.7
	qou1	2	1.4
	qu	2	1.4
	qui1	7	4.9
	qvo1	1	.7
	qyui1	1	.7
	xao	1	.7
	xao1	1	.7
	xiou1	3	2.1
	xiu1	2	1.4
	xiu2	2	1.4
	yiu1	1	.7
	Total	142	100.0

The syllables *qiu1* and *tian1* together form the word meaning "autumn". The syllable *qiu1* alone means "autumn" here.

Fifty-four first-graders spelled this syllable exactly as *qiu1*, with correct tone. The most common deviant spelling was by 16 of them, along with five second-graders who spelled it as *qiou*, which was exactly what *qiu* stands for in sound. In fact, some scholars have asked whether it should be changed back to the true phonetic transcription for the two-to-three syllables, as well as other syllables to be analysed later (Jiang 2004; Wang 2004).

We saw one child spell it as *qiiu*, suggesting a representation *qi* + *iu* → *qiu*. The spelling *qiui* suggests a transposition of *qiiu*. As for the letter *n* in *qin,* it was likely an upside-down version of *u* in *qiu*.

The spelling *qyui* was indeed odd from the appearance. However, the letter *y* is pronounced as *i* in pinyin and *ui* could be transposition of *iu*, and thus this spelling is quite plausible as an attempt at phonetic transcription.

The spelling *yiu* is even odder from the look. However, we have seen one child's *x* rather like a *y* as he did not write the descending stroke long enough. So the apparent *y* may have been an intended *x*. Such exchanged use of *j*, *q*, and *x* has been observed in other syllables. It prompts one to think that the similar sounds between them plus the same position of the tongue has some influence on this phenomenon. It seems that all children's errors were made by trying to spell according to the sound for this syllable, apart from those 23 children who did not write anything.

5.5.4 The spelling of *zun1*

Grade	Answer	Frequency	Percent
1.00	0	26	18.3
	jun1	1	.7
	shui1	1	.7
	z	7	4.9
	zh	1	.7
	zhi0	2	1.4
	zhuan1	1	.7
	zhuen1	2	1.4
	zhui1	4	2.8
	zhun	4	2.8
	zhun1	25	17.6
	zhuun1	1	.7
	zhv1	1	.7
	zhwo2	1	.7
	ziu1	4	2.8
	znu	1	.7
	zu	3	2.1
	zu1	1	.7
	zuen	3	2.1
	zuen1	7	4.9
	zui2	1	.7
	zun	13	9.2
	zun1	30	21.1
2.00	0	4	8.0
	zh	1	2.0
	zhen1	3	6.0
	zhi1	2	4.0
	zhing1	1	2.0
	zhni1	1	2.0
	zhu	1	2.0
	zhuen1	2	4.0
	zhuen2	1	2.0
	zhui1	3	6.0
	zhun	2	4.0
	zhun1	13	26.0
	zhun2	1	2.0
	zuen1	2	4.0
	zun	1	2.0
	zun1	12	24.0
	Total	50	100.0

	zun2	1	.7
	zün1	1	.7
	Total	142	100.0

The syllable *zun1* and the syllable *xun2* make the word meaning "following (instructions, advice, teaching, etc.)".

Forty-four first-graders spelled this syllable as *zun*, with ten who did not mark the first tone. This phenomenon is more common in spelling syllables in the first tone than in any other tone. Equally, no other tone mark was written on this syllable, unlike in syllables in the second, third, or fourth tone, where all the four marks were written. But, why is tone 1 different? In teaching pinyin, the initial and the final are pronounced in the first tone. That is to say, when the teacher writes an initial or a final on the whiteboard, the tone mark is never used, even though the initial or the final is pronounced in the first tone. The tone mark is added only after the syllable is composed. It seems that some children bypassed the first tone mark because of this practice—whether with the first tone mark or without it, the syllable is pronounced in the first tone.

Twenty-nine first-graders spelled it as *zhun*, showing the influence from vernacular resulting in hypercorrection for *z*.

The next common spelling was *zuen* (by ten first-graders): a logical and faithful phonetic transcription. This spelling might have been considered the result of blending in this way: *zu* + *en* → z*uen*; however, no teacher blends the syllable this way, because the final *uen* is taught as *un* right from the start, as was mentioned previously for other two-to-three type spellings. Perhaps it should be mentioned here that the combination of the finals *u* and *en* makes the sound of *uen*.

We found altogether five instances of *zhuen*, which is a phonetic transcription, allowing for dialect over correction, just as *zuen*.

5.5.5 The spelling of *sun3*

Grade	Answer	Frequency	Percent
1.00	0	25	17.6
	s	6	4.2
	sen3	1	.7
	sh	2	1.4
	sh3	1	.7
	shao	1	.7
	shen2	1	.7
	shen3	2	1.4
	shnu3	1	.7
	sho1	1	.7
	shu1	1	.7
	shuan3	1	.7
	shuen3	1	.7
	shui3	1	.7
	shun	2	1.4
	shun1	2	1.4
	shun2	1	.7
	shun3	34	23.9
	shunu3	1	.7
	shvn2	1	.7
	shvn3	1	.7
	shwo	1	.7
	su2	1	.7
	suen3	4	2.8
	sui3	2	1.4
	sun	4	2.8
	sun1	5	3.5
	sun2	3	2.1
	sun3	32	22.5
	suun3	3	2.1
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	3	6.0
	c	1	2.0
	sh	1	2.0
	shen2	1	2.0
	shen3	4	8.0
	shueng3	1	2.0
	shui2	1	2.0
	shui3	3	6.0
	shun3	7	14.0
	shvn2	1	2.0
	su	1	2.0
	suen3	2	4.0
	sui3	1	2.0
	sun	1	2.0
	sun1	2	4.0
	sun3	17	34.0
	suo	1	2.0
	xun1	1	2.0
	zhen4	1	2.0
	Total	50	100.0

The syllable *sun3* was presented with *wo1* as the word *wo1sun3*, which is a type of Chinese asparagus.

Forty-four first-graders spelled it correctly as *sun*, but 39 spelled it as *shun*, possibly showing the hypercorrection, again, in order to overcome the vernacular influence.

We would like to treat the spelling *shün* by one child as an attempt at *shun*. This spelling suggests that the child used *ün* for the sound *un*, a muddling of the rule for the *ü* sound, which was examined for the syllable *lü* in Section 5.3.8.

Four first-graders spelled it as *suen*, a true phonetic transcription of *sun*. On child spelled *shuan* for *shuen*.

Three children spelled it as *suun*. This kind of spelling has been discussed concerning the spelling *huui* in Section 5.5.1, which either suggests a lengthened syllable, or an indication of being aware of an extra sound between the two letters, i.e. *u* and *n*. However, more than anything, such spelling seems to show us how the blending was carried out: *su* + *un* (see syllable *shuang* for example).

The spelling of *sen* (1 child) and *shen* (8) seem to confirm that the syllable was blended by first *s* + *u* → *su*, and then *su* + *en* → *suen*, but *u* was omitted, perhaps influenced by the practice of pronouncing an initial with a vowel as a syllable, and then dropping that vowel when the initial is blended with the wanted final, the other way round to *suun*.

5.5.6 The spelling of *zhun3*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	8	5.6	2.00	0	1	2.0

Valid	shu	1	.7		shuen3	1	2.0
	xun3	1	.7		z	1	2.0
	z	2	1.4		z3	1	2.0
	zh	15	10.6		zh	1	2.0
	zhan3	1	.7		zhen1	2	4.0
	zhen	1	.7		zhen2	1	2.0
	zhen3	4	2.8		zhen3	1	2.0
	zhin	1	.7		zhi	1	2.0
	zhu	2	1.4		zhu3	1	2.0
	zhu2	1	.7		zhu4	1	2.0
	zhu3	1	.7		zhuen2	1	2.0
	zhuang3	1	.7		zhuen3	3	6.0
	zhuen3	6	4.2		zhui	1	2.0
	zhui2	1	.7		zhui2	1	2.0
	zhui3	2	1.4		zhui3	2	4.0
	zhun	5	3.5		zhun	1	2.0
	zhun2	4	2.8		zhun1	1	2.0
	zhun3	40	28.2		zhun3	22	44.0
	ziun2	1	.7		zuen	1	2.0
	zu1yi4	1	.7		zuen4	1	2.0
	zuen3	2	1.4		zun3	4	8.0
	zun	3	2.1		Total	50	100.0
	zun1	4	2.8				
	zun2	1	.7				
	zun3	32	22.5				
	zuo3	1	.7				
	Total	142	100.0				

The meaning of zhun3 is “accurate”. The long list of variations seems to indicate that this syllable was difficult for the children to spell correctly.

We saw as many as 37 first-graders, compared to 49 children who spelled it correctly, spell this syllable as *zun*, with a flat *z* rather than a retroflex *zh*. We have mentioned that it is only through learning pinyin that people become aware of that distinction between *z* and *zh*, *c* and *ch*, and *s* and *sh*. So, when one of the sounds is pronounced, they may well tend to think it is the other one, unless they are absolutely

sure which the correct one is. This seeming confusion can persist because the local pronunciation does not change the meaning in any realistic context.

Next, we saw the spellings *zuen*3 and *zhuen*3. Both variations are true phonetic transcription because the final *un* is an abbreviated *uen*. Although only eight first-graders spelled the final as *uen*, given that *uen* is never taught at schools, its appearance seems to suggest that children spelled with the logic of letter–sound correspondence. It is possible that this logic was enhanced by the fact that *u* and *en* are individual finals, and the combination of the two finals would produce the sound of *uen*, expressed by *un*. The spelling *uen* was proportionately more common in the second-graders, with 6 out of 50, indicating and confirming the persistent effect of the alphabetic logic.

The spelling *zu1yi4* is particularly touching, the child painstakingly marking the tone on the *zu* and then on *yi* as if the syllable was divided into the first half of the syllable and then the other half. Now we are led to realize the insight that the child had on the syllable *zui*: first, indeed *zui* has two parts *zu* and *i*, the latter of which can be expressed by *yi*; and secondly, the third tone could sound much like two tones, especially like the fourth tone at the end, if blending the syllable precisely. Such a lovely, sincere, and unexpected but insightful spelling would not be seen by quantitative analysis, and deserves a further investigation into why they spelled like that.

The spellings of *zhen* by nine children, *zhan* by one child, and *zhin* by one child are interesting. At a first glance, it seems that children might hear *zhen* or *zhan* instead of *zhun*. However, it is very unlikely, because *zhun* and *zhen*/*zhan* are quite different in sound. The spelling *zhin* seems to confirm this unlikeliness, because *zhin* is not a pinyin syllable. Then why did they omit the *u*? The phenomenon of omitting the first final in the

preschoolers' spelling was encountered in all the syllables which contain two finals. Thus, it was more likely the same cases as *sen*/*shen* in the previous syllable discussed in Section 5.5.6.

5.5.7 The spelling of *zuir3*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	21	14.8	1.00	zui1	1	.7
	jue	1	.7		zui3	17	12.0
	shui2	2	1.4		zui3er2	1	.7
	shui3	1	.7		zui3er3	1	.7
	shun2	1	.7		zun	1	.7
	Z	5	3.5		zun2	1	.7
	zai3	1	.7		zun3	4	2.8
	zei3	1	.7		zun3er2	2	1.4
	zen3	1	.7		zuoer3	1	.7
	zh	7	4.9		zuoier2	1	.7
	zhai2er2	1	.7		zuun3	2	1.4
	zhao3	1	.7		Total	142	100.0
	zhei	7	4.9	2.00	0	6	12.0
	zhei3	1	.7		xui3	1	2.0
	zhiu1	1	.7		xun3	1	2.0
	zhiu3	1	.7		z	2	4.0
	zhner	1	.7		zh	1	2.0
	zhu1	1	.7		zhen3	1	2.0
	zhu3	1	.7		zhin3	1	2.0
	zhue3	1	.7		zhiu2	2	4.0
	zhuei2	1	.7		zhiu3	2	4.0
	zhuen3	1	.7		zhr	1	2.0
	zhueng3	2	1.4		zhu	1	2.0
	zhuer3	1	.7		zhuei2	1	2.0
	zhui1	2	1.4		zhuei3	1	2.0
	zhui2	2	1.4		zhui	1	2.0
	zhui3	26	18.3		zhui2	1	2.0
	zhui3er	1	.7		zhui3	6	12.0
	zhui3er3	1	.7		zhun3	3	6.0

	zhun	1	.7		zhun4	1	2.0
	zhun1	1	.7		zhur3	1	2.0
	zhun3	7	4.9		ziu3	1	2.0
	zhun3er2	2	1.4		zuen3	1	2.0
	zhuo3	2	1.4		zui2	2	4.0
	ziu3	1	.7		zui3	10	20.0
	zu2	1	.7		zui3er	1	2.0
	zui	1	.7		zuir3	1	2.0
					Total	50	100.0

Zuir3 means “mouth or mouth-shaped devices”. This syllable was presented in the word *wei2zuir3*, which means “bib”.

The *r* at the end of the syllable is an indication of retroflex when the syllable is pronounced. The feature of retroflection often indicates affection or endearment. An expression of the syllable *zuir* in written Chinese would comprise two characters, and the two-syllable word would have three characters: the first character is for the first syllable *wei*, the second is for the second syllable when it is pronounced without the retroflection, and the third is for the retroflection *er*: 围嘴儿. This example, when three characters are read as two syllables instead of three, is the unique exception to the rule that one character corresponds to one syllable in Chinese. This syllable was chosen to observe how children romanize a unique feature of the Chinese language. Because of the feature of retroflection, the sound of such syllables changes depending on the individual syllable. For example, although this syllable is spelled as *zuir*, its true pronunciation is *zuer* in pinyin, or [ts ɚ] in IPA.

We observed that 12 children spelled the syllable with *er* at the end of z*ui*, demonstrating that they noticed the retroflective pronunciation and therefore put in *er*. Interestingly, eight of these children made an effort to show that *er* was a syllable on its

own with a tone mark independently used for *er*. Thus we were shown two tone marks on the spelling: one for the syllable *zui* or *zhui* and the other for *er* as in *zhui3er3* or *zui3er2*. What an exact annotation of the two Chinese characters 嘴儿! What is more interesting is that the children did not separate the *zhui*3*er*3 or *zui*3*er*2 into two syllables.

How would the first-grade children spell the retroflection syllable? No child spelled as it should be. We found only one child, in the second grade, who spelled it exactly as the standard form—*zuir*. Eighteen first-grade children spelled it as *zhui*, and thirteen spelled it as *zui*, sign of not knowing how to representing the unique feature.

We also saw eight children spell it as *zhei*. But why did they spell like that? Recall here that the final *uei* is abridged as *ui*. So, the actual syllable is *zhuei*. But why did *u* disappear here? We mentioned previously that it is common practice to pronounce an initial with a vowel attached to it, called the hudu method, in teaching pinyin. It seems that the attached vowel *u* did not make its appearance in spelling but only in pronunciation. The process of the syllable was possibly like this: *zhu +ei* → *zh*(*u*)*ei*, another case of *s*/*shen* (Section 5.5.5), or *zhen* (Section 5.5.6).

This syllable is another example showing that, at school, pinyin is taught as a tool to aid the reading of the characters, not as orthography for writing the Chinese language. What is instructive is that none of children spelled *er* separately from the syllable *zui*. This seems to show that they understood that *zuir* is regarded as one syllable: it was read as one syllable and should be spelled as one. This could be seen as a possibility to teach pinyin with word boundaries, which has not yet been done at schools in China.

5.5.8 Summary

From the analysis of the two-to-three spelling types, we have been shown the children's marvellous insight; that is, the alphabetic writing system should be one-to-one in the correspondence between letters and sounds. That the children spelled out, for all the three finals (*iu*, *ui*, *un*), what was kept hidden in the orthography reflects the calls for the reform of pinyin writing for these finals at the moment in China—to spell the three finals as they are pronounced. This type of spelling has seen so many variations and is open to so many interpretations that this is one of the most difficult types of spelling. This points to the importance of understanding children's creative spellings, and thence experimenting with different teaching methods.

5.6 Analysis of spelling: wuyi type

This type of spelling features *w* or *y* at the beginning of the syllable. Therefore, *w* and *y* are taught as initials, although here *w* is stands for the sound *u* and *y* for *i.* Syllables that we looked at in Section 5.5 all have a *u* or *i* sound in the finals. If these finals become syllables on their own, the vowel that is omitted in the two-to-three type will be displayed, but the *u* and *i* will be changed into *w* and *y*, accordingly. Thus, the final *iou* would be spelled as *you*, *uen* as *wen*, and *uei* as *wei*.

5.6.1 The spelling of *wo1*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	18	12.7	2.00	0	2	4.0
	bo1	2	1.4		go1	1	2.0
	go	1	.7		o	1	2.0
	go1	1	.7		o1	6	12.0
	guo	1	.7		o2	2	4.0

	o	2	1.4		ou	1	2.0
	o1	1	.7		u	2	4.0
	oin	2	1.4		uo4	1	2.0
	ou1	2	1.4		wo	3	6.0
	ow	2	1.4		wo1	26	52.0
	u	2	1.4		wo2	1	2.0
	u1	1	.7		wu1	4	8.0
	uang1	1	.7		Total	50	100.0
	uo	1	.7				
	uo1	20	14.1				
	uo4	1	.7				
	vo1	1	.7				
	w	2	1.4				
	wo	9	6.3				
	wo1	56	39.4				
	wo2	2	1.4				
	wo3	6	4.2				
	wo4	1	.7				
	wou1	1	.7				
	wp	1	.7				
	wu1	3	2.1				
	wuo2	1	.7				
	yo1	1	.7				
	Total	142	100.0				

This syllable *wo1* was presented in the word *wo1sun3*, which means a type of asparagus, a vegetable mainly grown in the southern provinces of China, but sold in the city markets throughout China.

One hundred and four children spelled this syllable correctly, with 22 wrong or missing tones. The most common error for this syllable was to spell it as *uo*, by 22 first-graders, an exact phonetic transcription.

Three children wrote *o*, three children wrote *u*, and two children wrote *w*. These spellings suggest that the difference in sound value between *o* and *uo* seems to be not

clear for the children. We mentioned earlier that the sound *o* is illustrated by the sound of a cockerel and more often pronounced as *uo,* especially in nursery rhymes. The ambiguity about the sound *o* is perhaps also caused by the Chinese language itself: because there is literally no proper word simply pronounced with a pure *o* (although the sound can express surprise as an interjection). The *o* sound is always combined with other sounds to make a compound final. Thus, we were able to observe these non-standard spellings.

It is surprising to find 18 first-graders who did not write anything for a syllable with only two letters. This seems to imply that extra attention would be needed in teaching the *wo* syllable, and identifying the *o* sound within it carefully.

5.6.2 The spelling of *you2*

Grade	Answer	Frequency	Percent
1.00	0	8	5.6
	iao2	2	1.4
	iiu2	1	.7
	ing	1	.7
	io2	1	.7
	iou	3	2.1
	iou2	12	8.5
	iou3	1	.7
	iu2	3	2.1
	iu3	1	.7
	jo2	1	.7
	liu	1	.7
	liu2	3	2.1
	u	1	.7
	u2	1	.7
	ui3	1	.7
	y	4	2.8
	ya2	1	.7

Grade	Answer	Frequency	Percent
2.00	0	1	2.0
	iou2	3	6.0
	liu2	1	2.0
	lui2	1	2.0
	yo3	1	2.0
	you	3	6.0
	you1	1	2.0
	you2	37	74.0
	you4	1	2.0
	yu	1	2.0
	Total	50	100.0

	yi	1	.7
	yi2	2	1.4
	yiou2	1	.7
	yiu2	13	9.2
	yiu3	2	1.4
	yo2	4	2.8
	yong2	1	.7
	you	3	2.1
	you1	1	.7
	you2	59	41.5
	you3	4	2.8
	you4	2	1.4
	yu3	2	1.4
	yuo2	1	.7
	Total	142	100.0

This syllable was presented in the word *lü3you2*, which means "travel; tour".

Ninety-eight children spelled the syllable correctly, ignoring tones. Nineteen spelled it as *iou*, an exact phonetic transcription. Fifteen children spelled it as *yiu*. This reflects that *y* was used as an initial and at the same time indicates an overgeneralization of the rule for *iu*, which we examined in Sections 5.5.2 and 5.5.3. In fact, *y* and *w* are treated as initial consonants in the pinyin class.

The other instances of attempted phonetic transcriptions were: *iu*, *jo*, *u*, *yu* (*u* here is more likely pronounced as *u* rather than *ü*) and *yo*. The spelling of *jo*, *u*, and *yo* might be influenced by English. The transposed form *ui* for *iu* was also observed.

5.6.3 The spelling of *wen2*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	17	12.0	2.00	0	3	6.0
	en2	1	.7		uei2	1	2.0
	fun	1	.7		uen2	2	4.0
	huan2	1	.7		uen4	1	2.0

	ien2	1	.7		ven2	1	2.0
	lun2	1	.7		we2	1	2.0
	men2	1	.7		wei2	2	4.0
	nun1	1	.7		wen	1	2.0
	oen2	1	.7		wen2	32	64.0
	run2	1	.7		wen3	1	2.0
	run3	1	.7		wen4	1	2.0
	u	4	2.8		weng2	1	2.0
	u2	1	.7		wun	1	2.0
	ua2	1	.7		wun2	2	4.0
	ua3	1	.7		Total	50	100.0
	uao2	1	.7				
	ue	2	1.4				
	uei2	2	1.4				
	uen	2	1.4				
	uen2	22	15.5				
	uen4	1	.7				
	uie2	1	.7				
	un	1	.7				
	un2	4	2.8				
	w	2	1.4				
	wan	1	.7				
	wan2	1	.7				
	wei	2	1.4				
	wei2	1	.7				
	wen	8	5.6				
	wen2	48	33.8				
	wie2	1	.7				
	wn	1	.7				
	wun	1	.7				
	wun2	4	2.8				
	yu2	1	.7				
	yun2	1	.7				
	Total	142	100.0				

Wen2 was presented in the word *er3wen2*, which means “hear of”. *Wen* on its own means “hear of”, too.

Fifty-six of the first-graders spelled this syllable correctly, and 25 spelled it as *uen*, an exact phonetic transcription.

In the non-standard spellings, the spelling of *wun* (8 children) suggests that *w* was treated as an initial, and therefore yielding the syllable *wun*. The spelling of *nun* (1) might have been an attempt at *wun*, but the *w* was written more like an *n*. The syllable *oen* (1 child) seems to suggest the ambiguity of the sound *o*. The reason for this was given in Section 5.6.1: that the *o* sound is uniformly taught with an illustration of a cockerel making this *o* sound in the morning. Because there is virtually no Chinese word with this sound, except a few miming the utterance of emotions, the sound that a cockerel makes is actually said as *uo*. Hence, we observed this spelling.

The spelling of *u* (5 children), *ua* (2), *uao* (1), *ue* (2), and *w* (2) might suggest that, as well as associating symbols with sounds, some children also learned syllables by memorizing the combination as one object. The failure of memory would result in incomplete and inaccurate syllables as these.

This syllable provided us with some very interesting variations in the initial among the first-graders, but not among the second-graders. The only variation of the spelling for the *u* sound in the second-graders was replacement by *v* or *w*.

5.6.4 The spelling of *wei2*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	20	14.1	2.00	0	2	4.0
	fen2	2	1.4		u4	1	2.0
	hui2	2	1.4		uai	2	4.0
	m	1	.7		uei2	2	4.0
	oe2	1	.7		w	2	4.0
	oei2	1	.7		wai2	2	4.0

	oin	2	1.4		wan2	1	2.0
	oui	1	.7		wei2	27	54.0
	u	4	2.8		wei3	2	4.0
	uao1	2	1.4		weiy	1	2.0
	uei2	21	14.8		wen2	2	4.0
	uei3	2	1.4		wen3	1	2.0
	uei4	1	.7		wie1	1	2.0
	uen	1	.7		wie2	2	4.0
	uen2	2	1.4		wiu2	1	2.0
	ueu	1	.7		wui3	1	2.0
	ui	1	.7		Total	50	100.0
	ui2	1	.7				
	uie2	2	1.4				
	uing1	1	.7				
	uiu	1	.7				
	un	1	.7				
	uoei2	2	1.4				
	uui3	2	1.4				
	w	2	1.4				
	wai	1	.7				
	wai3	1	.7				
	wei	2	1.4				
	wei2	44	31.0				
	wei3	3	2.1				
	wen	1	.7				
	wen2	9	6.3				
	wen3	1	.7				
	wie2	1	.7				
	win2	1	.7				
	wui2	1	.7				
	Total	142	100.0				

Wei2 was presented with the syllable *zuir3* as one word *wei2zuir3*, meaning “bib”. The meaning of *wei2* is “surround”.

There were 49 correct spellings, 35 exact phonetic transcriptions, e.g. *uei*, and 4 spellings starting with *o* in the place of *w*/*u*, i.e. *oei*, which is also a phonetic transcription,

if we consider *o* might stands for the sound *uo* (Section 5.6.1). The blending of *u* and *ei* would produce *o* in between.

The spelling *ueu* might be a version of *uen*, with the *u* inverted, which is phonetic transcription. The additional spellings *ui* (1 child), *un* (1), *uoei* (2), *uui* (2), *uiu* (1), *wie* (4), *oui* (1), *oin* (2), and *win* (1) can be interpreted as attempts at, with inversions and transpositions of *u* for *n* or vice versa, phonetic transcription of the syllable.

5.6.5 Summary

The most common error in the wuyi type of spelling was, as the previous types have shown, to spell phonetically, ignoring how they are taught in the pinyin class. While wuyi type of spelling is taught in the analytic way, the syllables, which also involve with the two letters *w* and *y*, presented next, is taught in the recognize-as-a-whole method.

5.7 Analysis of spelling: w0y0 type

In this type, the letters *w* and *y* do not stand for sound but only function as a syllable boundary. When the finals *i*, *u*, *in*, and *ing* stand as syllables themselves, *w* will precede *u* and *y* precedes *i*. All the four syllables, *yi*, *wu*, *yin*, and *ying*, belonging to this type were tested.

The teaching method for these four syllables adapts the recognize-as-a-whole strategy, in which there is no analysis of initial or final; just the whole syllable is presented to the children. The children are expected to remember the syllable as a whole. In addition, the pronunciation of the syllable *yi*n should be pronounced as *yen*, *yien*, or *ien* and equally *ying* as *yeng*, *yieng*, or *ieng*.

5.7.1 The spelling of *yi1*

Grade	Answer	Frequency	Percent
1.00	0	3	2.1
	i	6	4.2
	i1	5	3.5
	iy	2	1.4
	y	4	2.8
	y1	1	.7
	yhi4	1	.7
	yi	9	6.3
	yi1	103	72.5
	yi2	2	1.4
	yi3	1	.7
	yi4	2	1.4
	yv	1	.7
	yv4	1	.7
	yy	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	1	2.0
	y	2	4.0
	yi	1	2.0
	yi1	43	86.0
	yi2	2	4.0
	yi3	1	2.0
	Total	50	100.0

This syllable was presented in the word *yu3yi1*, which means “raincoat”. In pronunciation, *i*, *y*, and *yi* all sound the same, but this syllable is taught in the recognize-as-whole method; that is, the syllable *yi* is presented to the children without telling them why it is spelled like that.

It is extraordinary to see so many variants (14), counting tones, among the first-grade pupils.

Apart from the correct spelling of the syllable *yi* by 117 first-graders, the spelling *yy* (one child), the transposed spellings *iy* (2), *i* (11), and *y* (5) are all phonetically faithful to the sound *i*.

The spelling *yü* (two children) cannot be explained except by over-correction for the syllable of *yu*. What is more interesting is that one preschooler spelled *yhi*, which is

also unexplainable. In addition, there were even two cases of using *y* to stand for the sound *i* in the second-graders. This could mean that the function of *y* as syllable boundary was not clear to them.

Only three first-graders and one second-grader did not write anything, confirming the relative ease of spelling this syllable.

5.7.2 The spelling of *wu1*

Grade	Answer	Frequency	Percent
1.00	0	16	11.3
	eu1	1	.7
	hun1	2	1.4
	o	2	1.4
	ow	1	.7
	u	4	2.8
	u1	9	6.3
	uo1	2	1.4
	uw	2	1.4
	w	6	4.2
	wo	3	2.1
	wo1	6	4.2
	wu	6	4.2
	wu1	76	53.5
	wu2	1	.7
	wu3	1	.7
	wu4	1	.7
	y	1	.7
	yu1	2	1.4
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	1	2.0
	o1	1	2.0
	u	1	2.0
	u1	1	2.0
	uw	1	2.0
	wu	1	2.0
	wu1	37	74.0
	wu2	1	2.0
	wu3	5	10.0
	yu1	1	2.0
	Total	50	100.0

The syllable *wu1* was presented in the word *wu1yun2*, which means “dark cloud”. *Wu1* itself means “dark”.

Eighty-five children in the first grade spelled this syllable correctly. Thirteen spelled it as *u*, nine as *wo*, and five as *w*. The spelling of *u* and *w* were phonetic transcription, but *wo* does not sound exactly like *wu*. However, if *wo* further indicated the confusion between the sounds *o*, *u*, and *uo*, as we discussed for the syllable *wo* in Section 5.6.1, and also for other syllables, then it suggests the presence of a real problem. We hope that this problem could be solved in teaching pinyin by pronouncing the sound *o* according to its true value rather than by imitating a cockerel's cry.

5.7.3 The spelling of *yin1*

Grade	Answer	Frequency	Percent
1.00	0	11	7.7
	ian1	1	.7
	ien	4	2.8
	ien1	5	3.5
	iin	3	2.1
	iin1	1	.7
	in	2	1.4
	in1	2	1.4
	ing1	1	.7
	jin1	1	.7
	y	1	.7
	yao1	1	.7
	yei1	1	.7
	yen	1	.7
	yen1	30	21.1
	yeng1	8	5.6
	yeu1	1	.7
	yhvn1	1	.7
	yi	1	.7
	yi1	3	2.1
	yie1	1	.7
	yin	8	5.6
	yin1	47	33.1

Grade	Answer	Frequency	Percent
2.00	0	3	6.0
	in1	1	2.0
	ing	1	2.0
	jin1	1	2.0
	y	2	4.0
	yen1	11	22.0
	yen4	1	2.0
	yi1	2	4.0
	yig1	1	2.0
	yin1	20	40.0
	yin4	2	4.0
	ying1	2	4.0
	yio1	1	2.0
	yiu1	1	2.0
	yn	1	2.0
	Total	50	100.0

	ying1	2	1.4
	yue4	1	.7
	yun	1	.7
	yun1	3	2.1
	Total	142	100.0

This syllable was presented to the children in the word *yin1yue4*, meaning "music". This syllable on its own means "sound". We found 55 first-graders who spelled it correctly, ignoring the tone mark.

We found 31 first-grade children who spelled it as *yen*, which is a non-pinyin syllable. We recall that *y* represents the sound *i* in the wuyi spelling type, and there is a final *en*, and so it is not difficult to see that *yen* was standing for the sound *ien*. However, there is no such final *ien* in the pinyin system. Now we look at the pronunciation of the final *in*. This final is publicly known as containing two sounds *i* and *n*; but when pronouncing it and listening to it, one does actually perceive a strong *e* sound in it. Therefore, the final *in* actually stands for the sound *ien*. In fact, this pronunciation was noted in Howie's (1976) "acoustical studies of Mandarin vowels and tones". It is exciting to see that so many children picked up the alphabetic principle and spelled the hidden sound *e* out. In fact, 31 first-graders and twelve second-graders spelled *yen.* In addition, nine first-graders spelled *ien*, which is the exact sound of *in* or *yen*. Here, we would like to mention, again, that the name of the Chinese linguist Lin Yen-Hwei (Lin 2007) would be spelled as Lin Yinhui in pinyin.

Altogether 61 children spelled it phonetically either as *yen, ien, iin*, or simply *in*.

We also noticed that eight children spelled it as *yeng*, and two children spelled it as *ying*. Both these spellings sound as *ieng*, which might be spelled as *yeng*, *yieng*, or *ying*. We will discuss the spelling *ying* in the immediately following section. Why did the

children spell *in* as *ing*? In fact, we have seen elsewhere the exchange of *n* and *ng* spellings. Perhaps sounds involving *n* and *ng* were similar to some children. Apart from possibly forgetting to write the letter *g*, it does not look as if the discrepancy between letters and sounds caused the error, but rather the closeness between the sound *n* and *ng*; otherwise, children would probably not take the trouble to add *g* to *n* to make *ng*, which does not exist in the syllable. Another possible reason for such spelling might be the influence from the second syllable or the combination of them both, as a sound changes in between, when it is pronounced on its own and when in a context.

5.7.4 The spelling of *ying1*

Grade	Answer	Frequency	Percent
1.00	0	11	7.7
	eng1	1	.7
	eng2	1	.7
	gin	1	.7
	ieng1	1	.7
	iing	1	.7
	iing1	2	1.4
	ing	17	12.0
	ing1	2	1.4
	ui1	2	1.4
	wang1	1	.7
	y	7	4.9
	yang1	4	2.8
	yen1	5	3.5
	yeng	2	1.4
	yeng1	27	19.0
	yeng2	2	1.4
	yi1	2	1.4
	yi2	1	.7
	ying	6	4.2
	ying1	45	31.7
2.00	ieng1	1	2.0
	in	1	2.0
	ing	1	2.0
	ing1	3	6.0
	ing2	1	2.0
	iyng	1	2.0
	jeng1	1	2.0
	xeng1	1	2.0
	yen1	2	4.0
	yeng1	11	22.0
	yeng2	2	4.0
	yi1	1	2.0
	ying1	24	48.0
	Total	50	100.0

	ying2	1	.7
	Total	142	100.0

This syllable means “eagle”. As the final *in* represents the sound *ien*, *ing* represents *ieng*.

Fifty-two first-graders spelled this syllable correctly, but as many as 31 of them spelled it as *yeng*, along with 13 second-graders, which should be considered as a faithful phonetic transcription, if *y* was used as *i*—and *y* does stand for the sound *i* in the wuyi type of spelling—in spite of the final *ing* standing for the sound *ieng* not being publicly explained.

We saw 21 first-grade children spell it as the final *ing*, one spelled it as *ieng*, and two spelled it as *iing*. These three kinds of spelling, expressing the exact sound of the syllable, suggested the attempt to spell according to the sound, but not the orthography. The spelling *iing* might suggest that the syllable was lengthened.

We saw four children spell it as *yang*. We have seen children use *a* and *e* interchangeably, suggesting that either they were unfamiliar with the spelling or the two letters are likely to confuse. As we mentioned regarding the syllable *tian*, the letter *a* in the syllable is pronounced more like *e* than *a*, and it is possible that they used *a* as *e*. (In fact, the letter *a* represents five different phones/sounds in the pinyin system.)

The spelling of *yen* by five children might suggest the closeness in sound between *yen* (*in*) and *yeng* (*ing*), which we discussed regarding the syllable *in* (Section 5.7.3).

We saw one spelling *gin* (perhaps a jumbled *ing*), two cases of *eng*, and two of *ui*. It is likely that *eng* was meant to be *ing*, and *ui* to be *in* with the letters transposed and the *n* inverted. All the three spellings suggested an attempt at phonetic transcription.

To our surprise, only eleven children left this syllable un-spelled. In contrast, we saw 30 who left *zun* blank and 28 who left *xun* blank (both syllables belong to the two-to-

three type). It seems that a syllable length of between three and four letters does not cause difficulties. It would be interesting to investigate this further.

5.7.5 Summary

The w0y0 type of spelling shows, again, the children's insight into the alphabetic principle, and their logical faithful phonetic transcription, according to the pinyin system. However, there are some spellings which remain unexplained, and this may need further investigation. Syllable length in this category does not seem to affect the children's enthusiasm for spelling, but ambiguity of the sound does.

5.8 Analysis of spelling: yu type

The yu type of spelling refers to those syllables whose *y* does not stand for a sound but rather acts as a syllable boundary, the same as the w0y0 type. This happens when the syllable is a final without initial. The finals are: *ü, üe, ün,* and *üan*. The umlaut on the letter *u* will be omitted, when they are syllables on their own, in which cases *y* is added in front of them to signal the starts of a syllable. All the syllables in this type, i.e. *yu, yue, yun,* and *yuan*, were tested. All these syllables are taught in the recognize-as-a-whole method. This method is adapted, because *ü* will never appear in these syllables. The letter *ü* only appear in four syllables, and *lü* is one of them (Section 5.3.8). We recall again here that *v* stands for *ü* in the table.

5.8.1 The spelling of *yu3*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	4	2.8	2.00	v	1	2.0
	iu	3	2.1		v2	1	2.0

	iu3	3	2.1		yu	2	4.0
	iv	1	.7		yu2	3	6.0
	v	4	2.8		yu3	42	84.0
	v3	3	2.1		yu4	1	2.0
	vi3	1	.7		Total	50	100.0
	y	1	.7				
	yi3	1	.7				
	yu	5	3.5				
	yu2	3	2.1				
	yu3	106	74.6				
	yu4	2	1.4				
	yue	1	.7				
	yun3	1	.7				
	yv	1	.7				
	yv3	2	1.4				
	Total	142	100.0				

This syllable was presented in the word *yu3yi1*, which means “raincoat”. The most common meaning and everyday usage of the syllable *yu*3 means “rain”, and the syllable *yi*1 means “clothes”.

First, we see only four first-graders not writing anything for this syllable. Spellings that were exact phonetic transcriptions of the sound *ü* are two*: ü* (7 children) and *yü* (3 children).

A spelling that is a phonetic transcription of *y* and *ü,* suppressing *y,* is *iu* by six first-grade pupils. There was one case of *üi*3, one case of *y*, one of *yi*3, and one of *yue*, which could have been attempts at phonetic transcription. Even the case of *y* and *yi* could have been meant to stand for *yu*. In fact, all these spellings have connection with either the visual spelling of the syllable or the sound *ü*.

Happily, 116 first-graders spelled it correctly, ignoring the tone, accounting for 82%, while the second-graders achieved 96% correct.

5.8.2 The spelling of *yun2*

Grade	Answer	Frequency	Percent
1.00	0	20	14.1
	i	2	1.4
	ien2	1	.7
	ive2	2	1.4
	un2	1	.7
	vn2	4	2.8
	y	6	4.2
	yen2	1	.7
	yeng	2	1.4
	yin	2	1.4
	yn2	1	.7
	yu2	8	5.6
	yuan2	1	.7
	yuen2	3	2.1
	yun	2	1.4
	yun1	11	7.7
	yun2	71	50.0
	yun3	2	1.4
	yun4	1	.7
	yvn3	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	0	4	8.0
	y	3	6.0
	yi	1	2.0
	ynu2	1	2.0
	yu	1	2.0
	yu2	2	4.0
	yuen2	2	4.0
	yun	3	6.0
	yun1	1	2.0
	yun2	29	58.0
	yun3	3	6.0
	Total	50	100.0

Yun2 means “cloud”, and was presented in the word *wu1yun2*, meaning “dark cloud”.

Eighty-seven first-graders spelled it correctly, which accounted for 61% of them. There were spellings as *ün* (4 children), *un* (1), *yuen* (4), and *yün* (1). They were all pure phonetic transcription of the sound.

Spellings such as *ien* (1 child), *iüe* (2), *yen* (1), *yeng* (2), *yin* (2), *yn* (1), and *yu* (8) might all have been the attempts to annotate the sound phonetically, as all the spellings showed part of the sound of the syllable. The spelling *yn* might be *yu* with the *n* upside-down.

What has also drawn our attention is the use of the letter *i* in the position of *y*. The appearance of *i* in the spellings might suggest the similarity between the sounds of *ü* and *i*, (Section 5.7.1) and thus indicate the efforts that children made in order to catch all the sound and express them in a syllable said to them.

5.8.3 The spelling of *yuan3*

Grade	Answer	Frequency	Percent
1.00	0	25	17.6
	iai2	1	.7
	iuan3	3	2.1
	ivan3	1	.7
	jan3	1	.7
	jao	1	.7
	uan	1	.7
	uan3	1	.7
	ue	1	.7
	van3	1	.7
	y	6	4.2
	y3	1	.7
	yai	2	1.4
	yan1	1	.7
	yan3	10	7.0
	yang3	2	1.4
	yiu	1	.7
	yu	1	.7
	yu3	2	1.4
	yuan	7	4.9
	yuan1	2	1.4
	yuan2	5	3.5
	yuan3	63	44.4
	yuan4	2	1.4
	yun3	1	.7
	Total	142	100.0

Grade	Answer	Frequency	Percent
2.00	y	1	2.0
	yuan3	1	2.0
	0	5	10.0
	yan3	1	2.0
	ynu3	1	2.0
	yu	1	2.0
	yu3	1	2.0
	yuan	2	4.0
	yuan1	1	2.0
	yuan2	2	4.0
	yuan3	34	68.0
	Total	50	100.0

This syllable means “far; far away”. Seventy-nine first-graders spelled it correctly.

The most common misspelling was *yan*, by eleven first-graders. It is possible that *yan* was misused as *yuan*, as there is such a syllable as *yan*. However, it would be more likely that *y* stood for *yu*, as there are two finals in the syllable, treating *y* as an initial (Section 5.4.7). The exact phonetic transcriptions were the spellings of *iuan* (3), *uan* (2), and *üan* (1).

The spelling *yang* by two children might also suggest the similarity between the sound *n* and *ng*, which was mentioned in Sections 5.7.3 and 5.7.4.

One child spelled it as *jan* and one as *jao*. The letter *j* might suggest the influence from IPA, which was mentioned in connection with other syllables with *y* in the initial position. In China, English is taught with IPA, so that pupils could know how to pronounce each word correctly. In the textbook, the IPA is printed right next to the new word. It would be interesting to investigate why the *ü* sound is expressed by letter *j* or *i*, owing to the frequent occurances.

While 25 first-graders did not spell anything for this syllable, only five second-graders offered no spelling. It seems that all the children who did not spell the correct way were trying to spell phonetically.

5.8.4 The spelling of *yue4*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	15	10.6	2.00	0	7	14.0
	hue4	1	.7		i	1	2.0
	ie4	4	2.8		le4	1	2.0
	ing	1	.7		lue4	1	2.0
	iue1	1	.7		ve	1	2.0
	ive	1	.7		y	2	4.0
	ivn	2	1.4		ye4	2	4.0
	jin4	1	.7		yiu4	1	2.0

	jiue4	1	.7		yu4	9	18.0
	le4	2	1.4		yue2	1	2.0
	ue	4	2.8		yue4	22	44.0
	un4	2	1.4		yuo4	1	2.0
	ve	1	.7		yvi4	1	2.0
	ve4	1	.7		Total	50	100.0
	xu4	1	.7				
	y	7	4.9				
	y4	1	.7				
	ye	2	1.4				
	ye4	4	2.8				
	yin1	1	.7				
	yin4	1	.7				
	yre3	1	.7				
	yu4	3	2.1				
	yuan4	1	.7				
	yue	5	3.5				
	yue1	1	.7				
	yue4	56	39.4				
	yun	1	.7				
	yun4	8	5.6				
	yuve4	2	1.4				
	yve4	8	5.6				
	yvn4	1	.7				
	yyu4	1	.7				
	Total	142	100.0				

This syllable was presented in the word *yin1yue4*, which means “music”. The syllable on its own means “melody”.

Sixty-two first-graders spelled it correctly. We see obvious attempts at phonetic transcription of the syllable in the spellings *yuüe* (2 children), *yüe* (8), *üe* (2), *iue* (1), and *iüe* (1). The non-standard spelling *yuüe* suggests that the two children spelled it with a lengthened *ü* sound, as if they were blending it. The spelling *iüe* seems to suggest that the children magnified the *üe* sound and found that there was an *i* sound at the beginning. We

have seen by now quite commonly that children use *i* instead of *y* for the previous syllable and other syllables, if the syllables have *y* in them.

We found one spelling of *jin*, perhaps an influence from IPA, where [j] is for the sound that *y* stands for. We also found one first-grader who spelled *jiue*, a combination of IPA and pinyin letters, the most detailed phonetic transcription of the syllable among all the 192 children.

5.8.5 Summary

The spellings in the yu type show that the children spelled phonetically, following the correspondence between letters and sounds. Non-phonetic orthographical rules have a strong influence on spelling; sometimes being followed correctly and sometimes not. Syllable length alone did not seem to impose a problem, either, as the syllable *yuan* was spelled better than *yue*, which has only three letters. The important matter might be the method for teaching the rules—perhaps the function of syllable boundary, in this case *y*, could be explained. In addition, when a syllable also involves visual transformation, it imposes more work on the learner. However, it seem that the recognize-as-a-whole method indeed has reduced some difficulty, viewed from performance compared with other types in the quantitative analysis.

5.9 Analysis of spelling: jqx type

When any of the finals in the *yu* type, i.e. *ü*, *üe*, *ün*, and *üan*, is preceded by *j*, *q*, or *x*, the umlaut will be omitted, just like the yu type. Therefore, any *u* appearing after these three letters in the children's spelling was interpreted as for *ü*.

5.9.1 The spelling of *quan2*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	10	7.0	1.00	quan1	3	2.1
	chao2	1	.7		quan2	29	20.4
	chuan1	1	.7		quan3	2	1.4
	chun2	1	.7		qun2	9	6.3
	gu2	1	.7		quo2	1	.7
	guan2	1	.7		qvan2	1	.7
	ju2	1	.7		qve3	1	.7
	jyuan2	1	.7		qvn	2	1.4
	pian2	2	1.4		qyaian1	1	.7
	pian3	1	.7		qyua	1	.7
	puan2	4	2.8		qyuan	1	.7
	q	12	8.5		qyuan2	4	2.8
	qan2	5	3.5		x	1	.7
	qan3	1	.7		Total	142	100.0
	qen2	1	.7	2.00	0	3	6.0
	qi	4	2.8		pian2	1	2.0
	qi2	1	.7		pian4	1	2.0
	qian1	1	.7		puan1	2	4.0
	qian2	15	10.6		puan2	1	2.0
	qian3	1	.7		qian	1	2.0
	qin2	2	1.4		qian1	1	2.0
	qiou2	1	.7		qian2	3	6.0
	qiu1	2	1.4		qu	1	2.0
	qiua	1	.7		qu2	2	4.0
	qiyvn3	1	.7		quan	1	2.0
	qman	1	.7		quan1	1	2.0
	qoao2	1	.7		quan2	28	56.0
	qu	4	2.8		quan3	1	2.0
	qu1	1	.7		quang1	1	2.0
	qu2	3	2.1		que1	1	2.0
	qua	1	.7		xuan2	1	2.0
	quan	3	2.1		Total	50	100.0

This syllable and the following one were dictated together as one word *quan2jun1*, meaning “the whole army forces”. The syllable *quan2* means “all, altogether, whole,

complete", and the meaning of next syllable *jun1* means "army, military forces". The list of varied spellings in the first-grade table (not counting tones) mounted to 45, indicating the challenge the children had to face at the early stage.

Firstly, thirty-seven first-graders spelled the syllable correctly. The most common non-standard spelling is *qian*. That 17 first-graders spelled *quan* as *qian* may suggest the similarity of the sound between *i* and *u*, again. This similarity might be liable to cause confusion, and this spelling can be spotted in five second-graders, too.

The spelling *qan* (non-pinyin syllable) by six first-graders might have been caused by dropping the first vowel *u*. This phenomenon has been seen in all the spellings that contain two-vowel finals, or two finals, also called compound finals (i.e. *xiong*, *shuang*). Alternatively, it might have stood for *qian*, because *q* is pronounced as *qi* in the pinyin class. Having explained it this way, we must also allow that spellings like this are open to other explanations. The spelling of *qyuan*2 (4 children) is an exact phonetic transcription of *quan*: as we have noted that *ü* is spelled *yu* when it is a syllable on its own.

The spelling of *qen* (1 child, non-pinyin) and *qin* (2 children, non-pinyin) might indicate more influence of the blending method, explained just now and in various other sections, than other influences such as incorrect recall.

The spelling *qiu* (2 children) might be *qin* with the *n* inverted. Similar inversion, together with transposition, might explain *qua* (1) as an image of *qan* (6), and *qiua* (1) as an image of *qian*; and even *qman* (1) might be a distorted image of *quan* (the correct spelling). On the whole, these spellings all have caught features of the sound and the spelling of this syllable, and could have been attempts of phonetic transcription.

The spelling *chao2* by one first-grader has the initial *ch*, which is different from the pinyin initial *q*. However, the English pronunciation of *ch* is very similar to, or the same as, the pinyin initial *q* (Section 5.4.8). This again suggests that learning English might have influenced spelling in pinyin.

The spelling of the initial in *ju2* by one child may indicate the similarity in the initials taught in this group, namely *j*, *q*, and *x*. We mentioned, earlier, the likeness in pronunciation of these consonants.

5.9.2 The spelling of *jun1*

Grade	Answer	Frequency	Percent
1.00	0	15	10.6
	j	8	5.6
	j1	1	.7
	jen1	1	.7
	ji	1	.7
	jian1	1	.7
	jin1	4	2.8
	jiou1	1	.7
	jivn	4	2.8
	ju	1	.7
	ju1	7	4.9
	ju4	2	1.4
	jui1	1	.7
	jun	3	2.1
	jun1	69	48.6
	jun2	2	1.4
	jun3	2	1.4
	jve1	1	.7
	jvn	4	2.8
	jvn1	7	4.9
	jvn2	1	.7
	jyun1	1	.7
	jyun2	1	.7

Grade	Answer	Frequency	Percent
2.00	0	3	6.0
	j	6	12.0
	ji1	1	2.0
	jing1	1	2.0
	ju	1	2.0
	ju4	1	2.0
	jue1	1	2.0
	juen1	1	2.0
	jui	1	2.0
	jun	1	2.0
	jun1	29	58.0
	nj	1	2.0
	vn1	1	2.0
	yun1	2	4.0
	Total	50	100.0

	q	1	.7
	xun	2	1.4
	zhvn1	1	.7
	Total	142	100.0

This syllable, meaning "the armed forces", was presented in the word *quan2jun1*, meaning "all the armed forces", as we mentioned in Section 5.9.1.

Seventy-six first-graders spelled *jun* correctly. Twelve first-graders spelled *jün* and four spelled *jiün*. The umlaut suggests they had not had a solid grasp of the rule yet. Two spelled *jyun*, and we know that *yu* is the syllabic spelling of *ü*, and so these 18 children spelled the syllable phonetically.

We found that first-graders used *x* and *zh* instead of *j* in the spellings *xun* (2 children) and *zhün* (1). In the analysis of the syllables *ji1* and *zhun3*, we saw the use of *x* in the place of *j* and *zh*. We have mentioned the same position of the tongue in pronouncing *j*, *q*, and *x*, except that *j* is aspirated and *q* is unaspirated, and *x* is aspirated but not affricated.

Fifteen first-graders did not write anything, five more than in the spelling of *quan*, a more complicated syllable. This seems to suggest, again, that length is not as challenging as abridging the logic; *quan* spells all sounds out, but *jun* omits one sound.

5.9.3 The spelling of *xun2*

Grade	Answer	Frequency	Percent	Grade	Answer	Frequency	Percent
1.00	0	42	29.6	2.00	0	7	14.0
	chun2	2	1.4		pue2	2	4.0
	pun2	1	.7		q	1	2.0
	qiong2	1	.7		qu2	1	2.0
	qun2	4	2.8		qun2	5	10.0
	x	3	2.1		shueng2	1	2.0

	xiun2	2	1.4		xi	1	2.0
	xnu	1	.7		xi1	1	2.0
	xu	7	4.9		xien2	1	2.0
	xu2	3	2.1		xing2	1	2.0
	xuan2	1	.7		xiu2	1	2.0
	xue2	1	.7		xnu2	1	2.0
	xuen	1	.7		xu2	2	4.0
	xun	11	7.7		xui2	1	2.0
	xun1	1	.7		xun	2	4.0
	xun2	48	33.8		xun1	1	2.0
	xv2	1	.7		xun2	20	40.0
	xve2	2	1.4		xun3	1	2.0
	xve4	1	.7		Total	50	100.0
	xvn	1	.7				
	xvn2	8	5.6				
	Total	142	100.0				

This syllable alone means “follow” in the word *zun1xun2*, which means “following (the instruction)”.

Sixty first-graders spelled the syllable as *xun*, correctly, accounting for 60% of the first-graders, if we exclude the 42 of them who did not spell. Nine spelled it as *xün*, an obvious phonetic transcription. We saw one transposed image: *xnu*.

Two spelled *xiun*, which might indicate the process of how the syllable was blended: *x* + *i* → *xi*, *xi* + *un* → *xiun*.

There was one instance of *xü* and ten of *xu*, which could suggest that *xu* represented the most distinctive part of the sound of the syllable, resulting the omission of the sound *n*, or even that the syllable was heard as *xu*. The spelling of *xüe* by three children and *xue* by one might also indicate that, to some children, there was sameness between the sound of *xun* and *xue*. However, this kind of spelling is open to many explanations.

This syllable seems a difficult one since nearly 30% of the first-graders did not write anything.

5.9.4 Summary

The *jqx* type of spelling used by first-graders shows that they spelled according to the correspondence between letters and sounds. We have seen that some children used *zh* [ts] or *z* [ts] for the sound *j*, *ch* [tsʰ] for *q*, and *sh* [ʂ] or *c* (the English letter) for *x*, suggesting the similarity between these sounds. Their spelling shows that, again, in the context of pinyin, where the longest syllable has only six letters, it is crucial to make clear the rules for abbreviation in setting the correspondences between letters and sounds.

Our attention was also brought to the spelling involving omission of the umlaut. Many pupils kept it when it should be omitted. In pinyin, *u* and *ü* represent different sounds. It is not the sound that causes a problem, but the fact that *ü* is written as *u* in certain types of syllable—an orthographic rule created to reduce the occurrence of the umlaut, which is not directly available on the standard qwerty keyboard. The pupils' errors in this type of spelling show us another kind of hypercorrection, apart from that arising from local speech.

In general, those who attempted to spell, but did not spell correctly according to orthography, spelled it according to logic, using a letter–sound correspondence, conceptualized both by the original design of pinyin and by the teaching method in the context of the Chinese language.

5.10 General summary

The present study on spelling recorded 6610 spellings on the 38 target syllables. The spelling errors we analysed were produced mainly by children at the start of first grade.

The predominant message that children have conveyed in their spelling of pinyin syllables is that they spelled by the logic of the alphabetic principle, that is, by letter–sound correspondence. Although there were a few cases which suggested that rote memory was involved in the spelling, it is not the main stream.

While the quantitative analysis allows us to see which types are more challenging than others, and therefore give us an order of difficulty, the evidence from the qualitative data show us what children do when they spell. The evidence from the creative spellings from all the syllables, which cannot be observed from quantitative analysis, supports the conclusion that Chinese children, like their English-speaking peers, use letter names to represent a whole syllable/word.

The spellings of *x* for syllable *xi*, Section 5.3.1, particularly for syllable *xong*, Section 5.4.6, *j* for syllable *ji*, Section 5.3.5, and *sh* for *shi*, Section 5.4.4, are examples which replicate the phenomena observed in Read's study—U (you) OVR (over) R (are) ME (me) (Read 1971), and confirmed by others (e.g. Bissex 1980).

Also like their English-speaking peers, the children spelled best in the one-to-one type of syllable and less well in the two-to-one type. In regard to the specific features of pinyin and Chinese, children also found yu and w0y0 types moderately challenging, followed by wuyi and two-to-one types. The two-to-three and jqx types are the hardest for the first grade pupils. On the other hand, the second-grade pupils find no difference in challenge between the yu, w0y0, and wuyi types. Like the first-grade pupils, they also

found two-to-three and jqx types were most challenging. The comparison between the two grades point to the most difficult type: two-to-three, where two letters represent three sounds.

Further, as well as the local vernacular and the hudu teaching method, English has shown its influence.

It is interesting to see that the syllable length did not seem to be a problem in spelling, for example, when comparing the spelling variations of *lü* and *tian*. Rather, the problem was the ambiguity of the correspondence between letters and sounds, for example, in the two-to-three type of spelling. In addition, visual transformation required in one type but not in the other also caused much hypercorrection, for example, *u* to *ü* or vice versa.

Few of the non-standard spellings that we have looked at have been recorded in any literature, English or Chinese, in the study of Chinese children's learning of pinyin. The common treatment of any variation in the classroom is either "right" or "wrong". The most detailed correction would be "you omitted this" or "you added that". This is because a mistake in writing a Chinese character is corrected in that way. However, this way of correction does not seem to be optimal for pinyin. What is worse is that simply saying something is wrong without analysing, explaining, or even understanding why it is wrong might discourage children from exercising their own mind, and cause confusion, as shown in the literature (Wu 2007). Perhaps, correction should also concern children's handwriting. We transcribed the original spelling as faithfully as possible in the hope that it might be helpful in understanding how Chinese children write in an alphabetic writing system.

We have been aware from the start that our dictation was presented in the unit of word, and not in the unit of syllable as is the practice in learning pinyin. Hence, the influence of the sound of the neighbouring syllable presented in the word might need further investigation.

A number of pedagogical or instrumental improvements suggest themselves. First, it is necessary, in the classroom, to have a clearer, more detailed, understanding of the phonemic structure (not just the syllabic and initial–final structure) of the Chinese language and its reflection in pinyin. In particular, teachers need to understand the difference between a consonant, on the one hand, and its pronounceable form in combination with its associated sounding-vowel on the other, and to be able to impart this understanding to their pupils. Secondly, teachers should be made aware of the structure of Chinese vowels, and how a phonetic representation of them is deliberately abbreviated in the pinyin orthography, and they chould teach the phonetic form and the abbreviating conventions explicitly.

Chapter 6 Results of the reading-aloud test

This chapter reports pupils' performance in the test of reading aloud in pinyin. Although investigating the difficulties in reading aloud was not a primary focus for the present study, reading aloud is part of learning the writing system.

The syllables in the reading-aloud test, as in the spelling test, are categorized according to grapheme–phoneme correspondence. There are syllable types with one-to-one, two-to-one, and two-to-three correspondences. There are also syllable types that involve the four orthographical rules. The wuyu type stands for syllables whose *w* and *y* represent the sound *u* and *i*, respectively; the w0y0 type stands for syllables whose *w* and *y* do not represent sound. The letter *u* stands for *ü* in the yu type, where *y* stands not for sound but for syllable boundary, and at last jqx type, where *u* stands for *ü* when it is preceded by *j*, *q*, or *x*. The selected syllables had a syllable structure parallel to that of the spelling test, but were different syllables: see Table 6.1, where the corresponding items of the spelling text are also shown. In the case of the w0y0 type, where only four syllables exist, the syllables in the reading-aloud test were the same as in the spelling test, but with different tones, in order to avoid repetition and a possible training effect.

Table 6.1 Test on reading aloud in the seven categories

Type of syllable structure	**Testing items, paired with the spelling test (in the first line)**
1. One-to-one (8 testing items)	***xi***, ***gua***, ***ji***, ***re***, ***zi***, ***jia***, ***tian***, ***lü*** rǎn, rú, guǒ, zi, nuò, liáo, luàn, nǚ
2. Two-to-one (8 testing items)	***zh****i*, ***ch****i*, ***sh****i*, ***er***, *yo****ng***, *qi****ng***, *xio****ng***, ***sh****ua****ng*** shì, ér, zhī, shi, róng, guāng, niáng, zhuàng

3. Two-to-three (7 testing items)	*h**ui**, z**ui**r, q**iu**, x**iu**, s**un**, z**un**, zh**un*** shuì, niú, dùn, ruì, xiù, qiú, miù, lùn (8 items in reading aloud)
4. wuyi type (4 testing items)	***w**o, **y**ou, **w**en, **w**ei* wén, wài, yàn (3 items in reading aloud)
5. w0y0 type (4 testing items)	***y**i, **w**u, **y**in, **y**ing* yì, wǔ, yìn, yǐng
6. yu type (4 testing items)	***y**u, **y**ue, **y**un, **y**uan,* yú, yuè, yǔn, yuán
7. jqx type (3 testing items)	***j**un, **x**un, **q**uan* jù, xuě, qū, qur (4 items in reading aloud)

The 39 syllables were combined into 21 words in pinyin and were printed on a sheet of paper as follows. All the words were printed with space between the syllables, as in their textbooks.

1 shì zi 2 nǚ ér 3 rǎn 4 rú guǒ 5 wài yàn 6 wén jù

7 wǔ shuì 8 qū qur 9 zhī shi 10 yǔn nuò 11 yǐng yìn

12 yú yuè 13 yuán yì 14 niú dùn 15 ruì xuě 18 xiù qiú

17 liáo luàn 18 miù lùn 19 guāng róng 20 niáng 21 zhuàng

Forty-eight first-grade and 20 second-grade pupils, who also took part in the spelling test, were tested individually with the researcher in a classroom. The pupils were selected arbitrarily for availability, and were tested mostly before the spelling test. The pupils were asked to read the syllables one by one. The researcher asked each pupil “Can you read this, please?”, while pointing her finger to the syllables one by one. Usually, the

pupil would read aloud in one attempt. Occasionally, a pupil might have made another attempt immediately after the first. The experimenter would discontinue the test to a pupil when the child could not read aloud three consecutive syllables, or when a child preferred to stop, following Hornsby (1995). In addition, this was out of concern to minimize the embarrassment and pressure that might be felt by a child, when reading aloud in front of an unknown adult. Sections 6.1 to 6.5 give the observations made on their performance.

6.1 Influence from the vernacular

First, we observed that the children read the syllables with *ing* all correctly as *ieng*. Second, the children read the syllables with two-to-three letter–sound correspondence correctly as one-to-one letter–sound correspondence.

We have also observed that pupils' spelling showed the influence from the vernacular in the spelling test. The local vernacular does not distinguish retroflex sounds (zh [tʂ], ch [tʂʰ], sh[ʂ]), which are blade-palatal sounds, and the corresponding dental sounds (z [ts], c [tsʰ], finals [s]) called alveolar, using only the latter sounds. It is observed in the children's spelling of these consonants that they tended to spell retroflex consonants as alveolar consonants or vice versa, an indication of overcorrecting their pronunciation after they learned that their local speech does not distinguish these two kinds of consonant (Section 6.3). So, in the vernacular form, *zhi*1 *shi*0 (知识) is pronounced as *zi*1 *si*0, and *shi*4 *zi*0 (柿子) is *si*4 *zi*0. How would the children read these syllables aloud in pinyin? Only one instance was observed of reading aloud *zi*0 as *zhi*1 in the word 柿子 (*shi*4 *zi*0), among the 68 children (Appendix VI). In fact, in reading aloud all the 6 syllables *zhi, zi, shui, zhi, shi, zhuang*, which contain these retroflex and alveolar

consonants, only this one first-grade pupil made the mentioned error among the 283 various entries. This one case might suggest the influence from the first retroflex syllable *shi* carrying over to the latter one *zi* rather than the influence from local vernacular. Thus, in contrast to the case of spelling, hypercorrection does not show up in reading aloud.

In the local speech, the retroflex alveolar [r] is pronounced as [l], if [r] is followed by phonemes [u] or [uei]. This makes syllables *ru* and *rui* sound the same as *lu* and *lui*. So the word 如果 (*ru*2 *guo*3) is pronounced as *lu*2 *guo*3 in the local vernacular. Three out of the 33 first-grade pupils who attempted the syllable pronounced *r* as *l* in the syllable *ru* in the word *ru*2 *guo*3; and 1 second-grade pupil out of 19 read it as such (Appendix VI). Thus, altogether, only 4 pupils among the 52 pupils read *ru* as *lu*, while none of the 31 first-and second-grade pupils who read the syllable *rui* made errors on *r* (Appendix VI).

The local speech for *r* in the context of finals *an* and *ong*, as in the syllable *ran* ([ran]) and *rong* ([rʊŋ]), would be pronounced as syllables *ian* ([ian]) and *iong* ([iʊŋ]), respectively, and would be spelt as *yan* and *yong*, respectively, or *ian* and *iong* as finals. These two syllables are called zero-initial syllables, because there are no consonant initials in them. Two out of 40 first-grade pupils read *ran* aloud as *ian*, but no second-grade pupils read as such. None of the 11 first-grade and 20 second-grade pupils made errors on the syllable *rong*.

6.2 Influence from the teaching method: syllable blending

When teaching a consonant initial in the pinyin class, the teachers would attach a vowel to it. This is identified as a cause of difficulty in blending initials and finals into syllables (see Section 3.1.1).

It was observed that one first-grade pupil failed to blend the syllable *nü* by pronouncing the initial *n* as *ne*, the name of the initial *n*, and then giving up, while 6 first-grade and 2 second-grade pupils did not attempt the syllable (Appendix VI). When coming to read aloud the syllable *er*, which is taught as a recognize-as-a-whole syllable, three first-graders and one second-grade pupil tried to blend *e* with *r*, but gave up eventually, because it would end up with two syllables: *er* would be read aloud as *e ri* or *e ruo*, which are not Chinese words (Appendix VI).

Three first-grade pupils pronounced *r* as *ri* in their attempts to compose the syllable *ran*. One first-grade pupil pronounced *r* as *ruo* and tried to blend *ruo* with *an* in the attempt and stopped with *ruo*. Recall that both *ruo* and *ri* are used as the standard pronunciations for *r* in teaching the initial *r* and in demonstrating how to blend syllables. This way of blending was also observed in reading aloud the syllable *ru*. The pupils did it by blending *ruo* and *u*. As a result, some pupils gave it up, eventually, with 10 first-grade pupils not even trying. The pupils read aloud the syllable *guo* by blending *ge* and *uo*, with 15 not attempting it.

In reading aloud the syllable *qu*, some pupils blended *qi* and *u* (not *ü*, which the *u* stands for); in the syllable *dun*, by blending *de* and *un*; in the syllable *rui*, by blending *ri* and *ui*; and in the syllable *qiu*, by blending *qi* and *iu*. The difficulties arise, most likely

because the consonants are taught as whole syllables, ending in a vowel, even though that vowel may not occur in the syllable being read.

Importantly, the way how the pupils blended syllables in reading-aloud test seemed to have confirmed why some spellings were spelled in a certain way.

6.3 Visual confusion

Visual confusion refers to those reading-aloud items where the pronunciation of the syllable is caused by a misinterpretation of what the letters represent. More errors arose from visual confusion than from the influence of vernacular: Errors apparently caused by visual confusion are summarized in Table 6.2.

Table 6.2 Examples of visual confusion (Appendix VI)

1. Omission of umlaut	
ü for *u*	*nü* read as *nu*
	qu read as *hu*, *qu* read as *pu*
	qur read as *gur* (*q* for *g*), *qur* read as *pua* (*q* for *p*)
ün for *un*	*yun* (pronounced as *ün*) read as *uei*, as *un*, as *yin*
2. Transposition of finals	
ui for *iu*	*shui* read as *shiu* (non-Chinese syllable)
iu for *ui*	*niu* read as *luei* (non-Chinese syllable)
uo for *ou*	*xiu* read as *xui* (non-Chinese syllable)
ou for *uo*	*guo* read as *dou*, *guo* read as *gou*
	nuo read as *nou*

3. Substitution of consonant	
t for *d*	*dun* read as *tun*
d for *g*	*guo* read as *dou*
h for *q*	*qu* read as *hu*
p for *q*	*qu* read as *pu*
g for *q*	*qur* read as *gur*, *qur* read as *pua*
4. Mixed/other errors	
e for *a*	*ran* read as *ren*
a for *i*	*yan* read as *yen*
uai for *y*	*wai* read as *wei*
yu for *yin*	*ying* read as *yang*
r for *i*	*yin* read as *uai* (maybe English influence, because *y* in pinyin is prounced as *ee* in English), *yin* read as *yu*
	er read as *ie*
5. Substitution of finals	
uan for *uang*	*yuan* read as *yuang* (non-Chinese syllable), *guang* read as *guan*, *guang* read as *gang*
7. **Medial omission**	
ao for *iao*	*liao* read as *lao* (Appendix VI),
ang for *iang*	*niang* read as *nian*, *niang* read as *lang*, *niang* read as *nang*, *niang* read as *ning*
uang for *uan*	*zhuang* read as *zhuan*

6.4 Retroflex syllable "qur"

Few retroflex syllables appear in school textbooks. For example, just one syllable *wanr*, which means "play", is in the first of the two volumes of the textbook for the first year (Wang & Yang 2009: 119). Although pinyin was designed to represent the spoken form of the Chinese language, and the retroflex feature is in everyday speech, this retroflex feature is not given much explicit teaching; because pinyin is taught, mainly, in order to learn Chinese characters. This means that, although people speak with the retroflex feature in their language, when they learn the Chinese characters, none of the characters is pronounced with the retroflex feature, nor is the character spelled with retroflex *r* in pinyin. So, the character 玩 is taught to be pronounced as *wan* instead of *wanr*.

The treatment of this retroflex feature in writing in Chinese characters is that a Chinese character, 儿 (*er*), is written separately to represent it. So the pinyin syllable *wanr* would be expressed as 玩儿, two characters, in the Chinese writing. The problem is that the character 儿 has its own pinyin syllable *er*, which is the syllable that children learn (with different tones) specially for characters such as 儿 (son), 二 (two), or 耳 (ear) in the pinyin class. Note that *er* is taught as a final, but it does not combine with any initial. It is a final and a syllable at the same time. Thus, it would be interesting to see how they read aloud a syllable with such feature.

One out 11 first-grade pupils and 5 out of 20 second-grade pupils read a syllable ending with *r* correctly, i.e. as one syllable. This was a much better performance than on the spelling test done by 153 pupils, of whom only one second-grade pupil spelled the retroflex syllable (*zuir*) correctly. Just as few pupils spelled the retroflex syllable *zuir*

with *er* to mark the retroflex feature, few pupils read aloud the syllable *qur* as two syllables: *qu* and *er* (Appendix VI).

6.5 Other observations

(1) Searching for meaning and reading aloud for its own sake

Pupils also seemed to be influenced by the meaning of the syllables. For example, a pupil read *yu* aloud as *que*, which was quite different from the sound of *yu*. However, *que* combined with the next syllable in the test (word 12), *yue*, makes a meaningful word: *queyue* (雀跃, jump with joy). Another example was the reading of *liao* as *lao*. *Liao* (缭, entangled) would probably be unfamiliar to young children, but *lao* would be familiar, which means "old", or "respected". The Chinese word for teacher is *laoshi* (老师), which the pupils would use every day at preschool or primary school.

Although all the pupils could read aloud some words correctly, they would not necessarily understand the meaning of what they read. For instance, when asked about the meaning of *yingyin* or *yunnuo*, none of the pupils who were asked knew what they meant. The latter word is another example where an unknown word was interpreted as a known one. For example, a pupil read aloud *yunnuo* as *yunduo*. The latter word means "cloud", which suggests that they might have tried to figure out the meaning. Another example seems to confirm this suggestion. When the researcher asked a pupil what *liaoluan* ("messy", "entangled") meant, she said "a lot of pupils talking in the class". This is not a bad guess, because the syllable *luan* means "disorder", and probably the occurrence most familiar to the children would be in the word *luanhonghong* ("hubhub"), used when the teacher is trying to reinstate order. None of the pupils who got full or

ceiling scores could tell the meanings of half of the words when asked, as they were confidently reading through the syllables. Noteworthily, only 6 out of 21 words, namely, *shi zi* (tomato or persimmon), *nü er* (daughter), *wen ju* (stationary), *zhi shi* (knowledge), *guang rong* (glory, honour), and *zhuang* (strong), were known by most of the participating pupils when asked.

(2) Reading aloud only the finals

It was also observed that some pupils only read aloud the final instead of the whole syllable in some cases, as in Table 6.3.

Table 6.3 Syllables of which only the finals were read aloud

Syllable	Read-aloud	Numberof pupils	Syllable	Read-aloud	Number of pupils
shi	*i*	1 first-grade	***zi***	*i*	1 first-grade
nü	*ü*	3 first-grade	***ran***	*an*	3 first-grade, 1 second-grade
ru	*u*	1 second-grade	***guo***	*uo*	3 first-grade
wai	*ai*	1 first-grade	***yan***	*an*	1 first-grade

Unlike the errors made in the attempts to blend initials (which were pronounced as a syllable) with the finals, which invited immediate explanation as the influence of the teaching method, it is not obvious why those pupils read only the finals. It was possible that, rather than failing to respond at all, the pupils still wanted to show that they could read the finals. It might also be possible that they could not use the blending technique to read aloud these syllables (*nü*, *ru*, *ran*, *guo*), or that they forgot how to pronounce the syllable, if it is a recognize-as-a-whole one (*shi*, *zi*), or that the rule for *w* and *y* was hard (*wai*, *yan*).

6.6 Overall scores for the reading-aloud performance

Only eleven first-grade pupils completed the whole test; that is, they attempted all the 39 syllables, almost all with just one attempt. However, this does not mean that the rest of the pupils were not able to read the syllables. The number was reduced only because the rest of the pupils were excluded when they failed to read three consecutive syllables, following the rules set up before the study was carried out, for the considerations mentioned at the end of the introduction to Chapter 6.

The overall scores for the first grade were calculated on those eleven pupils, and therefore were biased. For that reason, caution should be exercised here when making any inference. However, only by analysing the results of those who had tried all the syllables could the test tell which syllables were difficult by straightforward statistics. For this reason, the data in the following analysis in this section and Section 6.7 for the first grade were based on these 11 pupils.

It would have been interesting to see how well the other pupils would perform if they had been encouraged to attempt all the syllables. It was observed that even those who failed to read three consecutive syllables would not necessarily have failed on the other following syllables—as shown by one second-grade pupil, who was so enthusiastic that, having been released from the test, he insisted on reading aloud the rest of the syllables. In contrast to the first grade, all the twenty second-grade pupils who took part in the reading test attempted all the syllables and most with one attempt on each syllable.

First, the pupils' performance was calculated with tone counted and with tone ignored. The graph in Figure 6.1 shows the average performance of the two year groups.

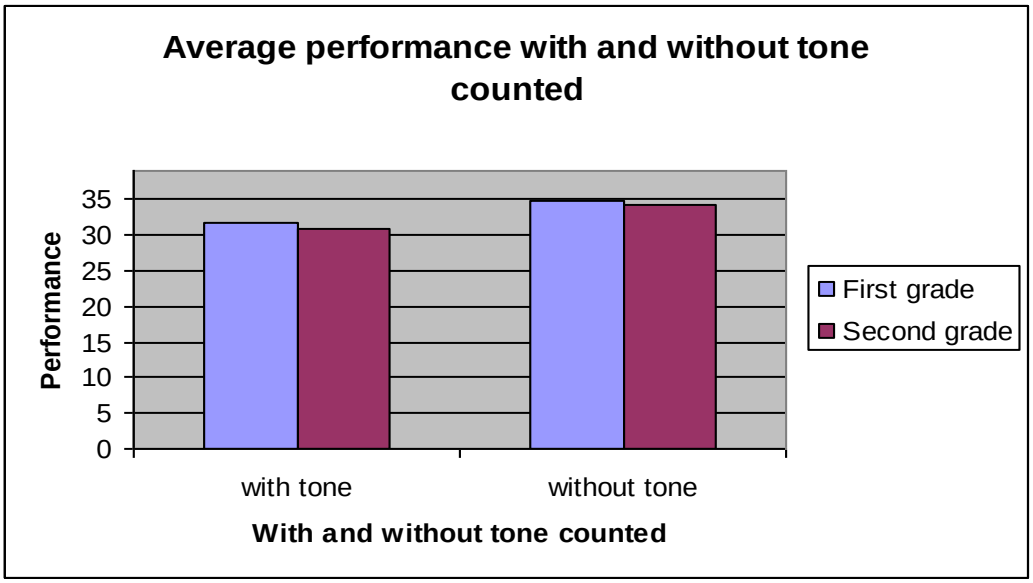


Figure 6.1: Average scores on reading aloud with and without tones

Wilcoxon tests show that there is a significant difference in the performance with and without tones taken into account (for the first grade, $z = –2.810$, $p = .001$, $r = –.60$; for the second grade, $z = –3.943$, $p < .0005$, $r = –.62$; Table 5.3). This might indicate that tone marks can be difficult to master.

The Mann–Whitney test was used to compare the performance between the two grades, and results (Table 6.4) show that there was no significant difference between the two grades in overall reading-aloud scores either with or without tones. In the following analysis, tones were not considered, as in the case of the spelling test.

Table 6.4 Test of statistics in reading-aloud test with and without tones

Test Statistics[a,c]

Grade				readingnotone-readingpinyin
1.00	Z			-2.810[b]
	Asymp. Sig. (2-tailed)			.005
	Monte Carlo Sig. (2-tailed)	Sig.		.001
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.002
	Monte Carlo Sig. (1-tailed)	Sig.		.001
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.001
2.00	Z			–3.943[b]
	Asymp. Sig. (2-tailed)			.000
	Monte Carlo Sig. (2-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000
	Monte Carlo Sig. (1-tailed)	Sig.		.000
		99% Confidence Interval	Lower Bound	.000
			Upper Bound	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on 10000 sampled tables with starting seed 303130861.

6.7 Performance on the seven types of syllable

The graph in Figure 6.2 illustrates the performance on the seven types of syllable in each year group.

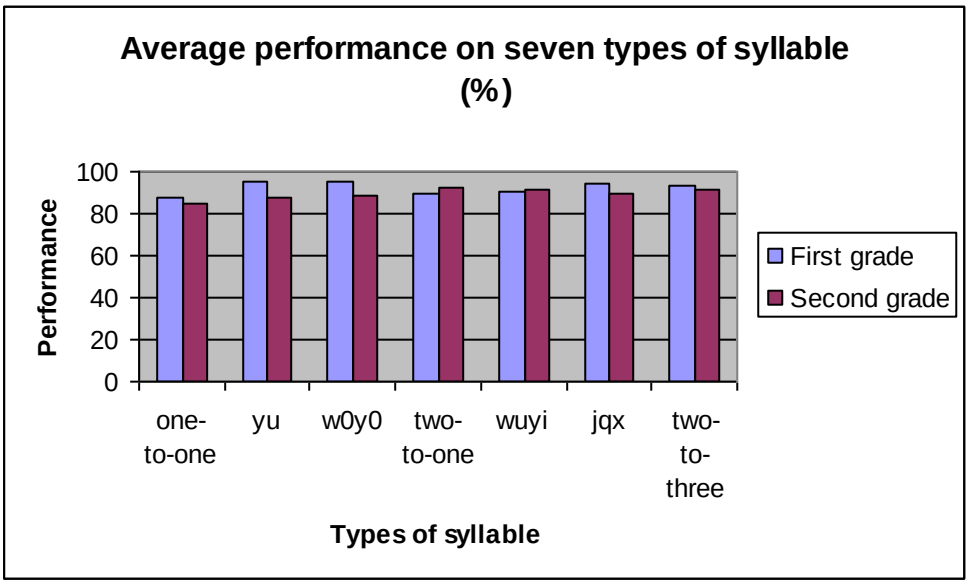


Figure 6.2: Mean percentage performance on the seven types of syllable in reading-aloud test

Comparison within each grade

Friedman's ANOVA show that there is no significant difference in the reading–aloud performance between the types of syllable in the first grade ($\chi^2(6) = 8.407$, $p = .21$) or in the second grade ($\chi^2(6) = 5.743$, $p = .46$) (Table 6.5). This indicates that the type of syllable structure had little influence on reading aloud. In particular, the syllable type with one-to-one letter–sound correspondence shows no advantage over the two-to-one or two-to-three syllable types, nor does the syllable type involving orthographical rules show any disadvantage. This suggests that spelling is different from reading aloud and, in

particular, the one-to-one type seems no easier than any other type in reading aloud in pinyin. The statistical tests showed no significant difference in difficulty (Table 6.5).

Table 6.5 Comparison between the seven types within each grade

	N			11
	Chi–Square			8.407
	df			6
1.00	Asymp. Sig.			.210
		Sig.		.211
	Monte Carlo Sig.	99% Confidence Interval	Lower Bound	.200
			Upper Bound	.222
	N			20
	Chi–Square			5.743
	df			6
2.00	Asymp. Sig.			.453
		Sig.		.458
	Monte Carlo Sig.	99% Confidence Interval	Lower Bound	.445
			Upper Bound	.470

Comparison between the two grades was also made by using the Mann–Whitney U test, which shows that there is no significant difference, in all the seven types of syllable, between the two grades. This result seems to suggest that there was no difficulty for the pupils to read aloud the pinyin syllables, with the performance of some pupils in both grades reaching the ceiling. However, the researcher would not advocate drawing this conclusion, because the sample of 11 first-graders was highly biased as a result of the exclusion rules described at the end of the introduction to this chapter. Also, although it is tempting to claim that the seven syllable types seemed equally easy for pupils in both grades, such a statement could not be made about the first-grade pupils without caution, because of the small sample size.

Chapter 7 Results of the pseudo-pinyin spelling test

The purpose of designing the pseudo-pinyin syllables was to control for familiarity of the syllables. The pseudo-pinyin syllables were made up of initials and finals that do not form a Chinese syllable. For example, *f* is a pinyin initial and *i* is a final, but the combination of the two, the syllable *fi*, does not exist in Chinese. Eight syllables bearing the three types of letter–sound correspondence (i.e. one-to-one, two-to-one, two-to-three) were dictated to 51 first-grade pupils and 13 second-grade pupils. Full marks would be 8.

7.1 Overall performance

Their overall performance was counted with tone and without tone. The following graph illustrates the pupils' performance, with and without taking tone into account (Figure 7.1).

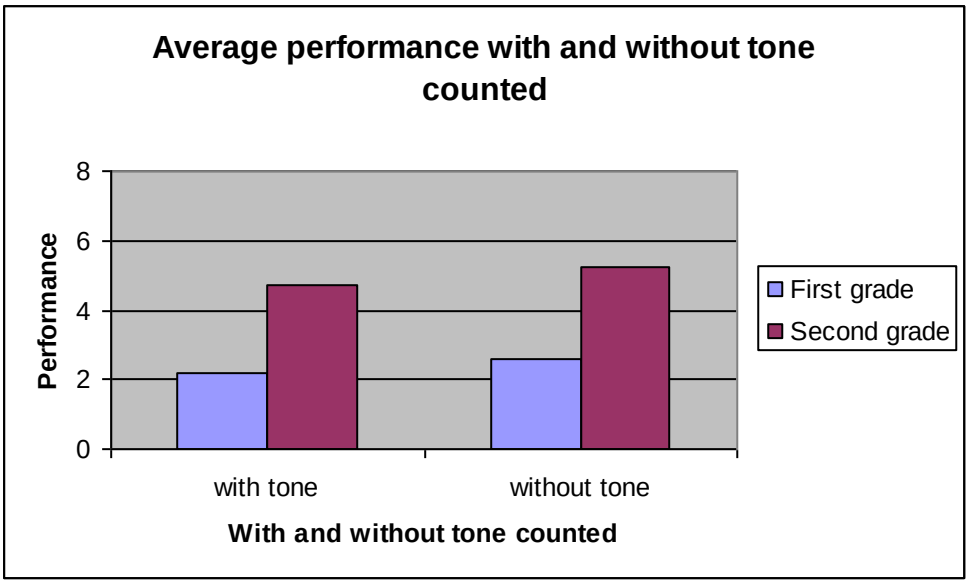


Figure 7.1: Pupils' mean performance in pseudo-pinyin spelling

The Wilcoxon sign-rank test was used, and the results show that there is a significant difference between the performance when tone was taken into account and when it was not in the first grade ($z = –2.858$, $p = .009$, $r = –.28$, two-tailed) but not in the second grade. This might indicate that the second-grade pupils were more familiar with using tone marks than the first-grade pupils, rather than that the second-grade pupils were more sensitive about the tones, because by this age children have more fully developed their ability in their spoken language. On the other hand, the sample size in the second grade might have been too small to establish significance in the statistical analysis. As with the other spelling analysis, tone was not considered for the further analysis of pseudo-pinyin spelling.

7.2 Results on the types of spelling

The three types of spelling here refer to the one-to-one, two-to-one, and two-to-three types. The graph in Figure 7.2 shows the performance on each type of spelling by each grade of pupils.

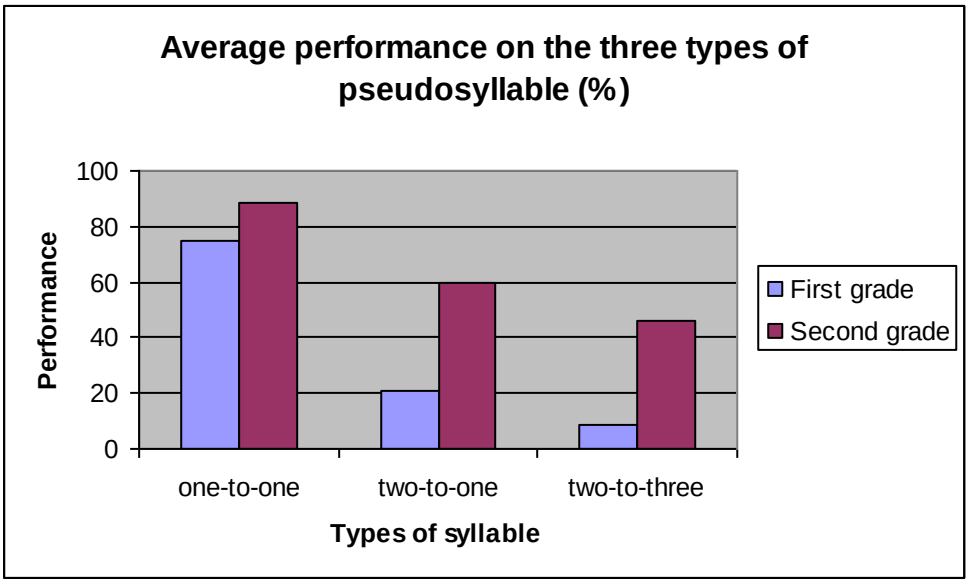


Figure 7.2: Mean percentage performance on three types of syllable

The difference in performance between the three types of syllable looks as striking as that in spelling real pinyin syllables. Friedman's test shows that there was significant difference between each of the three types of syllable in both the first grade ($\chi^2(2) = 70.311$, $p < .0005$) and in the second grade ($\chi^2(2) = 15.116$, $p < .0005$). To determine between which individual types these scores were significantly different, the Wilcoxon signed-rank test was employed, with significance level at 0.025 after applying the Bonferroni correction, as follows.

Comparison within the first grade Within the first grade, there is significant difference between one-to-one and two-to-one types ($z = –5.76$, $p < .0005$, $r = –.52$), between the one-to-one and two-to-three types ($z = –5.90$, $p < .0005$, $r = –.58$), and between two-to-one and two-to-three types ($z = –2.78$, $p = .005$, $r = –.28$).

Comparison within the second grade Within the second grade, there is a significant difference between one-to-one and two-to-three types ($z = –2.31$, $p = .021$, $r = –.45$), but

not between one-to-one and two-to-one types or between two-to-one and two-to-three types (Table 7.1).

Table 7.1 Comparison of each syllable type within each grade

		PseuSpeTwoToOne/4 - PseuSpeOneToOne/2	PseuSpeTwoToThree/2 - PseuSpeOneToOne/2	PseuSpeTwoToThree/2 - PseuSpeTwoToOne/4
1	Z	–5.760[b]	–5.896[b]	–2.778[c]
	Asymp. Sig. (2–tailed)	.000	.000	.005
	Point Probability	.000	.000	.000
2	Z	–2.1749[b]	–2.309[b]	–1.933[c]
	Asymp. Sig. (2–tailed)	.030	.021	.053
	Point Probability	.000	.000	.039

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

Comparison between the two grades

Comparison was also made between the two grades (Table 7.2). The Mann–Whitney U sign test shows that there is no significant difference between the two grades in the one-to-one type, but there is in the other two types: that is, in the two-to-one type ($U = 48$, $p < .0005$, $r = –.62$) and in the two-to-three type ($U = 104.50$, $p < .0005$, $r = –.59$). This result seems to indicate that the first-grade pupils did not find spelling the one-to-one type harder than the second-grade pupils did, but they found that spelling other two types were more difficult than the second-grade pupils did.

Table 7.2 Comparison between the two grades

	PseuSpeOneToOne/2	PseuSpeTwoToOne/4	PseuSpeTwoToThree/2
Mann–Whitney U	246.500	48.000	104.500
Wilcoxon W	1572.500	1374.000	1430.500
Z	–1.661	–4.955	–4.758
Asymp. Sig. (2–tailed)	.097	.000	.000

As in previous studies in English (e.g. Treiman 1993) as well as in pinyin (Cao 1983), it was found that short syllables were easier to spell than longer ones. There were two syllables of the one-to-one type. One is *fi*, and the other is *tuai*. The four syllables in two-to-one type were *giang*, *zhia*, *luang*, and *shiong*, and the two syllables in two-to-three type are *nui* and *pun*.

It might be interesting to look at the results by excluding the shortest syllable *fi* to control for length, and see whether there are changes in the relative performance between the three types. Figure 7.3 shows the results of the performance in mean percentage.

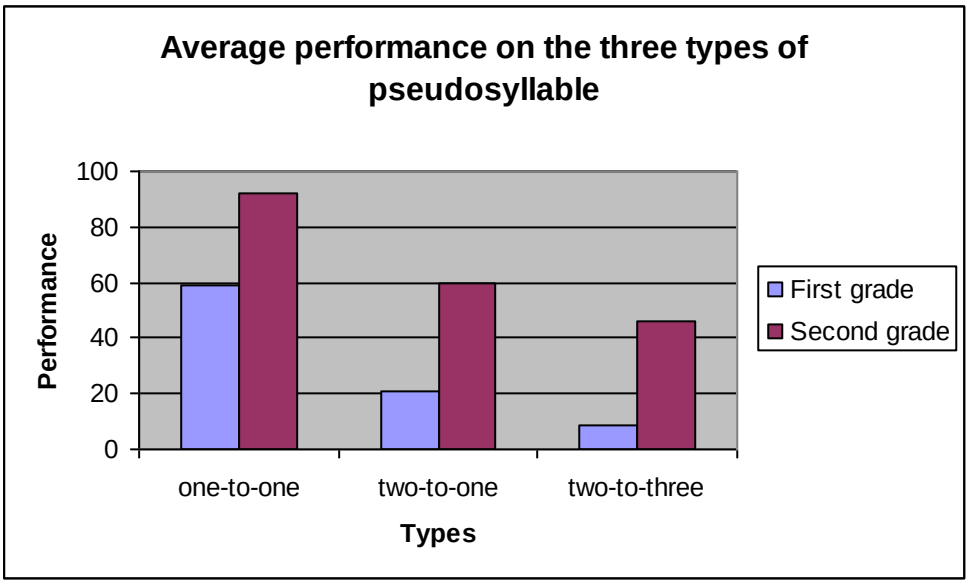


Figure 7.3: Mean performance on pseudo-pinyin syllables excluding "*fi*"

The comparison between the one-to-one, two-to-one, and two-to-thee types of syllable was also made by using non-parametric tests, as with all the other tests in this study. The Wilcoxon Tests show results very similar to those that included the syllable *fi*, with significant difference between all the three types in the first grade. This indicates the length of syllables might not be influential in spelling pinyin syllables.

For the second grade, there is a significant difference between the one-to-one type (represented by the single syllable *tuai*) and the two-to-three type, and between one-to-one and two-to-one (Table 7.3).

Table 7.3 comparison of spelling types in pseudo-pinyin syllables

		PseuSpeTwoToOne/4 – tuai	PseuSpeTwoToThree/2 – tuai	PseuSpeTwoToOne/4 – PseuSpeTwoToThree/2
1	Z	–4.105[b]	–4.480[b]	–2.778[c]
	Asymp. Sig. (2–tailed)	.000	.000	.005
	Exact Sig. (2–tailed)	.000	.000	.005
	Exact Sig. (1–tailed)	.000	.000	.002
	Point Probability	.000	.000	.000
2	Z	–2.339[b]	–2.472[b]	–1.933[c]
	Asymp. Sig. (2–tailed)	.019	.013	.053
	Exact Sig. (2–tailed)	.014	.014	.094
	Exact Sig. (1–tailed)	.007	.007	.047
	Point Probability	.000	.000	.039

a. Wilcoxon Signed Ranks Test b. Based on positive ranks. c. Based on negative ranks.

7.3 The pupils' spelling variants on the pseudo-pinyin syllables

The spellings by the first-grade pupils were far more diverse than those of the second-grade pupils. Also, for the first-grade pupils, the longer the syllable, the more variants they tended to produce. Take the syllable *fi* for example. The first-grade pupils produced

five entries, but the second-grade pupils had only two entries (Appendix VII, Table 1). The syllable *tuai* saw 17 variations among the first-grade pupils, with 58% of the spelling correct without counting tones, but only two variations were produced by the second-grade pupils, with 92.3% correct (Appendix VII, Table 2). The contrast of the spelling between the two grade groups is shown in the following table, which sums up the variations of the eight syllables. The result seems to suggest that, as children became more experienced with pinyin, their spellings tend to conform to the orthography. But comparison is difficult because of the unequal size of the samples (51 first-grade to 13 second-grade). For more details, see Appendix VII, Tables 1 to 8.

Table 7.4 Entries of variants of the pseudo-pinyin syllables

Syllables	Number of entries in the first grade	Number of entries in the second grade
fi	5	2
tuai	17	2
giang	23	2
zhia	18	8
nui	18	5
pun	22	5
luang	17	3
shiong	21	10

7.4 The pupils' spellings

The strikingly better performance on syllables with one-to-one letter–sound correspondence indicates that the pupils followed the alphabetic principle in their spelling. Where there is an ambiguity about this correspondence, the pupils—especially those in the first grade—would spell out the sound which is abbreviated in the orthography. This

phenomenon can be seen in the spellings of *duei*, *duui*, *nuai*, *nuei*, and *nuui* for *nui* (Appendix VII, Table 5), where *ui* stands for the sound *uei*; and in the spellings *huen*, *guen*, *tuun*, *uen*, *wen*, and *puen* for *pun* (Appendix VII, Table 6), where *un* stands for *uen*. These finals in the two syllables *nui* and *pun* bear two-to-three letter–sound correspondence.

Perhaps, children's spelling following one-to-one sound–letter correspondence is better seen in their spellings *duui*, *nuui*, and *tuun*, because there is no syllable in pinyin using a doubled letter to represent a lengthened sound. Therefore, this doublet could indicate that they had noticed that the sound was longer than the spelling *ui* or *un* represents, and chose to add extra letter to express the length of the syllable. But why did they choose *u*, not other letter, to represent the length? We have mentioned that the initial is taught by pronouncing with a vowel attached to it. However, which vowel is attached is entirely dependent on what final follows the initial. Probably that is why, in these two cases, we observed *u* rather than another sound. However, this tendency to accord to one-to-one letter–sound correspondence decreased dramatically in spelling these two syllables in the second grade. Could this reduction in transcribing phonetic details signal the better mastery of the pinyin orthography?

7.5 Influence of vernacular

Thirteen first-grade pupils spelled *zh* as *z*, but none of the second-grade pupils did. Instead, two second-grade pupils spelt *zh* as *j*, while four first-grade pupils did so. Recall that the sound of *z* and *j* are fundamentally the same ([ts]) (Duanmu 2007: 322, 328). The reason for the adoption of *j* in the pinyin orthography is that this letter is only followed by the *i* and *ü* sounds, and this way the pinyin system can maintain the alphabetic principle

of one symbol to one sound, while utilizing all the letters of the Roman alphabet. The same principle also applies to the adoption of the letter *q* and *x*. This use of *j* seems to continuously confirm that pupils did spell according to sound. The tendency to spell according to sound was more obvious in the syllable *shiong* in the first grade with as many as 33 pupils spelling *sh* as *x*. Interestingly, English-speaking learners of Chinese usually use *sh* to proximate the sound of *x*. Only 5 of the second-grade pupil spelled this syllable correctly.

7.6 Influence from the teaching method

It was mentioned in the introduction that an initial is usually pronounced with a vowel attached to it, which can result in the same pronunciation between the initial and the syllable. For example, children use the initial *c* to represent the syllable *ci*. This phenomenon is exactly like the English-speaking children using letter names to represent a word, which has the same sound. For example, using the letter R to represent the word ARE (Bissex 1980). Thus, twelve first-grade pupils spelled *za* as *zhia* and *ja* as *zhia* (featuring hypercorrection, as well, in the first case *z* → *zh*); at the same time, three second-grade pupils spelled *zha* for *zhia*. Here we recall, again, that in the teaching of the pinyin initials *z*, *zh*, or *j*, they are pronounced as *zi*, *zhi*, and *ji*, respectively. The hypercorrection of *z* to *zh* and vice versa and the omission of medial *i* were discussed in section 7.5 and in Sections 5.4 and 5.5. Equally, the omission of the medial *i* is likely to suggest the teaching influence. Such omission is also observed in the syllable *shiong*, with 7 first-grade pupils and 4 second-grade pupils omitting the medial *i*. This echoes the phenomenon in the omission of medial in spelling pinyin syllables, especially the ones

which seem redundant, when the sounds of having the medial and without it are identical, because of the hudu teaching method (Sections 5.4, 5.5, 5.6).

Chapter 8 Discussion

This chapter discusses the results of the children's performance in spelling, reading aloud, and pseudo-pinyin spelling tests.

The definition of challenge usually refers to something that needs great mental or physical effort in order to be done successfully (Merriam-Webster 2004). In the case of correctly using the orthography, the findings show there was no critical distinction between challenges that children face and difficulties that children found. To address the research questions, the important thing was to observe what was spelled and read aloud most correctly or incorrectly.

8.1 The pupil's overall performance in pinyin spelling

The performance suggests that even for Mandarin-speaking children there are challenges in learning to spell in pinyin.

Compared with the second-grade children of Jia's (1985) survey in Shanghai (Section 3.2.1), the Mandarin-speaking children of the present study had much lower attainment considering the full score of 37 (if the one retroflective syllable *zuir* is excluded) in the present study and that 61.4% of Jia's second-grade pupils got full marks on 400 syllables. The comparison draws attention to the differences between the two studies.

Jia's (1985) survey was conducted two months into the second year, while the present study was carried out during the school holidays or just a few days after the second year started. The pupils in the present study had no preparation for the test, while

Jia's were well prepared during term time. Jia selected schools for his survey, but the present study included schools over a wide academic range.

Considerations might also be given to the language the pupils speak. While the Shanghai dialect is unintelligible to Mandarin speakers; the non-native version of Mandarin influenced by the Shanghai dialect has some features which sound more like what the pinyin orthography represents. For example, the Shanghai pronunciation of *in* and *ing* coincides with the orthography of *yin* and *ying*. In contrast, the pupils in the present study would pronounce them as *ien*/*yen* and *ieng*/*yeng*, respectively, because this is how the local Mandarin of the study and the standard Mandarin is spoken, as is the Mandarin of Song's (1981) study (Section 3.4.2). Also, the Shanghai pupils' pronunciation would match, or be more close to, the pinyin orthography in *iu*, *ui*, and *un* (influenced by their dialect) than standard Mandarin pronunciation. The Mandarin speakers of the present study would pronounce these as *iou*, *uei*, and *uen*, as in standard Mandarin. Therefore, two types of syllable may not pose problems to Shanghai-dialect speakers. Especially, the most difficult type of syllable, i.e. two-to-three type, for the Mandarin-speaking pupils in this study might not be so difficult to spell correctly for Shanghai-dialect-speaking pupils. It was also noticed that in his spelling test comparing speakers of Shanghai dialect and speakers of Mandarin, Cao (1989) did not select any syllable which bears this two-to-three letter–sound correspondence type (see Section 2.2.2).

Another fact noticed is that, among the 400 syllables, most of them involve just one-to-one and two-to-one letter–sound correspondence. Syllables that involve orthographical rules are a minority. For instance, there are only four syllables in the w0y0

type, four syllables in the yu type, 15 syllables in the wuyi type, and 12 in the jqx type. The present study carefully selected syllables to balance the proportion of types, with only eight syllables of the simple one-to-one type. While Jia's (1985) research was to show that pinyin is not difficult in the Shanghai region for pupils in their second year of learning, the aim of the present study was to investigate where the difficulties are. Also, there might be other factors that make the performance different. The discussion above is presented partly to counter the naïve conclusion which might be drawn from Jia's result: that, since even non-Mandarin-speaking children found pinyin easy, native Mandarin speakers should find it yet easier. What Jia's (1985) results also suggest, on the other hand, is that more studies need to be done on the difficulties that face Mandarin-speaking pupils in learning to spell. The present study is one attempt, but more studies could be carried out with the comparison of the results in this particular study.

In the case of the first-grade pupils in Jia's (1985) study, they were only tested on the initials and only the six single finals, namely, *a*, *o*, *e*, *i*, *u*, and *ü*; while the first-grade pupils in the present study spelled exactly the same syllables as the second-grade pupils did. The fact that Jia did not test the whole set of syllables in the first grade suggests that it was less common than nowadays for children to learn pinyin in their preschool in the 1980s.

Recall that Shen & Bear (2000) wondered whether learning to spell in pinyin is developmental (Section 3.6). The present study shows that to be the case, in general. Such developmental performance was observed in the overall performance, with the second-grade pupils spelling significantly more correctly than the first-grade pupils.

However, in just one specific case, development in spelling correctly for the two-to-three type of syllable seems to have stopped at the first-grade level.

8.2 Pupils' performance in different types of syllable

A look at the pupils' creative spellings shows that children's errors were not made randomly based on memory but follow a pattern, which fits in the correspondence between the letters and sounds.

For the Mandarin-speaking pupils, their performance on the seven types seems to suggest that, when there is a one-to-one letter–sound correspondence in the syllable type, pupils spelled more correctly; when this correspondence is more complicated, they spelled less correctly; and when this correspondence is not clear or distorted, pupils spelled the worst (i.e. the two-to-three type). Both first- and second-grade pupils performed best in the one-to-one type and worst in the two-to-three type. Following the second-grade pupils, some of whom reached ceiling score on spelling the one-to-one type, the first-grade pupils spelled this type almost 80% correctly on average. In contrast, both grades spelled the two-to-three type below 50% correctly. All these seem to suggest that the pupils' spelling was guided by the alphabetic principle.

The results do not seem to fully support Cao's (1983) statement that syllables involving *w* and *y* are difficult to spell, if we look at the data. This is because, although the syllables involving *w* and *y* were not spelled most correctly, they are the second most correctly-spelled syllables. This indicates the importance of evidence-based research in children's learning to spell.

In addition, what Cao (1983) did not make clear is that there are two types of syllable under his category of *w* and *y* spellings. The present study shows that one type is

more difficult to spell correctly than the other for the younger pupils: that is, when *w* and *y* do not stand for sound (w0y0 type), this type of syllable was spelled more correctly than when they stand for sound (wuyi type). For the more experienced second-grade pupils, they seemed to have spelled equally well (Section 5.2). One notices that the yu and the w0y0 types are recognize-as-a-whole syllables. It seems this method works better with younger children, as it was believed (Section 3.1.2). In addition, one of the spelling types is not associated with letter-sound correspondence, but rather with the change of configuration, i.e. omitting the umlaut on the letter *ü* to produce *u*, called the jqx type.

Which type is more difficult, the type with distorted letter-sound correspondence or the change of form of the particular letter? For the first grade, the result for the spelling of jqx type was lower than the two-to-three type, but for the second grade it was the other way round, though no statistical significance was found. Such results suggest that younger children might have found the jqx type, a type that requires visual change, more challenging to learn than more experienced children. Importantly, this confirms Read's studies that beginner children spell initially phonetically, not visually.

The pupils' performance across the category of seven types show the relative ease of spelling recognize-as-a-whole types of syllable compared with the types of syllable whose orthographical correspondence between letters and sounds is either inconsistent (w0y0 type vs wuyi type) or distorted, i.e. the two-to-three type. This observation holds true for both first- and second-grade pupils. The first-grade pupils' performance on the recognize-as-a-whole syllables was not statistically different from that of the second-grade pupils in the yu type and the w0y0 type, which seems to have supported the recognize-as-a-whole method (Section 3.1.1). Note that the syllables involved in the two-

to-three type were taught in the same explicit way and yet with the worst result. This, again, seems to be best explained by citing the power of the logic behind the alphabetic principle. That is, if it is not logical, memory does not seem to work as well as the teachers expect.

However, the results seem to support Cao's remark that elements of pinyin can be difficult to spell because of the burden on memory; however, Cao (1983) did not clearly inform what exactly these elements are, nor whether the difficulties were of equal degree. The present study extends his statement and shows that, if the correspondence between letters and sounds in the syllable type is one to one, it is easiest to spell correctly. When the correspondence is two to one, it is hard, and when this correspondence is distorted to two to three, it becomes the hardest.

By categorizing syllable types according to the alphabetic principle, on which pinyin was designed, challenges in spelling each type correctly have been made clearer. Moreover, by including the second-grade pupils, information about whether the development is equal or not in spelling different type of syllables was obtained. For example, although the jqx type, which involves the change of letter form (i.e. *ü* to *u*) is difficult for both grades, the second-grade pupils spelled this type statistically better than the first-grade pupils. On the contrary, the performance on the two-to-three type of syllable suggests that development seems to have stopped at the first grade, because there is no statistically significant difference in the performance between the two grades. This particular finding suggests future experimenting with other teaching methods.

8.3 The pupils' creative spellings

The categorization of the seven types of syllable was based on the design of the pinyin system, but it is the pupils' creative spellings in their raw data that reveal the alphabetic logic in greater detail. Thanks to the "creative" spellings from the pupils, the question of why it is challenging to learn to spell certain types of syllable correctly can be answered with surer evidence.

Lin Mingxian (2009) and Shen & Bear (2000) show that children would make errors in syllables whose initial sounds the local vernacular do not distinguish. This is confirmed by the present raw data, particularly in the spelling of *zi* for *zhi* or vice versa. Such errors were described by Duanmu (2007) as "hypercorrection" when he notices people's speech after learning, and were implied by Jia (1985) and Cao (1989). The recorded raw data prompts a different interpretation. For example, *zr* or *zhr* were found by the present study, and the interpretation of such errors is that children spell according to sound. Equally, although Ha & Wei (2000) reported the error *sr* in their study of children, they believed, along with other researchers, that the errors occur because of lack of good memory. This might indicate the everlasting influence of learning Chinese characters where the visual memory plays an important role, while forgetting that the alphabet represents the sound only.

The fact that Yale romanization (see Section 1.2) concurs with the younger pupils' erroneous spellings in this study suggests that children do not only rote-memorize the sequence of letters, even under the situation of explicit teaching. On the contrary, their sharp hearing is not yet numbed by the customs of the orthography. Thus, Treiman's (1993) children spell *sky* as *sgy*, and the Chinese children spell *zi/zhi* as *zr*.

One merit of the pinyin system is that the majority of syllables bear the simple one-to-one correspondence between letter and sound. Largely, what the teachers are doing in the first few lessons (Appendix I) is, in effect, to demonstrate this one-to-one relationship between the letter and the sound. Therefore, the nonstandard "creative" spellings provide the evidence that children quickly grasp the alphabetic principle and apply it in a way unexpected by adults. So, if a syllable has the sound of *z* and *r*, then *zr* is a natural spelling. And so they did spell it. As a matter of fact, many alphabetically logical misspellings turn out to be the "common errors" in the observations by Song (1981), in the experiment by Lin (2009), and in the research by Ling (2004); for example, the spellings *yen*, *yeng*, *xiou*, and so on. In addition, as shown by researchers on the learning of the English writing system (Ellefson et al. 2009), the pupils' spellings in the present study also inevitably showed influence from the "Hudu" teaching method.

The puzzle of Lin Shouhua (1993) about the phenomenon of medial omission can be explained by the attribution of this method. This phenomenon echoes the findings among English-speaking children by other researchers, particularly Read (1971) and Treiman (1993). Thus, the medial-omission mystery adds to the evidence that children learn to spell in pinyin by following the logic of letter–sound correspondence, although this logic was little expected by the adults. It is tempting to claim that children at the beginning stage spell not phonemically but syllabically.

Pupils' errors were not limited to influence from the vernacular and the teaching method, both of which can also be explained by the correspondence between the symbols and sounds. Errors in spelling syllables involving *u* and *ü*, as shown in the syllable *lü*, have nothing to do with how the syllable is pronounced, but rather are concerned with a

rule, and probably with the appearance of the letters. In the spelling of *lu* for *lü*, by many children, an over-application of a rule is manifested. It seems that the emphasis on omitting the umlaut when *ü* is preceded by *j*, *q*, *x* is so overwhelming that children did it when the rule did not apply. What is surprising is that this type of syllable was the most difficult one to spell correctly for the younger children. This suggests that the change of the look of a letter makes learning the alphabetic writing system difficult. After all, it is a diacritic, *ü* versus *u*, which is not so noticeable as a totally different letter. Perhaps this is what Cao (1983) meant by "burden" on memory. However, learning this rule seems developmental, as the second-grade pupils spelled this type of syllable significantly better than the younger ones. Considering the hypercorrection in the syllable *lü*, one might look for errors in the opposite direction: to see whether there are *ü*s in the spelling of *xun*, *jun*, and *quan*. And indeed there are. (Here a reminder is posted that the letter *v* in the tables of children's spelling records stands for *ü*, following the way that *ü* is input on the qwerty keyboard to output the Chinese characters).

As Jia (1985) showed that visual confusion seems to cause some difficulties in spelling certain letters correctly, the pupils in the present study also made errors with letters which are mirror images of one another, such as *p* or *q*.

Thus, the pupils' misspelled syllables reveal the dialect they speak, the teaching method that was used, and the individual perception of the language and the pinyin writing system. What strikes one is the logic behind them: whatever the letters they used, for example *lu* for *lü*; *jün* for *jun*; *qyuan* for *quan*; and *qeng*, *peng*, *ping*, or *ging* for *qing* and how ever many letters they used e.g. *xong* for *xiong*, *huei* or *huui* for *hui*, and *shuuang* or *shang* for *shuang*; there is a correspondence between the letters and the sound.

However, it is admitted that there are many singular spellings that do not fit these descriptions and defy explanation.

The spelling data, along with the reading-aloud data and pseudo-pinyin data, show what errors are most common, hence pointing to the reason why certain syllables are challenging, but more importantly, the data show how reliable and repeatable the tests can be.

8.4 Children's performance in reading aloud

The performance in reading aloud suggests that reading in pinyin is easier than spelling. Moreover, seen from both grades, reading aloud does not seem to follow the alphabetic principle: the pupils read the one-to-one type of syllable no more readily than the other types, in contrast to their performance in spelling. Further, the two-to-three ceased to cause problems, and neither did the wuyi type and jqx types seem to be challenging, although these three types were the hardest types of syllable to spell correctly for the first-grade pupils. Such results perhaps can be explained by the fact that reading is provided by others, but spelling requires production on one's own. The result of reading aloud prompts one to think that recognize-as-a-whole method could be a far more effective approach than an analytical one-to-one approach in teaching children in this age range to read.

Recognizing this difference between reading and spelling, one could be curious to observe whether there was any influence from local vernacular in the reading aloud and influence from the hudu teaching method. There was, however, little trace of it: that is, pupils read with a clear standard Mandarin pronunciation, including almost flawless tones. What stopped the pupils having a perfect first attempt was when they tried to blend

syllables, using syllabic initials to blend with the finals. This blending problem is well known and was observed as soon as pinyin was promulgated among illiterate adults (Yu 1959), documented by Yin et al. (1992), and tested in experiments by Wang & Gao (2011), and also observed by Read et al. (1986).

Apart from this, unlike the big challenge that children faced in spelling, the jqx type, a type where the *u* stands for *ü* caused only a few faulty readings. Compared with the spelling performance, the result in the reading aloud test suggested that reading is different from spelling, though certainly not the reverse of spelling. Rather, it may have its own process, as found by the research in the English language (e.g. Frith 1979; Read 1986). Because of the short span of pinyin syllables, with the longest having only six letters, and most having three or four letters (plus the small number of different ones), it is tempting to interpret that, after an initial stage of learning how to blend the syllables, pupils read the syllables in the recognize-as-a-whole manner. However, because the first-grade pupils' data were biased towards those who had attempted all the syllables with no more than two stumbles in succession, the discussion here should be treated with caution.

While the pupils seemed to read aloud happily, it did not imply that they knew the meaning. The fact that many pupils did not understand the meaning of the syllables indicates that they could not guess the meaning just by looking at the syllables, unlike the Chinese characters where "scholars could read by half of it", as the Chinese saying goes (Zhou 1964). This also brings forward some interesting questions for future research, such as how far can meaning be obtained simply by reading in pinyin. It would be interesting to compare reading pinyin with reading Chinese characters.

8.5 Children's performance in the pseudo-pinyin spelling test

Consideration of frequency and familiarity has become the norm in the study of children's literacy development in other languages, English for instance (Nunes & Bryant 2009). To eliminate the possible effect of these factors on performance with pinyin syllables, a test was done with pseudo-pinyin syllables. The pupils' performance more or less reflects the findings in their performance in the pinyin-spelling test. The one-to-one type of syllable was the easiest to spell correctly and the two-to-three the hardest. The results seem to confirm that, if a syllable has an exact match between letters and sounds, then it is easy to spell correctly; otherwise, the syllable is likely to cause problems. However, this result begs the question: how is the number of sounds counted? No doubt, it is the teachers, or anyone who teaches the writing system, who decides it. On the other hand, the operation of it, the way each sound is pronounced might complicate the matter. For example, if *xi* is pronounced as *x*, how many sounds are there in *xi*? And vice versa? If, as all the phoneticians pointed out (e.g. Jones 1976), the number of sounds in an utterance is indefinitely large, then it is up to the phonetician to decide how many sounds there are in a word or syllable. And, the most frequent reference they consult is the orthography. When there is a discrepancy between the orthography and the language, it is likely to cause difficulties in learning to spell. In addition, difficulties may arise when a change in the visual appearance of a letter is required: in the case of pinyin, the *ü* changing into *u*.

As well as showing results broadly similar to those in the pinyin spelling test in spelling the three types of pseudo-syllable, the pupils' spelling reflects the influence from the teaching method and vernacular. However, their spellings also seem to show that, for

pseudo-pinyin syllables, the influence of vernacular is weakened, as they may have to spell according to the sound they heard. This observation suggests that, although pinyin does not embody the meaning, it would eventually link with meaning, as soon as it is used to represent the living language.

In summary, the pupils' performance shows that there are difficulties in learning to spell in pinyin. Their performance also shows that the difficulties lie in the mismatch between the letters and sounds. Moreover, the difficulties are not of equal degree: if there is a one-to-one match between the letters and sound, it is easy to spell correctly; otherwise, it is hard. A difficulty also arises in modifying the letter, as in writing *u* for *ü*. However, the most difficult spelling type is the one that has the most ambiguous match between the letters and sounds, and that is the two-to-three type, even though the exact sequence of letters is explicitly taught.

8.6 The pinyin system and the Chinese language

Not much has been recorded, prior to the present study, about where the pinyin writing system is at variance with the standard Chinese—Putonghua that it was designed to represent. Nevertheless, there has been a belief that, in learning to spell, pupils only needed to memorize the sequence of the letters because every possible correspondence between the letters and sounds in the pinyin system is explicitly taught.

The present data reveal that, given the freedom to spell, pupils produce spellings that have previously never been recorded, reported, or studied. These creative spellings are a reflection of the Chinese language, which is not represented as transparently as is thought in the pinyin writing system. One of the reasons that there is a discrepancy between a writing system and a language is that the sounds of a language have many

dimensions but the letters have only one: their linear order. This means that, for children, learning to spell is not only a matter of passive copying and rote learning the sequence of letters, as was once assumed, but also an active exercise of their own initiative. This is true even in learning pinyin, the easiest writing system in the world, according to Newnham (1971).

Contrary to the preconceived adults' belief that learning to spell is to rote-learn everything that is explicitly taught, the pupils' spellings demonstrate that there is also reasoning, trying to deduce the rules involved in the process. The logic behind their reasoning is the alphabetic principle.

8.7 The pinyin system and its logic

It is interesting to see that reasoning is more persistently exercised than simple memorization. To see where this logic comes from, it is necessary to go briefly over the teaching sequence in learning pinyin (Appendix I).

Pinyin teaching starts with initials and finals that have a one-to-one relationship such as *ba* (dad) and *ma* (mum). This means that teaching pinyin is teaching the ideal alphabetic principle. This exact mapping continues until pupils come to learn digraphs. The consonant digraphs, namely, *zh*, *ch*, and *sh*, which are in the initial position, are taught explicitly. Explicit teaching is also given for the digraph *er*, which only forms a syllable on its own and does not have initials to precede it, in the case of 儿 (*ér*: son), 二 (*èr*: two), 耳 (*ěr*: ear). Therefore, the relationship between letters and sounds in the four diagraphs *zh*, *ch*, *sh*, and *er*, which have two-to-one correspondence, is explicit. However, the fifth diagraph *ng*, which is part of the finals of *ing*, *ang*, *ong*, and *eng*, is usually not

taught separately from the vowels in the finals. The reason is that the sounds represented by *i, a, o,* or *e* in these finals are not exactly the same as those taught separately as single-vowel finals.

What is interesting is that children show no difficulty in reading aloud this kind of syllable. It seems that reducing the number of letters is more beneficial for reading than for spelling. The contrast between spelling and reading such syllables seems to indicate that the letter–sound correspondence does not play an overwhelming role in reading pinyin syllables—but it does in spelling. The present finding seems to echo the evidence in children's learning of English writing, that pupils read with the "eye" and spell with the "ear" (Frith 1979). This finding might also have explained why research in pinyin has not been approached from the viewpoint of the logic of linking letters and sound: on the one hand, such a principle did not manifest in any evidence from reading aloud; on the other, there is little research on spelling. A reason for this lack of research in spelling might be that the design of the pinyin writing system is not thoroughly understood, as Wang (2008) points out.

The difficulties, reflected in the contrast between pinyin syllable structure and the memorization method in teaching it, also suggest that individual differences play a role in acquiring the logic. Although the teaching may rely on memorizing some forms of whole syllables at some stage, the underlying principle will begin to make sense from the outset when pinyin is taught by beginning with initials and finals with one-to-one correspondence. However, as research on learning English has made clear (e.g. Read 1975; Treiman 1993), this letter–sound correspondence is relatively easy for some children but difficult for others. Since there is discrepancy between the underlying

principle and the spelling, the link between the two might need to be made more explicit by the teachers (e.g. two-to-three type of syllables).

The other examples which show the logic behind the pupils' spellings of syllables are revealed in syllables such as *yin* and *ying*, where letter–sound correspondence is abbreviated in the orthography; the logic was expressed by the pupil's phonetically (but not orthographically) accurate spellings such as *yen*, *ien*, or *yien* for *yin*, and *yeng*, *ieng*, or *yieng* for *ying*.

In the present study, the pupils' logical spelling errors demonstrate their power of observation and their ability to relate things to one another. Moreover, the errors show that children learn far beyond what they were expected to do (i.e. memorize the sequence of letters).

Chapter 9 Conclusions

The aim of this study was to investigate the challenges that young Mandarin-speaking children encounter in learning to spell, particularly in pinyin, the alphabetic writing system for the Chinese language. One hundred and forty-two 5-to-6-year-old pupils, who learned pinyin at preschool, and 50 pupils aged from six to seven years old, who had exposure to pinyin for one more year at primary school, took part in a spelling test, while some took part in a reading-aloud test and a pseudo-pinyin spelling test. Their raw data and their performance in the tests were analysed according to the theoretical framework of the alphabetic principle. Four conclusions are drawn.

First, pupils learn to spell following the principle of the alphabetic writing system: there is a correspondence between letters and sounds. At the simplest level, one letter corresponds to one sound. Although this important principle is not taught explicitly, and not known to some teachers (Wang 2005), the pinyin lessons show the relationship, albeit not exact sometimes, which results in seven types of spelling pattern in the orthography. This one-to-one logic was manifested in all the spelling types, but the two-to-three type, where the correspondence between three letters to three sounds was abridged to two letters to three sounds, was particularly revealing (see Section 5.2).

Perhaps the explicit teaching method reinforces the belief that learning to spell in pinyin depends on rote learning. And yet, the logic of the writing system, which most of the time fits the correspondence of letters and sounds by one-to-one relationship, seems to be the driving force in their learning process. Memory is essential in spelling as with learning in many subjects at school. However, the pupils' spellings demonstrate that, in learning to spell in pinyin, much more than memory is involved, even under the condition

where every initial, final, and combination of them is taught explicitly. As people seek rules and categories when learning, learning pinyin is no exception. This was best revealed by their logical mind and sharp ears in their creative spellings such as *zr*, *yen*, *yeng*, and *xiou*, where there is discrepancy between the language and the orthography. With the evidence that alphabetic logic influences children's strategies in spelling, it gives rise to certain types of error (discussed in Sections 5.5, 5.7).

Secondly, the pupils' performance on spelling shows that Mandarin-speaking children have challenges in learning to spell in pinyin, even though pinyin is tailored to the Mandarin dialect. The pupils' spelling performance leads one to conclude that spelling challenges in pinyin vary with dialect and teaching method. Therefore, findings for one dialect group may not be generalized to another. Consequently, time and strategy in teaching certain types of syllable would need to vary, as would the teachers' response to the errors that their pupils make. This means there might not be such a thing as universal challenges in learning pinyin, with seven major dialects spoken among the major ethnic group—the Han people. This is even before one considers the fifty ethnic minority groups of people in China, principally within the large areas of Tibet, Xinjiang, and Yunnan. Each ethnic group would have several dialects of its own. This means that more research needs to be conducted in order to understand what challenges young pupils face in different regions.

Thirdly, learning to spell is still developing after one year at the primary school, but reading aloud seems to develop quickly and reach a ceiling by that time. In addition, reading aloud does not seem to follow the alphabetic logic. This finding is in line with

Frith (1979), whereby learning the English language among primary schoolchildren occurs by reading with the eye and spelling by the ear (e.g. Frith 1979).

The data also brings a fourth conclusion about learning an alphabetic writing system in general. Although there are great differences between the European languages and Chinese, the spelling strategies of children are similar. First, Chinese children's creative spellings show the same logic as the English-speaking children's creative spellings in the observations by Read (1970, 1971, 1975), Treiman (1993), and Beers et al. (1977). Also, like their peers speaking English, the Chinese pupils found it easiest to spell the syllables with a one-to-one letter-sound correspondence. To take an example, the medial *u* ([w]) in the English word *quarter* was omitted, and the word was spelled as *qarter* by children in Treiman's (1993: 326) study. Similarly, the Chinese pupils would omit the *i* in a syllable such as *xiong*, using *x* for *xi*. These similarities confirm the existing theory that learning to spell follows the alphabetic principle in general and also using the sound of letters to represent the whole word or syllable in particular. Thus, one is tempted to conclude that learning an alphabetic writing system for beginner children is not only universally similar but exactly the same logically. However, there can be no such thing as universal challenge, with regards to learning to spell in pinyin, as it has been shown that spelling is affected by the speech spoken in different regions.

The findings in the present study prompt some interesting questions for future research. Pinyin was designed purely based on the sound—not meaning. However, because syllables have meaning, it would be interesting for future research to address whether there is a connection between learning the syllables and knowing the meaning

(of what the pupils spell and read). The present research was only incidentally able to address this question.

Another question is whether young pupils can learn to spell and read in the unit of the word in pinyin. Two points have been identified as handicaps that do not make pinyin an independent working orthography (e.g. Duanmu 2007). First, pinyin only represents the sound of the language, and there are far too many homophones in the language. The popular extreme example is that of the syllable *yi*, which corresponds to more than a hundred characters; and the small number of syllables, about 400 (varying slightly according to criteria), proves this point. The second point lies in the difficulty of defining the unit of word in the Chinese language. With the present finding on the spelling of *zuir*, it may not be so difficult for children to parse words in everyday language. Also, since most words are of two syllables, the number of homophone *words* is greatly reduced. Therefore, the two facts pointed out just now might not be handicaps in reality, or less so than thought. However, there is political issue involved: that is, if pupils find learning pinyin is easier than learning the Chinese characters, and if it is really possible to use pinyin to express what can be expressed in the Chinese characters, then there is a danger of losing the cultural heritage of the Chinese characters. This raises the question: then what is Chinese?

A further question is whether, and to what extent, there is a transfer from pinyin to English, as the writing systems are both alphabetic and the logic behind their learning to spell is similar, bearing in mind that English spelling is far more complex.

The present research adopted a cross-sectional approach and focused on the challenges encountered by first- and second-grade pupils, and it was conducted in a

Mandarin-speaking region. Other research could be based on either a cross-sectional or a longitudinal method and carry out investigations comparing different dialects. Given that the children's spellings show the logic of the alphabetic principle, an explanation by teachers about the abbreviation of letters in the orthography may be pedagogically useful. This, however, needs to be tested by further studies.

This investigation of difficulties in spelling and reading aloud in pinyin has produced some results that may be useful for pedagogical purposes. The results support the idea that, since pinyin is not orthographically "transparent", when teaching Chinese through pinyin, the discrepancies between pinyin orthography and actual sound should be pointed out and paid attention to. While the approach by the categorization of the spelling type is effective for identifying and understanding spelling difficulties, it does not exhaust the topic. Children's creative spellings deserve more attention, since it is the raw data that disclose what cannot be seen from the standard spelling. It is hoped that the present study opens up an area of research and illustrates some ways in which the acquisition of the pinyin writing system may be approached.

There are presently about 30 million children in China in their first two years of learning and using pinyin (National Bureau of Statistics of China 2012). These children are geographically widely dispersed. Roughly two-thirds of them are native speakers of some variant of Mandarin, while the rest speak varieties of Chinese that, initially at least, are mutually unintelligible with Mandarin (and to a large degree, with each other). From such a population, it is not easy to obtain a truly representative sample yet. There is great scope for other researchers in the field of educational linguistics to extend the sample and the present study.

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Appendix I Chinese textbook (Wang & Yang 2009)

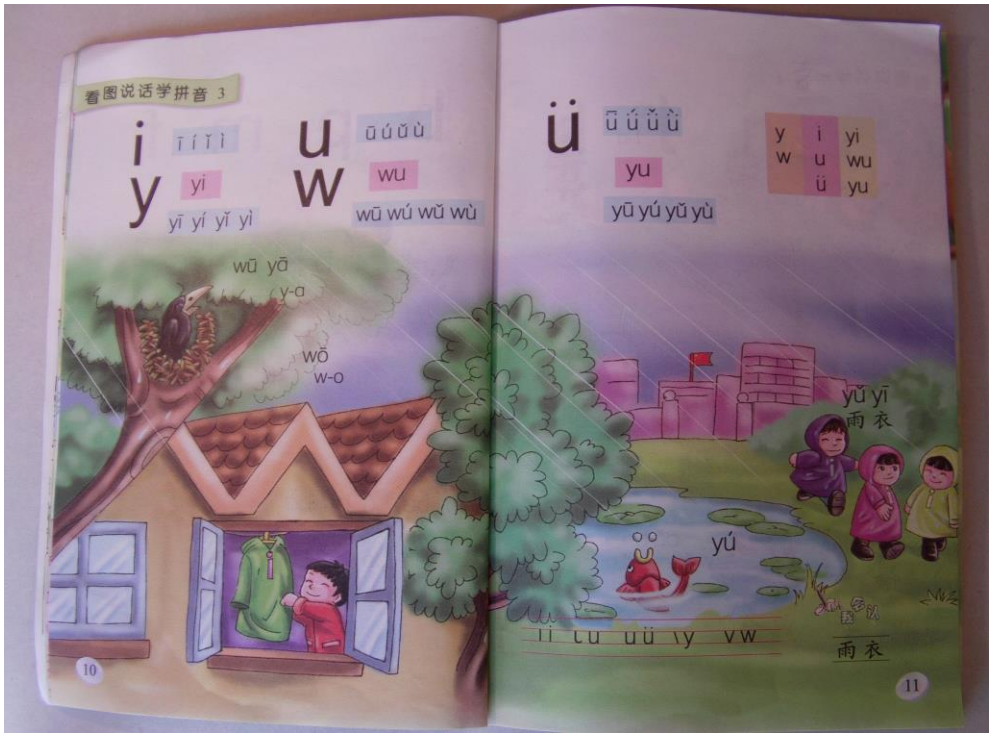
1. Lesson One: a, o, e



2. Lesson Two: b, p, m, f



3. Lesson Three: i, u, u; y, w; yi, wu



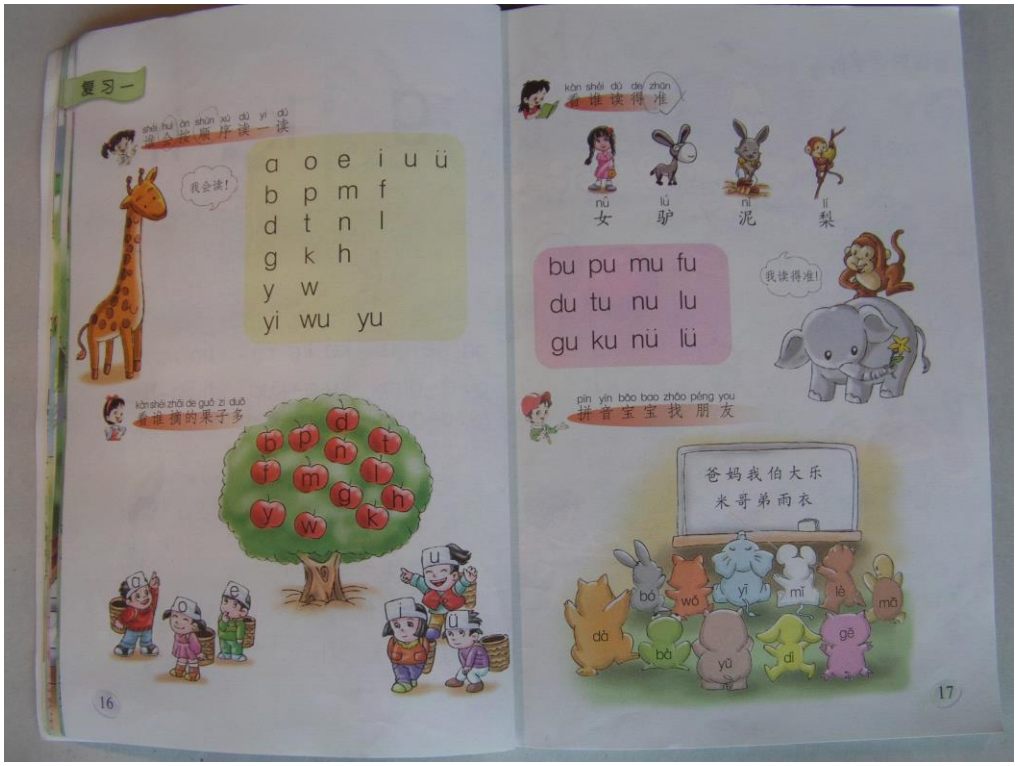
4. Lesson Four: d, t, n, l



5. Lesson Five: g, k, h



6. Revision One



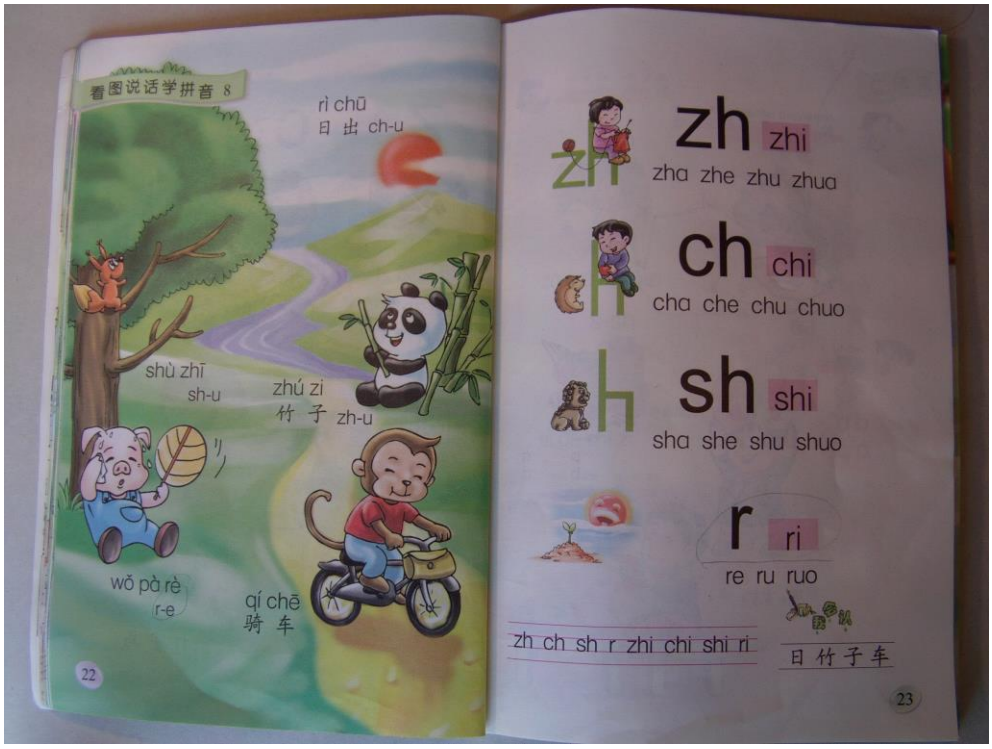
7. Lesson Six: j, q, x



8. Lesson Seven: z, zi; c, ci; s, si



9. Lesson Eight: zh, zhi; chi, chi; sh, shi; r



10. Revision Two



11. Lesson Nine: ai, ei, ui



12. Lesson Ten: ao, ou, iu



13. Lesson Eleven: ie, ye; üe, yue; er



14. Lesson Twelve: an; en; in, yin; yuan



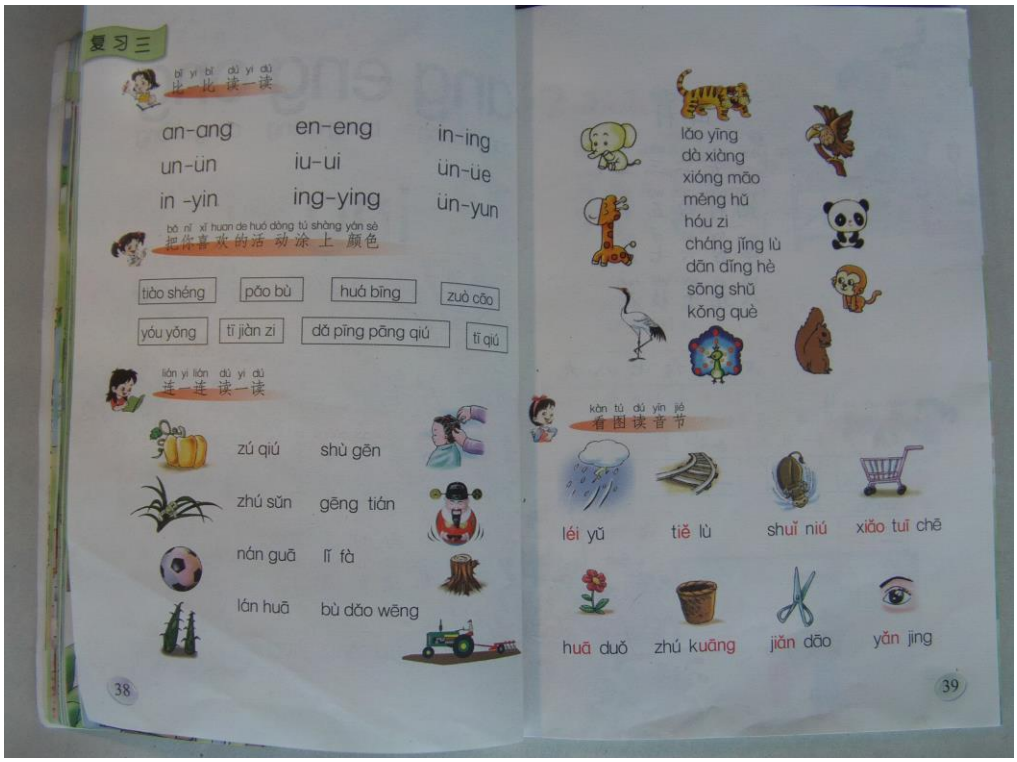
15. Lesson Thirteen: un; ün, yun



16. Lesson Fourteen: ang; eng; ong; ing, ying



17. Revision Three



18. Read aloud and sing along

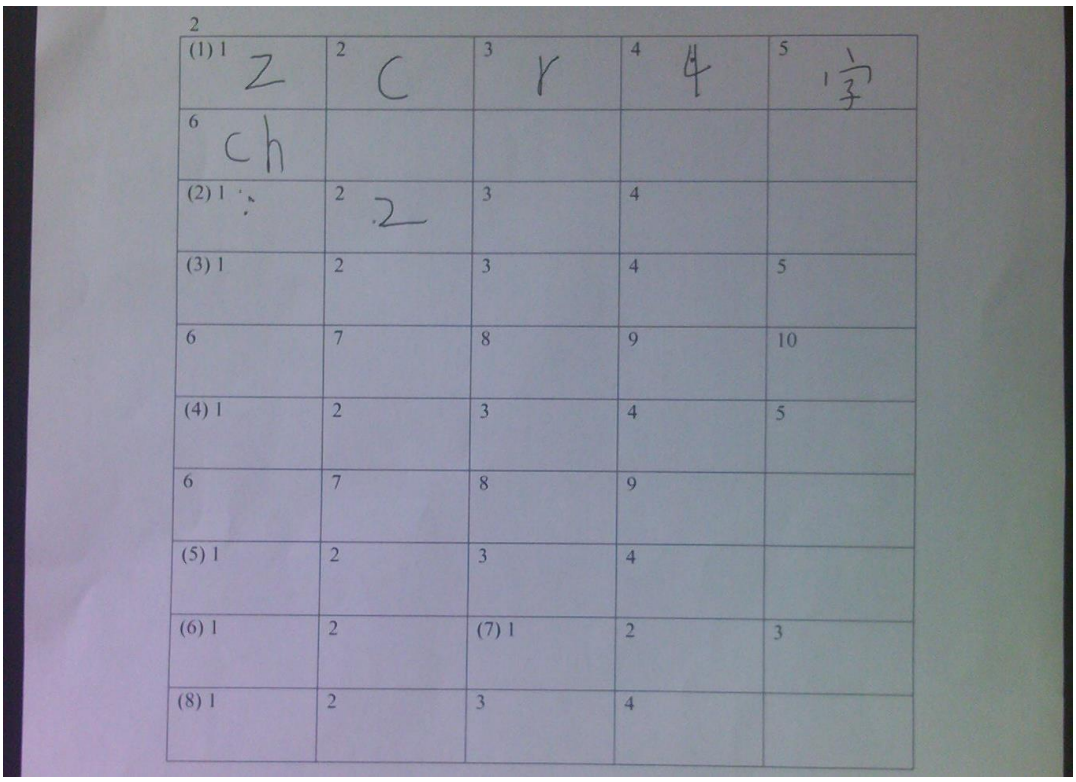


19. Summary of the taught pinyin (page 42)
Learning the characters: Lesson One (page 43)



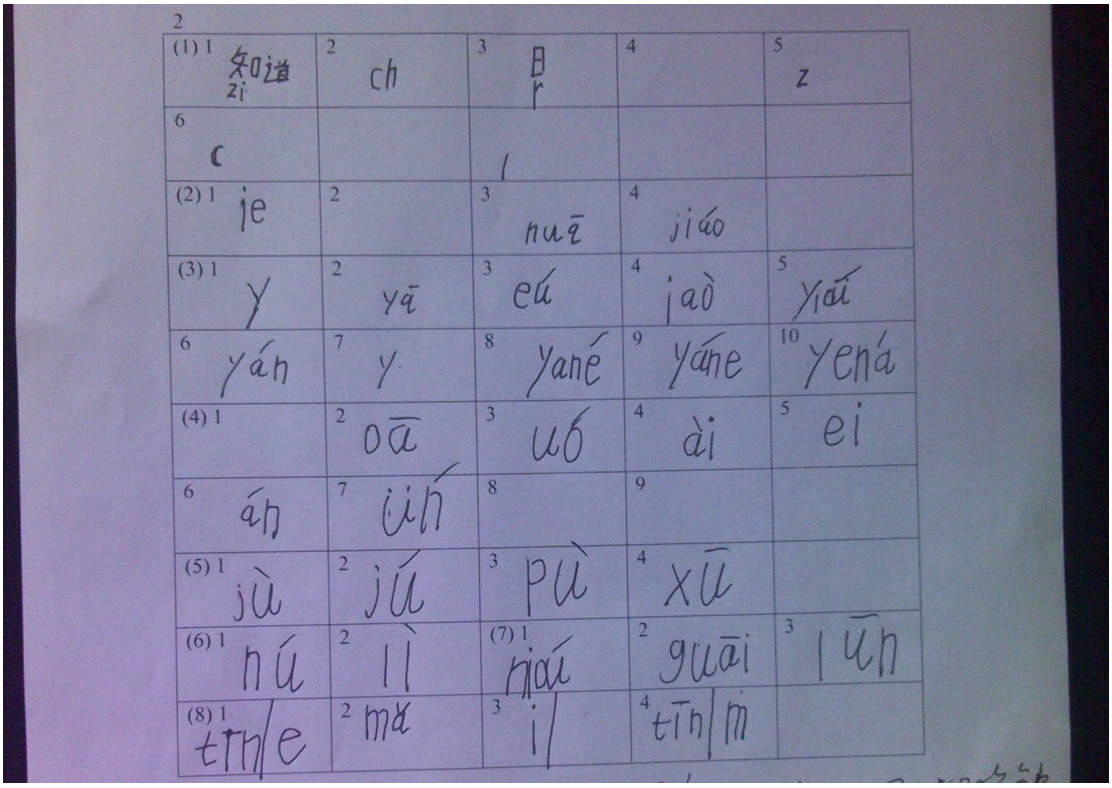
Appendix II Four children's testing papers in a pilot

Appendix II-1: Lucy's paper



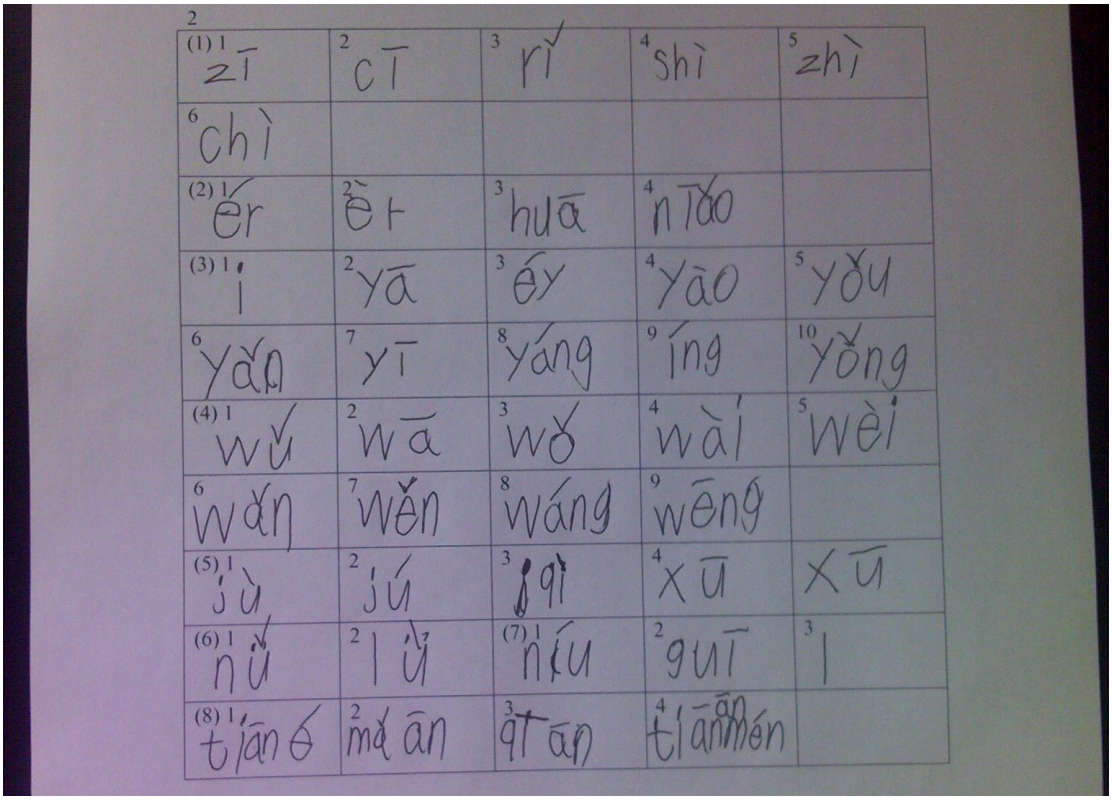
(1) 1 Z	2 C	3 r	4 4	5 1 1/7
6 ch				
(2) 1 :	2 2	3	4	
(3) 1	2	3	4	5
6	7	8	9	10
(4) 1	2	3	4	5
6	7	8	9	
(5) 1	2	3	4	
(6) 1	2	(7) 1	2	3
(8) 1	2	3	4	

Appendix II-2: Rosie's paper



(1) 1 zi	2 ch	3 r	4	5 z
6 c		l		
(2) 1 je	2	3 nuē	4 jiáo	
(3) 1 y	2 yā	3 eú	4 jaò	5 yiáí
6 yán	7 y	8 yané	9 yáne	10 yená
(4) 1	2 oā	3 uó	4 ài	5 ei
6 áh	7 iih	8	9	
(5) 1 jù	2 jú	3 PÙ	4 xū	
(6) 1 hú	2 lì	(7) 1 hiáí	2 guāi	3 lūh
(8) 1 th/e	2 mǎ	3 i/	4 tīh/m	

Appendix II-3: Ian's paper



(1) 1 zī	2 cī	3 rǐ	4 shì	5 zhì
6 chì				
(2) 1 ér	2 èr	3 huā	4 nǎo	
(3) 1 ì	2 yā	3 éy	4 yào	5 yǒu
6 yán	7 yī	8 yáng	9 íng	10 yǒng
(4) 1 wǔ	2 wā	3 wǒ	4 wài	5 wèi
6 wǎn	7 wěn	8 wáng	9 wēng	
(5) 1 jù	2 jú	3 qì	4 xū	xū
(6) 1 nǚ	2 lǜ	(7) 1 niú	2 guī	3 ì
(8) 1 tiān é	2 mǎ ān	3 qǐ ān	4 tiānmén	

Appendix II-4: Henry's paper



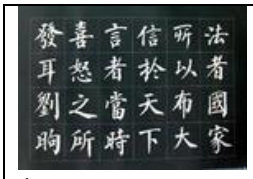
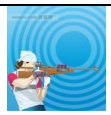
2				
(1) 1 zhī	2 chī	3 rì	4 sì	5 zì
6 chì				
(2) 1 ér	2 èr	3 huā	4 niǎo	
(3) 1 yī	2 yā	3 yé	4 yào	5 yǒu
6 yǎn	7 yīn	8 yáng	9 yíng	10 yǒng
(4) 1 wǔ	2 wā	3 wǒ	4 wài	5 wèi
6 wǎn	7 wén	8 wáng	9 wēng	
(5) 1 jù	2 jú	3 qǔqù	4 xū	xū
(6) 1 nǚ	2 lǜ	(7) 1 ~~liú~~ niú	2 guī	3 lún
(8) 1 tiān é	2 mǎ ān	3 xī ān	4 tiān ān mén	

Appendix III Tests

Spelling test

听写：小朋友，请你用拼音写出你所听到的。 听到什么写什么。 (Dear children, please write in pinyin what I am going to read for you. There is no right or wrong. Whatever you write is correct. Please write as many as you can) 。

1 字 zì 2 雨衣 yǔ yī 旅**游** lǚ yóu 4 机会 jī huì 5 热 rè 6 准 zhǔn 7 全军 quán jūn
8 音乐 yīn yuè 9 耳闻 ěr wén 10 围嘴儿 wéi zuǐr 11 蛹 yǒng 12 熊 xióng 13 霜 shuāng14 西瓜 xī guā 15 莴笋 wō sǔn 3 乌云 wū yún 17 休假 xiū jià 18 支持 zhī chí 19 秋天 qiū tiān
20 事情 shì qing 21 遵循 zūn xún 22 鹰 yīng 23 远 yuǎn

 1	 2	 3	 4
 5	 6	 7	 8
 9	 10	 11	 12
 13	 14	 15	 16
 17	 18	 19	 20

 21	 22	 23	

Pseudo-pinyin spelling test

T's use 姓名　　男女 班级：　　出生：　年　月　日 是否学过英语：是否
ID 代号:　　School:　　Teacher:　　Test date:
Note:

The following words are spoken by an alien. Have you ever heard the language spoken by an alien? The language spoken on this other planet, where the alien comes from, sounds a bit like Chinese, so you can write the words in pinyin, but they are not really Chinese words. Please listen carefully and write down the alien words in pinyin. (你听过外星人说的话了吗？外星人的话有点像中国话，所以你可以用拼音写下他们的话。但他们的话不是中国话。下面的话是外星人说的，请用拼音写下来)

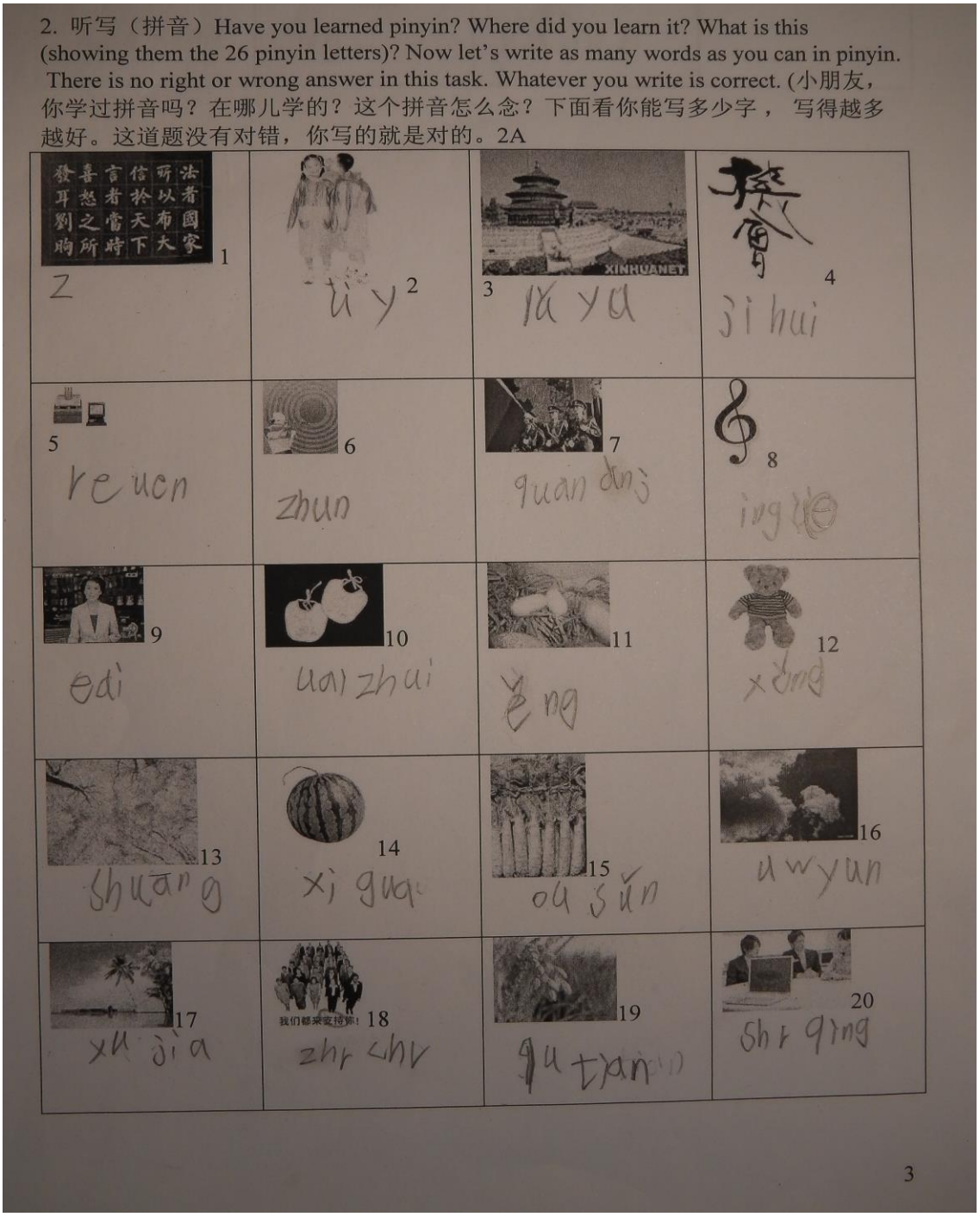
1 fì 2 tuǎi 3 giáng　　4 zhiā　5 nuī　6 pún 7 luǎng　8 shiòng

Reading aloud test

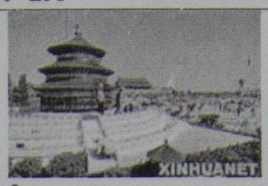
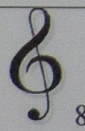
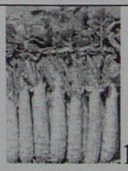
朗读：Would you please peal the sticker and see what is underneath? Please tell me what is written。
（请你揭开粘纸看看底下写的是什么。读一读）

1．Shì zi　　2 nǔ ér　　3 rǎn　　4 rú guǒ
5 wài yàn　　6 wén jù　　7 wǔ shuì　　8 qū qur
9 zhī shi　　10 yǔn nuò　　11 yǐng yìn
12 yú yuè　　13 yuán yì　　14 niú dùn　　15 ruì xuě
16 xiù qiú　　17 liáo luàn　　18 miù lùn　　19 guāng róng
20 niáng　　21 zhuàng

Appendix IV: Two first-grade pupils' papers

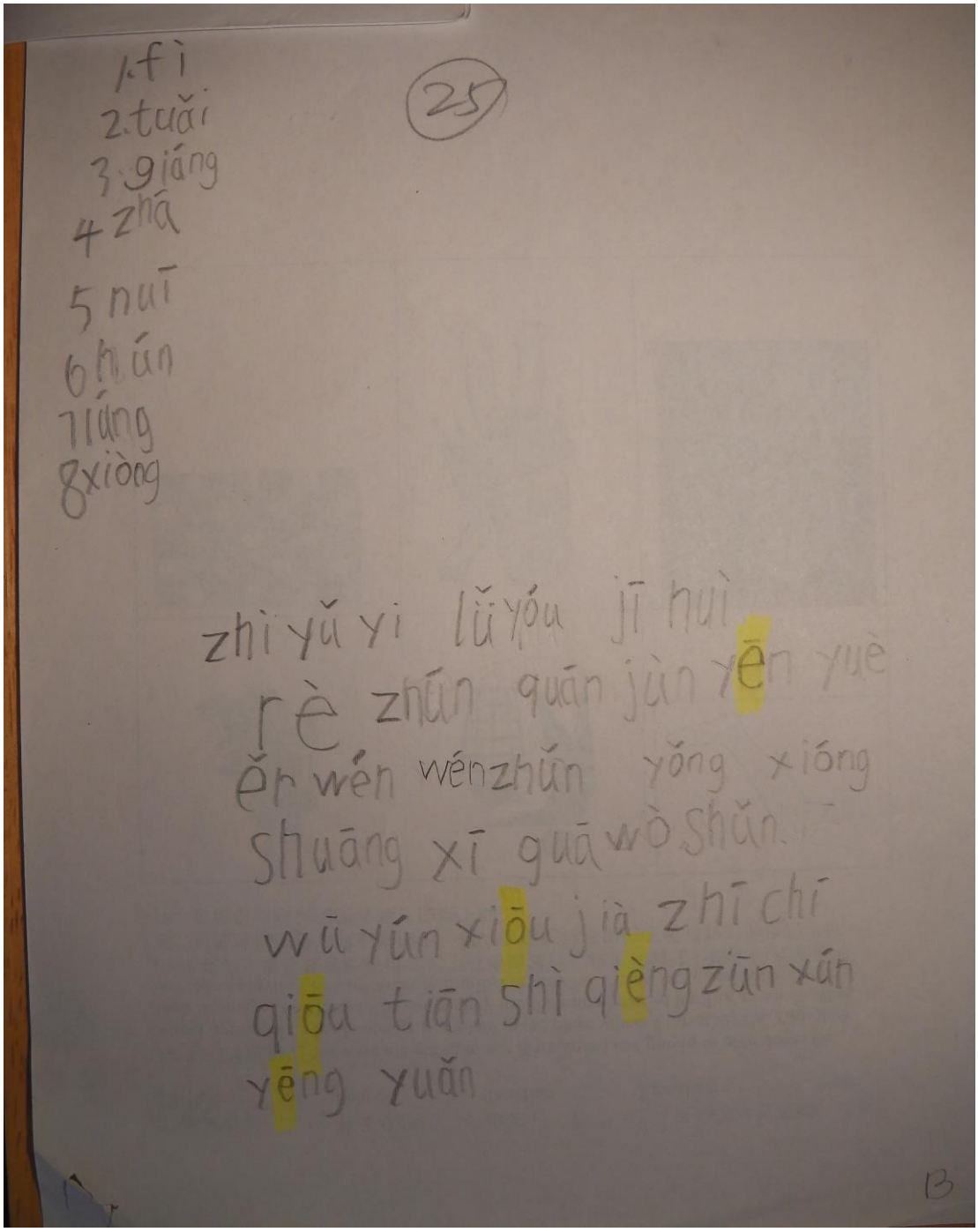


(showing them the 26 pinyin letters)? Now let's write as many words as you can in pinyin. There is no right or wrong answer in this task. Whatever you write is correct. (小朋友，你学过拼音吗？在哪儿学的？这个拼音怎么念？下面看你能写多少字， 写得越多越好。这道题没有对错，你写的就是对的。2A

 1 zì	 2 yǔ yī	 3	 4 jī huì
 5 rè	 6 zh	 7 qián jūn	 8 yēn yù
 9 e	 10 w zhǔi	 11 yóu	 12 x
 13 sh	 14 guā	 15 ~~wo~~sh	 16
 17 xiū jià	 18 zhīchí	 19 qiūtiān	 20 shì qing

 21 zhun xam	 22 ing	 yuan 23	

Appendix V: A first-grade pupil's paper



Appendix VI: Reading-aloud data

Shi4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	1	9.1	9.1	9.1
		shi1	4	36.4	36.4	45.5
		shi4	6	54.5	54.5	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0
		shi1	6	30.0	30.0	35.0
		shi4	13	65.0	65.0	100.0
		Total	20	100.0	100.0	

zi0

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	1	9.1	9.1	9.1
		zi0	4	36.4	36.4	45.5
		zi1	6	54.5	54.5	100.0
		Total	11	100.0	100.0	
2.00	Valid	zi	11	55.0	55.0	55.0
		zi0	2	10.0	10.0	65.0
		zi1	6	30.0	30.0	95.0
		zi4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

nv3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	nu3	1	9.1	9.1	9.1
		nv3	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	2	10.0	10.0	10.0
		nu3	1	5.0	5.0	15.0
		nv1	1	5.0	5.0	20.0
		nv3	16	80.0	80.0	100.0
		Total	20	100.0	100.0	

er2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent

1.00	Valid	er2	11	100.0	100.0	100.0
2.00	Valid	0	1	5.0	5.0	5.0
		e2	1	5.0	5.0	10.0
		er1	1	5.0	5.0	15.0
		er2	15	75.0	75.0	90.0
		er3	2	10.0	10.0	100.0
		Total	20	100.0	100.0	

ran3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	1	9.1	9.1	9.1
		ran3	9	81.8	81.8	90.9
		ren3	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0
		an3	1	5.0	5.0	10.0
		kan3	1	5.0	5.0	15.0
		ran2	1	5.0	5.0	20.0
		ran3	13	65.0	65.0	85.0
		ren	1	5.0	5.0	90.0
		ren3	2	10.0	10.0	100.0
		Total	20	100.0	100.0	

ru2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	lu2	1	9.1	9.1	9.1
		ri4	1	9.1	9.1	18.2
		ru2	9	81.8	81.8	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0
		lu4	1	5.0	5.0	10.0
		r	1	5.0	5.0	15.0
		ru2	16	80.0	80.0	95.0
		u2	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

guo3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	gou2	1	9.1	9.1	9.1

		gou3	1	9.1	9.1	18.2
		guo1	1	9.1	9.1	27.3
		guo3	7	63.6	63.6	90.9
		uo	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
		0	1	5.0	5.0	5.0
		gou3	1	5.0	5.0	10.0
2.00	Valid	guo3	17	85.0	85.0	95.0
		guo4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

wai4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		wai4	10	90.9	90.9	90.9
1.00	Valid	wei4	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
		wa3	1	5.0	5.0	5.0
		wai3	1	5.0	5.0	10.0
		wai4	16	80.0	80.0	90.0
2.00	Valid	wei2	1	5.0	5.0	95.0
		wei4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

yan4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		yan2	1	9.1	9.1	9.1
		yan4	9	81.8	81.8	90.9
1.00	Valid	yen4	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
		yan3	3	15.0	15.0	15.0
2.00	Valid	yan4	17	85.0	85.0	100.0
		Total	20	100.0	100.0	

wen2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		wei2	1	9.1	9.1	9.1
1.00	Valid	wen2	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	wen2	20	100.0	100.0	100.0

ju4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	ju4	10	90.9	90.9	90.9
		jue4	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
2.00	Valid	ju2	1	5.0	5.0	5.0
		ju3	1	5.0	5.0	10.0
		ju4	16	80.0	80.0	90.0
		jue4	1	5.0	5.0	95.0
		yu4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

wu3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	wa1	1	9.1	9.1	9.1
		wu1	1	9.1	9.1	18.2
		wu3	9	81.8	81.8	100.0
		Total	11	100.0	100.0	
2.00	Valid	wu1	1	5.0	5.0	5.0
		wu3	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

shui4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	shu4	1	9.1	9.1	9.1
		shui3	2	18.2	18.2	27.3
		shui4	8	72.7	72.7	100.0
		Total	11	100.0	100.0	
2.00	Valid	shi4	1	5.0	5.0	5.0
		shou4	1	5.0	5.0	10.0
		shui4	17	85.0	85.0	95.0
		sjui4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

qu1

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	qu–	1	9.1	9.1	9.1
		qu1	10	90.9	90.9	100.0
		Total	11	100.0	100.0	

		q	1	5.0	5.0	5.0
2.00	Valid	qu1	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

qur0

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	7	63.6	63.6	63.6
		qu–er2	1	9.1	9.1	72.7
		qu4	1	9.1	9.1	81.8
1.00	Valid	qur0	1	9.1	9.1	90.9
		quri	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
		0	10	50.0	50.0	50.0
		qiong2	1	5.0	5.0	55.0
		qiu2	1	5.0	5.0	60.0
		qu1er	1	5.0	5.0	65.0
2.00	Valid	qu2er2	1	5.0	5.0	70.0
		que1	1	5.0	5.0	75.0
		qur	2	10.0	10.0	85.0
		qur0	3	15.0	15.0	100.0
		Total	20	100.0	100.0	

zhi1

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	2	18.2	18.2	18.2
1.00	Valid	zhi1	9	81.8	81.8	100.0
		Total	11	100.0	100.0	
		zh1	1	5.0	5.0	5.0
2.00	Valid	zhi1	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

shi0

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	2	18.2	18.2	18.2
		shi	5	45.5	45.5	63.6
1.00	Valid	shi0	1	9.1	9.1	72.7
		shi1	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0

		chi	1	5.0	5.0	10.0
		sh1	1	5.0	5.0	15.0
		shi	8	40.0	40.0	55.0
		shi0	4	20.0	20.0	75.0
		shi1	5	25.0	25.0	100.0
		Total	20	100.0	100.0	

yun3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		yuan3	1	9.1	9.1	9.1
1.00	Valid	yun3	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
		0	4	20.0	20.0	20.0
		yin4	1	5.0	5.0	25.0
		yun2	2	10.0	10.0	35.0
2.00	Valid	yun3	12	60.0	60.0	95.0
		yun4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

nuo4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		nuo	1	9.1	9.1	9.1
1.00	Valid	nuo4	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
		0	1	5.0	5.0	5.0
		duo3	1	5.0	5.0	10.0
2.00	Valid	nou4	1	5.0	5.0	15.0
		nuo4	17	85.0	85.0	100.0
		Total	20	100.0	100.0	

ying3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		ying3	10	90.9	90.9	90.9
1.00	Valid	ying4	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
		0	1	5.0	5.0	5.0
		yang3	1	5.0	5.0	10.0
2.00	Valid	yen3	1	5.0	5.0	15.0
		ying3	17	85.0	85.0	100.0

		Total	20	100.0	100.0	

yin4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	yin4	11	100.0	100.0	100.0
2.00	Valid	0	1	5.0	5.0	5.0
		yin4	18	90.0	90.0	95.0
		yu4	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

yu2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	yu1	1	9.1	9.1	9.1
		yu2	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	que4	1	5.0	5.0	5.0
		yu2	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

yue4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	yue1	1	9.1	9.1	9.1
		yue4	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	yue3	1	5.0	5.0	5.0
		yue4	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

yuan2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	yuan1	1	9.1	9.1	9.1
		yuan2	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0
		an2	1	5.0	5.0	10.0
		yuan2	16	80.0	80.0	90.0
		yuang2	2	10.0	10.0	100.0
		Total	20	100.0	100.0	

yi4

Grade	Frequency	Percent	Valid Percent	Cumulative Percent

1.00	Valid	yi4	11	100.0	100.0	100.0
		yi4	1	5.0	5.0	5.0
2.00	Valid	yi4	17	85.0	85.0	90.0
		yin4	2	10.0	10.0	100.0
		Total	20	100.0	100.0	

niu2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	niu2	11	100.0	100.0	100.0
		0	1	5.0	5.0	5.0
2.00	Valid	niu2	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

dun4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		dun2	1	9.1	9.1	9.1
1.00	Valid	dun4	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
		de	1	5.0	5.0	5.0
		dun4	17	85.0	85.0	90.0
2.00	Valid	tun4	2	10.0	10.0	100.0
		Total	20	100.0	100.0	

rui4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	1	9.1	9.1	9.1
		ru4	2	18.2	18.2	27.3
1.00	Valid	rui2	1	9.1	9.1	36.4
		rui4	7	63.6	63.6	100.0
		Total	11	100.0	100.0	
		0	1	5.0	5.0	5.0
		r	1	5.0	5.0	10.0
2.00	Valid	rou4	1	5.0	5.0	15.0
		rui4	17	85.0	85.0	100.0
		Total	20	100.0	100.0	

xue3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	1	9.1	9.1	9.1
		xue3	10	90.9	90.9	100.0

		Total	11	100.0	100.0	
		0	1	5.0	5.0	5.0
		xue1	2	10.0	10.0	15.0
2.00	Valid	xue2	2	10.0	10.0	25.0
		xue3	15	75.0	75.0	100.0
		Total	20	100.0	100.0	

xiu4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	1	9.1	9.1	9.1
1.00	Valid	xiu4	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
		xiu1	1	5.0	5.0	5.0
2.00	Valid	xiu4	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

qiu2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	1	9.1	9.1	9.1
1.00	Valid	qiu2	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
		qi2	1	5.0	5.0	5.0
2.00	Valid	qiu2	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

liao2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	1	9.1	9.1	9.1
		lao2	1	9.1	9.1	18.2
1.00	Valid	liao2	9	81.8	81.8	100.0
		Total	11	100.0	100.0	
		0	2	10.0	10.0	10.0
		lao2	2	10.0	10.0	20.0
2.00	Valid	liao2	16	80.0	80.0	100.0
		Total	20	100.0	100.0	

luan4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		luan2	2	18.2	18.2	18.2
1.00	Valid	luan4	9	81.8	81.8	100.0

		Total	11	100.0	100.0	
2.00	Valid	0	1	5.0	5.0	5.0
		luan2	1	5.0	5.0	10.0
		luan4	18	90.0	90.0	100.0
		Total	20	100.0	100.0	

miu4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	miu4	11	100.0	100.0	100.0
2.00	Valid	miu2	1	5.0	5.0	5.0
		miu4	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

lun4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	lun4	11	100.0	100.0	100.0
2.00	Valid	0	1	5.0	5.0	5.0
		lun2	1	5.0	5.0	10.0
		lun4	18	90.0	90.0	100.0
		Total	20	100.0	100.0	

guang1

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	guan1	1	9.1	9.1	9.1
		guang1	8	72.7	72.7	81.8
		guang4	1	9.1	9.1	90.9
		suang1	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
2.00	Valid	gang1	1	5.0	5.0	5.0
		guang1	19	95.0	95.0	100.0
		Total	20	100.0	100.0	

rong2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	rong2	11	100.0	100.0	100.0
2.00	Valid	rong2	20	100.0	100.0	100.0

niang2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	nian2	1	9.1	9.1	9.1

		niang2	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	0	2	10.0	10.0	10.0
		lang2	1	5.0	5.0	15.0
		nang2	1	5.0	5.0	20.0
		niang2	15	75.0	75.0	95.0
		ning2	1	5.0	5.0	100.0
		Total	20	100.0	100.0	

zhuang4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	zhuan4	1	9.1	9.1	9.1
		zhuang4	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
2.00	Valid	zhuan1	1	5.0	5.0	5.0
		zhuang2	1	5.0	5.0	10.0
		zhuang4	18	90.0	90.0	100.0
		Total	20	100.0	100.0	

Appendix VII: Pseudo–pinyin spelling data

fi4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	3	5.9	5.9	5.9
		fe	1	2.0	2.0	7.8
		fi	4	7.8	7.8	15.7
		fi1	1	2.0	2.0	17.6
		fi4	41	80.4	80.4	98.0
		i	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
2.00	Valid	0	1	7.7	7.7	7.7
		f	1	7.7	7.7	15.4
		fi4	11	84.6	84.6	100.0
		Total	13	100.0	100.0	

tuai3

Grade	Frequency	Percent	Valid Percent	Cumulative Percent

		0	4	7.8	7.8	7.8
		bai	1	2.0	2.0	9.8
		dai	1	2.0	2.0	11.8
		duia2	1	2.0	2.0	13.7
		fuai3	1	2.0	2.0	15.7
		guai3	1	2.0	2.0	17.6
		t	2	3.9	3.9	21.6
		tai3	3	5.9	5.9	27.5
		tian4	1	2.0	2.0	29.4
		tu4	1	2.0	2.0	31.4
1.00	Valid	tua	1	2.0	2.0	33.3
		tua3	1	2.0	2.0	35.3
		tuai1	2	3.9	3.9	39.2
		tuai2	1	2.0	2.0	41.2
		tuai3	27	52.9	52.9	94.1
		tuan3	1	2.0	2.0	96.1
		tuan4	1	2.0	2.0	98.0
		zhuan3	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
		t	1	7.7	7.7	7.7
2.00	Valid	tuai3	12	92.3	92.3	100.0
		Total	13	100.0	100.0	

giang2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	3	5.9	5.9	5.9
		b	1	2.0	2.0	7.8
		bang3	1	2.0	2.0	9.8
		biang2	1	2.0	2.0	11.8
1.00	Valid	dian2	1	2.0	2.0	13.7
		diang2	1	2.0	2.0	15.7
		g	1	2.0	2.0	17.6
		gan	1	2.0	2.0	19.6

		giang2	14	27.5	27.5	47.1
		giang3	3	5.9	5.9	52.9
		jiang3	1	2.0	2.0	54.9
		kang	1	2.0	2.0	56.9
		kiang1	1	2.0	2.0	58.8
		lang2	2	3.9	3.9	62.7
		li2	1	2.0	2.0	64.7
		lian	1	2.0	2.0	66.7
		liang2	6	11.8	11.8	78.4
		liang3	1	2.0	2.0	80.4
		p	1	2.0	2.0	82.4
		piang3	1	2.0	2.0	84.3
		ruang3	1	2.0	2.0	86.3
		siang3	1	2.0	2.0	88.2
		tiang2	3	5.9	5.9	94.1
		yang2	3	5.9	5.9	100.0
		Total	51	100.0	100.0	
2.00	Valid	giang2	12	92.3	92.3	92.3
		giang3	1	7.7	7.7	100.0
		Total	13	100.0	100.0	

zhia1

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	2	3.9	3.9	3.9
		hun2	1	2.0	2.0	5.9
		ja3	1	2.0	2.0	7.8
		jia1	3	5.9	5.9	13.7
		qia	1	2.0	2.0	15.7
		shua1	1	2.0	2.0	17.6
		za	6	11.8	11.8	29.4
		za1	5	9.8	9.8	39.2

		za4	1	2.0	2.0	41.2
		zh1	1	2.0	2.0	43.1
		zha1	18	35.3	35.3	78.4
		zha2	2	3.9	3.9	82.4
		zha3ya2	1	2.0	2.0	84.3
		zhi1	1	2.0	2.0	86.3
		zhi1a1	1	2.0	2.0	88.2
		zhia	1	2.0	2.0	90.2
		zhia1	2	3.9	3.9	94.1
		zhia3	1	2.0	2.0	96.1
		zhua1	1	2.0	2.0	98.0
		zia1	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
2.00	Valid	0	1	7.7	7.7	7.7
		jia1	1	7.7	7.7	15.4
		jiang1	1	7.7	7.7	23.1
		zha	1	7.7	7.7	30.8
		zha1	2	15.4	15.4	46.2
		zhang1	2	15.4	15.4	61.5
		zhang3	1	7.7	7.7	69.2
		zhia1	2	15.4	15.4	84.6
		zhua1	2	15.4	15.4	100.0
		Total	13	100.0	100.0	

nui1

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	3	5.9	5.9	5.9
		duei1	2	3.9	3.9	9.8
		dui	1	2.0	2.0	11.8
		dui1	3	5.9	5.9	17.6
		duui1	1	2.0	2.0	19.6
		hiu1	1	2.0	2.0	21.6
		nei1	1	2.0	2.0	23.5
		nie1	1	2.0	2.0	25.5

		nin	1	2.0	2.0	27.5
		niu1	4	7.8	7.8	35.3
		nu2	1	2.0	2.0	37.3
		nuai1	1	2.0	2.0	39.2
		nuei1	2	3.9	3.9	43.1
		nui1	23	45.1	45.1	88.2
		nui3	1	2.0	2.0	90.2
		nun1	1	2.0	2.0	92.2
		nuui1	2	3.9	3.9	96.1
		nve2	1	2.0	2.0	98.0
		yuan1	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
2.00	Valid	nei	1	7.7	7.7	7.7
		nui	1	7.7	7.7	15.4
		nui1	9	69.2	69.2	84.6
		nui2	1	7.7	7.7	92.3
		nui4	1	7.7	7.7	100.0
		Total	13	100.0	100.0	

pun2

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
1.00	Valid	0	5	9.8	9.8	9.8
		b	1	2.0	2.0	11.8
		dun2	1	2.0	2.0	13.7
		guen2	1	2.0	2.0	15.7
		gun	1	2.0	2.0	17.6
		huen2	1	2.0	2.0	19.6
		hun2	8	15.7	15.7	35.3
		nun2	1	2.0	2.0	37.3
		nun3	1	2.0	2.0	39.2
		p	1	2.0	2.0	41.2
		pen2	2	3.9	3.9	45.1
		pun2	8	15.7	15.7	60.8
		pwn1	1	2.0	2.0	62.7
		qun2	1	2.0	2.0	64.7
		tu2	1	2.0	2.0	66.7

		tui2	1	2.0	2.0	68.6
		tun2	4	7.8	7.8	76.5
		tuun2	2	3.9	3.9	80.4
		u	1	2.0	2.0	82.4
		uen2	1	2.0	2.0	84.3
		un2	1	2.0	2.0	86.3
		w	1	2.0	2.0	88.2
		wen2	6	11.8	11.8	100.0
		Total	51	100.0	100.0	
2.00	Valid	puen	1	7.7	7.7	7.7
		pui2	1	7.7	7.7	15.4
		pun1	1	7.7	7.7	23.1
		pun2	9	69.2	69.2	92.3
		tun2	1	7.7	7.7	100.0
		Total	13	100.0	100.0	

luang3

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	2	3.9	3.9	3.9
		huang 2	1	2.0	2.0	5.9
		len	1	2.0	2.0	7.8
		lu	1	2.0	2.0	9.8
		lu2	1	2.0	2.0	11.8
		lua	1	2.0	2.0	13.7
		luan2	2	3.9	3.9	17.6
1.00	Valid	luang 1	1	2.0	2.0	19.6
		luang 2	17	33.3	33.3	52.9
		luang 3	7	13.7	13.7	66.7
		luann 2	1	2.0	2.0	68.6
		lvang	1	2.0	2.0	70.6
		qiuan	1	2.0	2.0	72.5
		rang	1	2.0	2.0	74.5

		rang2	1	2.0	2.0	76.5
		ruang	1	2.0	2.0	78.4
		ruang 2	8	15.7	15.7	94.1
		ruang 3	3	5.9	5.9	100.0
		Total	51	100.0	100.0	
		luang 1	9	69.2	69.2	69.2
		luang 2	2	15.4	15.4	84.6
2.00	Valid	luang 3	2	15.4	15.4	100.0
		Total	13	100.0	100.0	

shiong4

Grade			Frequency	Percent	Valid Percent	Cumulative Percent
		0	4	7.8	7.8	7.8
		shao4	1	2.0	2.0	9.8
		shiou4	1	2.0	2.0	11.8
		sho4	1	2.0	2.0	13.7
		shong 3	1	2.0	2.0	15.7
		shong 4	3	5.9	5.9	21.6
		shou4	3	5.9	5.9	27.5
		shu1	2	3.9	3.9	31.4
1.00	Valid	shu4	1	2.0	2.0	33.3
		siu4	1	2.0	2.0	35.3
		so	1	2.0	2.0	37.3
		x	1	2.0	2.0	39.2
		xi1	1	2.0	2.0	41.2
		xiiu4	1	2.0	2.0	43.1
		xiong	1	2.0	2.0	45.1
		xiong4	4	7.8	7.8	52.9
		xiou4	2	3.9	3.9	56.9
		xiu	2	3.9	3.9	60.8

		xiu4	16	31.4	31.4	92.2
		xiug4	1	2.0	2.0	94.1
		xong4	2	3.9	3.9	98.0
		xui4	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
2.00	Valid	chong4	1	7.7	7.7	7.7
		sh	1	7.7	7.7	15.4
		shiong2	1	7.7	7.7	23.1
		shiong4	4	30.8	30.8	53.8
		shong4	1	7.7	7.7	61.5
		shrong4	1	7.7	7.7	69.2
		shuing4	1	7.7	7.7	76.9
		song4	1	7.7	7.7	84.6
		xiu4	1	7.7	7.7	92.3
		xong4	1	7.7	7.7	100.0
		Total	13	100.0	100.0	