The Role of Oral Form, Written Form, and Meaning In Chinese Children's Learning of English Vocabulary

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This thesis represents the culmination of a journey that has spanned over a decade, one marked by both perseverance and profound personal growth. While all experiments were conducted during the first three years of my doctoral study, the process of writing extended far beyond what I initially imagined. Life unfolded in unexpected ways, and each chapter of this work is interwoven with moments of both great joy and deep sorrow.

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ABSTRACT

This thesis investigates how Chinese children learning English establish connections between the three core components of word knowledge: **oral form, written form, and meaning**. Three experiments were designed to examine how these elements interact in second language vocabulary acquisition.

Experiment 1 explored whether word meaning supports learning the written form. Fifty-three children in Beijing completed a word learning task and a phonological working memory task. Results showed that (1) the presence of meaning significantly supported the acquisition of written forms, and (2) phonological working memory was positively correlated with vocabulary learning outcomes.

Experiment 2 examined the effects of practice type—reading vs. spelling—on the retention of written forms and meanings. Using a similar word learning task and the same working memory measure, 54 children participated. Results indicated that spelling practice led to significantly better learning of both written form and meaning of novel words compared to reading practice. Once again, phonological working memory was significantly associated with learning outcomes.

Experiment 3 investigated whether **exposure to the written form** during learning enhances the recall of word meaning. Fifty-six Grade 3 children were taught novel English words either with print exposure or without it. Results from Post-test 1 revealed a **marginal interference effect**. This effect was not maintained at Post-test 2.

Together, the three experiments offer theoretical and practical insights into how Chinese children learn English words through instruction. The findings have

implications for instructional design and shed light on the cognitive processes that underlie second language literacy development in young learners.

CHAPTER ONE – INTRODUCTION

1.1 The Foundation: Constituents of Written Words

The journey into literacy, the ability to read and write, fundamentally revolves around understanding the nature of written words. A written word, within any literate society, is not a monolithic entity but rather a complex construct defined by the intricate interplay of three core elements: its **oral form** (phonology), its **written form** (orthography), and its associated **meaning** (semantics) (Coltheart, 2006; Ehri, 2014; Perfetti & Hart, 2002).

The oral form of a word is its sound, or phonology, which is the sound structure of the word, encompassing its pronunciation, rhythm, and intonation – how it is spoken and heard in the flow of language. Acquiring this phonological representation requires auditory processing and memory, specifically the capacity often referred to as phonological working memory, which enables learners to perceive, segment, retain, and reproduce sequences of sounds accurately (Gathercole & Baddeley, 1993).

The written form, or orthography, constitutes the visual representation of the word. In alphabetic systems like English, this primarily involves a specific sequence of letters intended to correspond, albeit often imperfectly, to the word's phonological structure. Orthography, however, encodes more than just sound; it is a structured system reflecting a language's phonological (sound), morphological (word structure), and sometimes semantic (meaning) characteristics (Perfetti, 1997). Learning the written form thus involves mastering not only letter shapes and sequences but also the complex, often rule-governed, sometimes arbitrary, conventions that link spelling to sound and structure. Similar to learning the oral form, working memory plays a critical role in

spelling, requiring the learner to hold the target sound sequence in mind while retrieving and ordering the corresponding graphemes (letters or letter combinations) (Ormrod & Cochran, 1988).

Central to the very concept of a word is its meaning. As Vygotsky (1986, p. 212) profoundly stated, "A word without meaning is an empty sound". Meaning transforms a mere sequence of sounds or letters into a unit of language capable of conveying concepts, ideas, and reference. It is the semantic component that allows words to function as tools for thought and communication. However, the relationship between meaning and the other two constituents, particularly the written form, varies significantly across different writing systems. While alphabetic systems primarily map orthography to phonology, other systems, such as the logographic system of Chinese characters, often incorporate visual elements directly related to meaning. Regardless of the specific orthography, learners must inevitably establish robust connections between a word's meaning and its phonological and orthographic representations. In the case of young Chinese English language learners who are learning English oral and written forms at the same time, they might need to connect meaning to the written form before they actually know the phonology because they might come across written words that they have never heard, or even words they might have heard, but cannot remember the sounds. Having the written form will help them access the sound and the meaning.

1.2 Research Aim and Significance

The primary objective of the research presented in this thesis is to undertake a detailed investigation into how these three fundamental elements – oral form, written form, and meaning – dynamically interact and influence the learning of both spelling and meaning

for a specific group of learners: young Chinese students acquiring English as a second language (L2). This focus is motivated by the understanding that the processes underlying L2 vocabulary acquisition may differ in crucial ways from those observed in first language (L1) learning, particularly concerning the relative prominence and interplay of phonological, orthographic, and semantic information during the initial stages of learning new words. Furthermore, acknowledging the cognitive demands inherent in language learning, this study will also explicitly examine the contribution of working memory (WM) capacity as a potential factor mediating individual differences in L2 vocabulary learning outcomes within this population.

The significance of this research lies in its potential to test predictions from word learning models developed for reading English words in L1 when children are learning to read English words as L2. While extensive research has illuminated the processes of L1 reading and spelling development, particularly in English, the application of these models to L2 contexts remains an area requiring further empirical validation and refinement. Understanding how L2 learners, especially those coming from a significantly different L1 linguistic and orthographic background like Chinese, integrate phonological, orthographic, and semantic information is crucial for understanding how lexical representations develop in diverse linguistic contexts.

1.3 Contextualizing L2 Word Learning: Beyond L1 Models

A considerable body of research dedicated to L2 reading acquisition has focused on the concept of cross-linguistic transfer – the influence of the learner's L1 skills and knowledge on their L2 development. Traditional methodologies employed in this domain often involve correlational studies, which seek to identify relationships between

performance on specific L1 skills (e.g., L1 phonological awareness) and corresponding L2 skills (e.g., L2 reading proficiency). For instance, studies have explored whether phonological skills known to predict L1 reading success also hold predictive power for L2 reading attainment (e.g., Cheug et al. 2007; Droop & Verhoeven, 2003; Verhoeven et al., 2017; Verhoeven et al., 2019). Another common approach involves comparative studies, which investigate how factors such as the typological distance between L1 and L2, or the learner's metalinguistic awareness of these differences, might mediate the transfer of skills (e.g., Ammar et al., 2010; Siegel, 2004).

While these approaches have yielded valuable insights, correlational studies are inherently limited in their ability to establish causal relationships. An observed correlation between an L1 skill and an L2 outcome does not necessarily imply that the L1 skill directly influences L2 learning; both could be influenced by an unmeasured third factor, such as general cognitive abilities or educational background (Bradley & Bryant, 1983). Recognizing this limitation, the research presented in this thesis adopts a different methodological stance. The novelty of this work lies in its utilization of an experimental approach to investigate L1-L2 transfer. Specifically, this research aims to test predictions derived directly from cognitive models developed to explain word learning processes in L1 English readers, but applied experimentally to the context of young Chinese children learning English words. By manipulating specific variables related to word learning (e.g., the presence or absence of meaning during learning, the type of practice provided) and observing the effects on spelling and meaning recall, this experimental design seeks to provide more robust evidence regarding the applicability and potential modifications needed for L1 models when extended to L2 learners. This approach allows for a more direct examination of the processes involved, moving

beyond correlation towards understanding potential causal links between instructional variables and learning outcomes.

1.4 The Unique Context of Young Chinese Learners of English

The participants in this research, young Chinese learners of English in Beijing, present a particularly interesting and relevant context for investigating L2 word learning processes. Several factors distinguish their learning situation from that of typical L1 English learners and potentially from other L2 learner groups.

Firstly, the timing and nature of language exposure differ significantly. Whereas L1 learners typically acquire a substantial oral vocabulary and sophisticated understanding of their native language's phonology before encountering formal literacy instruction, young Chinese learners often begin formal English instruction in school (starting from Year 1 or Year 3) with limited prior oral exposure to English. Consequently, they are frequently in the position of learning the oral form, written form, and meaning of new English words simultaneously, or encountering the written form in textbooks or environmental print before fully mastering the pronunciation. This contrasts sharply with the foundational assumption of many L1 reading models, which presuppose existing oral language proficiency. The challenge for these learners is therefore not simply mapping known oral words onto written forms, but often involves concurrently building phonological, orthographic, and semantic representations for entirely new lexical items.

Secondly, their L1 background involves literacy in two distinct systems: Pinyin and Chinese characters. Pinyin, introduced formally in primary year 1, is an alphabetic system using the Latin alphabet to represent Mandarin sounds (Murthy et al., 1979).

Exposure to Pinyin provides Chinese children with foundational knowledge of alphabetic principles and sound-symbol correspondences before they encounter English orthography. Research suggests that Pinyin learning positively impacts phonological awareness skills in both Chinese and English (Ping et al., 2006; Shu et al., 2008). Concurrently, they learn Chinese characters, a logographic system where characters primarily represent syllables or morphemes. A key feature of Chinese characters is that the majority (estimated at 80-90%) are semantic-phonetic compounds, containing distinct components (radicals) that provide clues to both the character's meaning category and its approximate pronunciation (Zhu, 1987; in Ching & Nunes, 2015). Characters related to insects often share a common semantic radical, while different phonetic radicals indicate their distinct pronunciations. For example, the semantic radical "虫", which means insect, is used in the character "蚁" [yǐ], which means ant. The same semantic radical gets repeated in many other characters related to insects' names, such as, "蚊" [wén] for the mosquito, and "蛛" [zhū] for the spider. The variation of pitch on top of the vowels marks the tone of *Pinyin*. The sounds of these three characters are indicated by the phonological radicals, "义" [yi], "文"[wen], and "朱"[zhu]. A small proportion of Chinese characters is pictographic (e.g. "山" for mountain), or ideographic (e.g. "上" for above, and "下" for below; the long horizontal line in both characters indicates a surface, and the meaning is conveyed by switching the position of this surface and an object). Although the sounds of the characters are not indicated in these characters, meaning representation is still present, and is to some extent symbolic. Furthermore, Chinese has a large number of homophones, words that sound the same but have different meanings and, crucially, are written using different characters (Shu, 2003). For instance, the third-person pronouns 'he' (他) and 'she' (她)

are pronounced identically ([tā]), but differ from each other in their semantic radicals "亻" (meaning person) and "女" (meaning female). This experience may cultivate an expectation among Chinese learners that meaning plays a direct role in differentiating written forms, even for words that sound alike. This contrasts with English, where homophone spelling is often based on etymology rather than transparent semantic components. This unique L1 literacy background, combining alphabetic principles (Pinyin) with a strong form-meaning connection (characters), may significantly influence how Chinese learners approach the task of learning English words, potentially heightening their sensitivity to the interplay between orthography and semantics.

Thirdly, the typical English learning environment for these children is largely classroom-based, often relying heavily on national textbooks and structured instruction. While informal exposure occurs through media and environmental print, much of the learning, particularly vocabulary acquisition, is mediated through written materials. This means learners frequently encounter new words visually (in print) simultaneously with, or even prior to, developing secure auditory representations. This emphasis on the written form underscores the practical importance of understanding how visual exposure to English orthography impacts the learning of both pronunciation and meaning for this population.

1.5 Research Questions and Thesis Outline

Given the theoretical background and the specific context of young Chinese L2 learners, this thesis aims to address several key questions through experimental investigation:

1. **The Role of Meaning in Spelling Acquisition:** Does explicitly associating meaning with a new English word facilitate the learning and accurate recall of its spelling (written form) for young Chinese L2 learners? Specifically, does learning a word as a meaningful unit, compared to learning it as a mere sequence of letters associated with a sound, lead to improved spelling performance?

2. **The Impact of Practice Type:** How do different types of practice – specifically, practice focused on **reading** (repeated visual exposure and decoding) versus practice focused on **spelling** (active recall and production of the written form) – influence the acquisition and retention of both the written form and the meaning of new English words for these learners? Is one form of practice demonstrably superior, or do they offer complementary benefits?

3. **Orthographic Facilitation in Meaning Acquisition:** Does the presence of the written form (orthography) alongside the oral form during learning facilitate the acquisition and recall of a new English word's meaning for young Chinese L2 learners? Or, conversely, could the simultaneous presentation of visual (orthographic) and auditory (phonological) information potentially overload cognitive resources and hinder meaning acquisition in this L2 context?

To address these questions, three experimental studies were designed and conducted with primary school students in Beijing. The structure of this thesis is as follows:

- **Chapter 1 (Introduction):** Provides the background, rationale, research aims, significance, specific context of Chinese learners, key research questions, and an overview of the thesis structure.

- **Chapter 2 (Literature Review):** Presents a comprehensive review of relevant theories and empirical research concerning L1 and L2 word reading, spelling, vocabulary acquisition, the roles of phonology, orthography, semantics, working memory, and different practice methods, establishing the theoretical foundation for the experimental studies.

- **Chapter 3 (Experiment 1):** Details the methodology and findings of the first experiment, which investigated the contribution of meaning to the acquisition of the written form (spelling).

- **Chapter 4 (Experiment 2):** Describes the methodology and results of the second experiment, comparing the effects of reading-focused versus spelling-focused practice on learning word forms and meanings.

- **Chapter 5 (Experiment 3):** Presents the methodology and outcomes of the third experiment, examining the role of orthographic exposure (presence vs. absence of written form during learning) on the acquisition of word meaning.

- **Chapter 6 (General Discussion):** Synthesizes the findings from the three experiments, discusses their collective theoretical and pedagogical implications, acknowledges limitations, and suggests directions for future research.

Through this structured investigation, the thesis seeks to shed light on the complex interplay of phonological, orthographic, and semantic factors in L2 vocabulary learning, offering empirically grounded insights relevant to both cognitive science and language education.

CHAPTER TWO – LITERATURE REVIEW

2.1 Introduction: Word Learning at the Lexical Level

This chapter reviews the theoretical perspectives and empirical research relevant to understanding how children, particularly those learning English as a second language (L2), acquire vocabulary at the single-word level, with a specific focus on the acquisition of spelling (orthographic form) and meaning (semantic representation). As established in Chapter 1, a word is conceptualized as an integrated unit comprising phonological, orthographic, and semantic information (Coltheart, 2006; Ehri, 2014; Perfetti & Hart, 2002). The process of learning a word involves establishing robust representations of these components and the connections between them. This review will delve into the cognitive processes thought to underlie this learning, drawing primarily on models developed within the context of first language (L1) acquisition, while critically examining their applicability and potential modifications needed for the L2 learning context, specifically for young Chinese learners of English. The review will focus on several key areas: the fundamental role of phonology in alphabetic literacy, the complexities introduced by English orthography, influential models of word reading and lexical representation, the specific contribution of meaning to learning orthography, the reciprocal effect of orthography on learning meaning (orthographic facilitation), the impact of different practice types (reading vs. spelling), the role of cognitive factors such as working memory, and finally, the specific considerations pertinent to L2 learners transitioning from a logographic L1 system. The assessment methods used in prior research will also be considered to justify the tasks employed in the current study's experiments.

2.2 The Role of Phonology in Alphabetic Literacy

Learning to read and spell in alphabetic orthographies like English is inextricably linked to the development of phonological processing skills. The alphabetic principle itself hinges on the understanding that written symbols (letters or graphemes) systematically correspond to the sound units (phonemes) of spoken language. A vast body of research, the seminal longitudinal and experimental work of Bryant and his colleagues (Bradley & Bryant, 1983; Bryant & Bradley, 1985 a & b; Bryant, MacLean & Bradley, 1990; Bryant et al., 1990; Kirtley et al., 1989), firmly established the causal role of phonological awareness – the ability to reflect on and manipulate the sound structure of spoken words – in learning to read and spell. This foundational work demonstrated that sensitivity to rhyme and alliteration predicted later reading success, and that training children in phonological awareness alongside letter knowledge significantly improved their literacy development compared to other forms of instruction.

The critical importance of phonological skills has since been corroborated by countless studies employing diverse methodologies across numerous laboratories and languages (e.g., Carillo, 1994; Defior, 2004; Gough et al., 1992; Harm & Seidenberg, 1999; Hatcher & Hulme, 1999; Leong, 1991; Lundberg, 1994; National Reading Panel, 2000; Ouellette, 2010; Perfetti et al., 1987; Porpodas, 1991; Share, 1995; Sprenger-Charolles et al., 1997; Treiman, 2004; 2017; Tunmer, 1994). This body of evidence highlights the critical importance that learners develop an awareness of the constituent sounds within spoken words – such as phonemes, onsets, rimes -- and master the correspondences between these sounds and their written representations, commonly referred to as grapheme-phoneme correspondences (GPCs). Such knowledge is essential not only for

successfully decoding written words into sound, but also for encoding spoken words into print (spelling). The ability to segment spoken words into phonemes and understand how these map onto letters is considered a foundational skill in alphabetic literacy acquisition.

2.3 Navigating the Complexities of English Orthography

While phonological decoding based on GPCs is essential, it is widely acknowledged that mastering English reading and spelling requires more than this single process. The English writing system is notoriously complex, often described as quasi-regular rather than purely phonetic. From the early days of experimental reading research, scholars recognized that reliance solely on phonological rules would lead to errors for a significant portion of the English lexicon. Several features contribute to this complexity:

- **Inconsistent GPCs:** Many English graphemes can represent multiple phonemes (e.g., 'ea' in 'read', 'bread', 'great'), and many phonemes can be spelled by multiple graphemes (e.g., the /i:/ sound in 'be', 'bee', 'seat', 'chief').

- **Exception Words:** A considerable number of high-frequency words deviate significantly from common GPC rules and cannot be accurately pronounced or spelled using phonological decoding alone. Baron and Strawson (1976), referencing Venezky's (1970) analysis of spelling-sound patterns, termed words like TONGUE, ANSWER, and BEIGE 'exception' words, highlighting the need for word-specific knowledge beyond general rules.

- **Homophones:** English contains numerous words that share the same pronunciation but differ in meaning and spelling (e.g., 'to'/'too'/'two', 'be'/'bee', 'week'/'weak', 'pain'/'pane'). Accurate spelling of homophones necessitates access to semantic information to select the correct orthographic form. Relying solely on sound would lead to spelling errors.

- **Heterophonic Homographs:** Conversely, some words have identical spellings but different pronunciations and meanings, disambiguated only by context (e.g., 'wind' /wɪnd/ vs. /waɪnd/, 'read' /riːd/ vs. /rɛd/) (van Daal & Wass, 2017). While less directly relevant to spelling, their existence further highlights the interplay of orthography, phonology, and meaning/context in word processing.

- **Morphological Influences:** English orthography often preserves the spelling of morphemes (meaningful units) even when pronunciation changes across related words (e.g., 'magic'/'magician', 'heal'/'health'). Recognizing morphemic units can aid both reading and spelling, sometimes providing a more reliable guide than phonology alone, particularly for complex words or words with unstressed vowels (schwa) whose spelling is often determined by morphology, such as the suffix -ION or -IAN (Nune & Bryant, 2006). The segmentation of letters into graphemes can itself be influenced by morphemic boundaries (e.g., 'sh' is a grapheme in 'dish·washer' but not in 'mis·heard'), impacting phonological realization.

These orthographic complexities necessitate models of reading and spelling acquisition that incorporate processes beyond simple phonological decoding, integrating

knowledge specific to individual words (lexical knowledge) and often involving semantic and morphological information.

2.4 Models of Word Reading and Lexical Representation

To account for the multifaceted nature of skilled reading and spelling, several influential theoretical models have been proposed. Two prominent lines of thought, while differing in emphasis, both acknowledge the roles of decoding and broader language knowledge:

2.4.1 The Simple View of Reading

Proposed initially by Gough and Tunmer (1986) and further elaborated by Hoover and Gough (1990), the "Simple View of Reading" posits that reading comprehension (R) is the product of two distinct but essential components: decoding (D) and linguistic comprehension (C) (R = D x C). In this framework, 'decoding' refers specifically to word recognition abilities – the efficient translation of print into sound or meaning at the word level based on letter-sound correspondence rules. 'Linguistic comprehension' encompasses the ability to understand spoken language, including vocabulary knowledge, grammatical understanding, inferencing, and knowledge of discourse structures. The model emphasizes that difficulties in reading can arise from deficits in either decoding, linguistic comprehension, or both. A key implication is that strong decoding skills are necessary but not sufficient for good reading comprehension; adequate language comprehension abilities are also required. Within this view, the role of word meaning during the act of decoding itself is somewhat secondary; meaning is primarily accessed through the broader language comprehension system once a word

has been successfully decoded, although it might aid in disambiguating context-dependent words like heterophonic homographs.

2.4.2 Lexical Quality Hypothesis and Amalgamation Models

An alternative, though not entirely incompatible, perspective places greater emphasis on the nature of the underlying mental representations of words. Perfetti and colleagues (Perfetti, 2007; 2017; Perfetti & Hart, 2002) proposed the **Lexical Quality Hypothesis (LQH)**, arguing that "reading comprehension rests to a considerable extent on knowledge of words" (Perfetti & Hart, 2002, p.189). The central idea is that individual differences in reading skill are heavily influenced by the quality of word representations stored in the mental lexicon. A high-quality lexical representation is characterized by fully specified and tightly linked information about a word's orthography, phonology, and semantics. When these components are robustly interconnected, word recognition becomes rapid and efficient, freeing up cognitive resources for higher-level comprehension processes. Conversely, low-quality representations (e.g., underspecified phonology, weak links between form and meaning) lead to slower, more effortful word recognition, hindering comprehension. The LQH posits a reciprocal relationship: strong lexical representations facilitate fluent reading and comprehension, which in turn provides more opportunities for learning and refining lexical representations.

A closely related perspective comes from Ehri and colleagues (Ehri, 2014; Ehri & Rosenthal, 2007), who describe word learning as the process of forming amalgamated representations where spellings, pronunciations, and meanings become bonded together in memory. According to Ehri's phase theory of reading development, learners progress through stages characterized by different types of connections between orthography and

phonology, eventually achieving consolidated alphabetic representations where multi-letter units are securely mapped onto sounds and integrated with meaning.

In both Perfetti's and Ehri's frameworks, meaning is not merely an outcome of decoding but an integral component of the lexical representation itself. Crucially, these models predict that strengthening any one component of the representation -- phonology, orthography, or meaning -- can enhance the overall quality and accessibility of the word, potentially facilitating learning and recall of the other components. This contrasts with the Simple View's primary focus on decoding as the gateway to meaning accessed via language comprehension.

2.5 The Contribution of Meaning to Learning Spelling

The theoretical perspective emphasizing integrated lexical representations (LQH/Amalgamation) leads to the specific prediction that accessing a word's meaning should facilitate the learning of its orthographic form (spelling). While the link between phonology and spelling is inherent in the alphabetic principle, the role of semantics in acquiring orthography requires specific investigation, particularly given the complexities of English spelling.

Evidence supporting this connection comes from several lines of research:

- **Morphemic Awareness:** Studies have shown that instruction focusing on morphological structure – teaching learners to recognize meaningful units within words – can improve spelling, especially for words with opaque GPCs whose spelling reflects morphology rather than surface phonology. For example, understanding that 'magician' contains the root 'magic' helps learners correctly

spell the /ʃ/ sound with 'ci', a less common spelling for that sound (e.g., Burton et al., 2021; Carlisle, 1988; Nunes et al., 1997; Rosa & Nunes, 2008; Rosa & Nunes, 2010). This demonstrates that accessing the meaning embedded in morphemes aids orthographic recall.

- **Homophone Spelling:** As previously noted, distinguishing between homophones like 'there'/'their'/'they're' or 'pain'/'pane' requires semantic knowledge. Learners must connect the specific meaning intended with the correct, distinct spelling, highlighting a direct role for semantics in accurate orthographic production.

- **Experimental Studies with Novel/Non-words:** More direct evidence comes from experimental studies manipulating the presence of meaning during the learning of new orthographic forms. Hilte and Reitsma (2011) found that Dutch children's learning of the spellings of morphologically complex words was enhanced when meaning was made salient. Ouellette and colleagues conducted key experiments using non-words to isolate the effect of meaning (Ouellette, 2010; Ouellette & Fraser, 2009). In these studies, children learned to spell non-words (e.g., "yait") under two conditions. One group (semantic condition) was taught meanings for the non-words using pictures and descriptions, effectively turning them into novel words. The other group (orthographic condition) received equivalent exposure to the non-word spellings but without any associated meaning. The results consistently showed that children in the semantic condition demonstrated significantly better subsequent recognition and spelling of the target forms compared to those in the orthographic condition. The most plausible interpretation, aligned with LQH/Amalgamation models, is

that associating meaning integrated the phonological and orthographic information into a more robust, higher-quality lexical representation – essentially, learning a 'word' rather than just a meaningless letter string. This process makes the orthographic form less arbitrary and more memorable. These findings strongly suggest that meaning is not just the endpoint of reading but an active ingredient that can facilitate the consolidation of orthographic knowledge itself. Research examining word recognition (reading) also points towards the influence of semantics, with studies on semantic priming showing that encountering a related word (e.g., 'doctor' then 'nurse') speeds up recognition, suggesting interactive activation involving meaning (McDonough & Trofimovich, 2009; Meyer & Schvaneveldt, 1971; Laing & Hulme, 1999). This shows that the relationships among words have a powerful influence on how they are stored and processed in the human mind. The current study builds directly on Ouellette's paradigm to investigate whether this facilitative effect of meaning on spelling extends to Chinese L2 learners of English.

2.6 The Contribution of Orthography to Learning Meaning and Phonology: Orthographic Facilitation

The interconnected nature of lexical representations proposed by Ehri and Perfetti predicts a bidirectional influence: just as meaning can aid spelling, exposure to the orthographic form should facilitate the learning and retention of a word's phonological form and its meaning. This phenomenon is often referred to as orthographic facilitation. The underlying rationale is that the stable, visual representation provided by print can help anchor the more transient auditory information (phonology) and provide an additional retrieval cue for accessing meaning.

Evidence for orthographic facilitation comes from various experimental paradigms:

- **Learning Phonological Forms:** Ehri and Wilce (1979) investigated whether seeing the spelling of novel words helped children remember their pronunciations. First and second graders were taught non-words as names for geometric figures. One group only heard the names, while another group both heard the names and saw their spellings during the learning phase. Results showed that children who had seen the spellings exhibited better subsequent oral recall of the non-word names. This suggests that the orthographic form provided a stable visual anchor that aided the encoding and retrieval of the phonological form, demonstrating an effect on *recoding* (spelling) as well as potentially decoding. The presence of the written form may help segment the sound stream and solidify the phonological representation in memory.

- **Learning Word Meanings:** Several studies have directly examined if orthographic exposure enhances the learning of word meanings. Rosenthal and Ehri (2008) taught children the meanings and pronunciations of low-frequency English nouns. For half the words, children only heard the word and learned its meaning through definitions, pictures, and sentences; for the other half, they also saw the word's spelling during the learning period. Crucially, spellings were not present during the recall tests. The results showed significantly better recall of both pronunciations and meanings for the words whose spellings had been presented during learning. This provides strong support for orthographic facilitation extending to semantic acquisition. Ricketts et al. (2009) replicated this finding, showing that 8-9-year-old children learning meanings for novel words benefited from seeing the written forms during training.

- **Reviews and Diverse Populations:** Reviews of the literature by Ehri and Rosenthal (2007) and Colenbrander et al. (2019) have consistently found positive evidence supporting the orthographic facilitation effect on vocabulary learning (both phonological and semantic aspects). Importantly, the benefits of orthographic exposure appear to extend beyond typically developing children to include individuals with developmental language disorder, autism spectrum disorder, Down syndrome, and reading difficulties (Colenbrander et al., 2019). This suggests that orthographic facilitation is a relatively robust phenomenon contributing to vocabulary growth once basic decoding skills are established.

The mechanism underlying orthographic facilitation is thought to involve the strengthening of the connections within the lexical representation. Seeing the spelling provides a precise, stable visual code that can reinforce the phonological representation and become directly linked with the semantic representation, making the overall word knowledge more robust and accessible.

2.7 The Role of Practice Type: Reading vs. Spelling

Consolidating knowledge of a word's orthographic form requires practice and repeated exposure. However, the type of practice engaged in may differentially affect learning outcomes, particularly concerning spelling ability. Two primary forms of practice relevant to orthographic learning are reading and spelling.

- **Reading Practice:** Repeatedly encountering words in print through reading is widely recognized as a major contributor to vocabulary growth and the implicit learning of orthographic patterns (Cunningham et al., 2002; Nation et al., 2007; Reitsma, 1983). Each time a word is successfully decoded, its orthographic

representation in memory is potentially strengthened. Reading provides exposure to words in meaningful contexts, which can also reinforce semantic knowledge.

- **Spelling Practice:** Engaging in the act of spelling – actively retrieving and producing the sequence of letters corresponding to a spoken word – places different cognitive demands on the learner compared to reading. Ehri (1997) highlighted that reading involves primarily recognizing a visual pattern and accessing its pronunciation/meaning, often requiring only partial processing of the letter string. Spelling, in contrast, requires precise knowledge of the entire letter sequence in the correct order; it involves multiple responses (writing each letter) and demands more detailed information to be retrieved from memory. Consequently, spelling practice is argued by some researchers to be a more potent method for consolidating detailed orthographic knowledge than reading alone (Bosman & Orden, 1997). The act of attempting to spell a word, even if initially incorrect, forces the learner to attend closely to its orthographic structure.

Experimental studies comparing the effectiveness of reading versus spelling practice have generally supported the notion that spelling practice yields specific benefits for spelling ability. Shahar-Yames and Share (2008) found that practice involving spelling led to better orthographic learning than practice involving reading only. Similarly, Ouellette (2010), in the same study examining the role of meaning, also compared reading-based practice with spelling-based practice for learning non-word forms. The results indicated that spelling practice resulted in significantly greater gains on subsequent spelling production tasks compared to reading practice alone. This suggests

that while reading contributes to orthographic learning, engaging in active spelling attempts provides a more direct and effective means of strengthening the specific knowledge required for accurate spelling production.

Another relevant comparison involves learning through auditory input only versus learning with accompanying visual (orthographic) input. Reitsma (1983) conducted an experiment with third graders learning non-words. Some words were learned through listening only, while others were presented auditorily along with their spellings. In a subsequent classification task, judging if a visually presented string was one of the learned non-words, children were significantly slower and less accurate initially for words learned through listening only, suggesting that the concurrent exposure to the spelling during learning had facilitated the formation of a more robust orthographic representation. This aligns with the concept of orthographic facilitation and highlights the potential limitations of relying solely on auditory input for building orthographic knowledge.

The relative merits of different practice types are a key focus of the current thesis (Experiment 2), examining how reading versus spelling practice impacts both spelling and meaning acquisition for Chinese L2 learners.

2.8 The Role of Working Memory

Cognitive abilities play an undeniable role in language learning, and working memory (WM) is frequently implicated as a critical factor. Defined as the ability to temporarily store and simultaneously process information (Baddeley & Hitch, 1974), WM is essential for a wide range of complex cognitive tasks, including language comprehension and production.

WM, particularly its phonological component (often assessed through tasks like non-word repetition or digit span), is considered crucial for vocabulary acquisition. Learning a new word requires holding its novel sound sequence in memory long enough to encode it and potentially link it to meaning. Baddeley and colleagues argued that phonological WM plays a key role not only in maintaining familiar words during processing but also specifically in the learning of new phonological forms (Baddeley et al., 1998; 2017; Nunes et al., 2010). Individuals with higher phonological WM capacity are generally better at learning and retaining new words, both in L1 and L2 contexts (Gathercole et al., 1997; Masoura & Gathercole, 1999; ALshehri, 2024).

The role of WM extends to spelling as well. As noted by Ormrod & Cochran (1988), spelling requires holding the sound sequence of the target word in WM while simultaneously retrieving and sequencing the appropriate letters. Limited WM capacity could constrain the ability to manage these concurrent demands, potentially leading to spelling errors.

In the context of L2 learning, WM demands may be particularly high. L2 learners are often grappling with unfamiliar phonological patterns, which may be more difficult to retain in phonological WM compared to familiar L1 sounds. Juffs and Harrington (2011), in their review, emphasized the importance of learning new sound patterns for L2 vocabulary acquisition and highlighted the link to WM. Several researchers have proposed that individual differences in WM capacity are a significant factor explaining variability in L2 learning success across various domains (Grymska, 2016; Wen, 2012). If WM is crucial for forming stable phonological representations, and these representations are foundational to building integrated lexical knowledge, including orthography and meaning, then individual differences in WM might significantly

impact L2 learners' ability to benefit from instruction and form high-quality lexical representations. Therefore, including a measure of WM in studies of L2 word learning, as is done in the present research, is important for better understanding the factors contributing to learning outcomes.

2.9 Second Language (L2) Word Learning: Specific Considerations

While models and findings from L1 research provide a crucial foundation, applying them directly to L2 learners requires careful consideration of potential differences and unique challenges.

- **Simultaneous Learning of Form and Meaning:** As highlighted previously, a major difference lies in the typical starting point. L1 learners usually possess a large oral vocabulary before learning to read and spell; their task is largely one of mapping known meanings and pronunciations onto written forms. In contrast, L2 learners, especially in formal instruction settings, often encounter the oral form, written form, and meaning of a new word concurrently. They may be learning unfamiliar sounds, an unfamiliar spelling system, and a new concept simultaneously. This concurrent learning might place higher demands on cognitive resources compared to the L1 situation. While L1 experiments using non-words or novel words mimic this simultaneous learning to some extent, L2 learners typically lack the extensive underlying knowledge of the target language's phonology and orthography that L1 learners possess, even when encountering novel items.

- **Limited Exposure and Input:** L2 learners generally have significantly less exposure to the target language compared to L1 learners, particularly outside

classroom settings. This reduced input may slow down the process of building robust lexical representations and limit opportunities for incidental learning through exposure.

- **Cross-Linguistic Influence (Transfer):** The learner's L1 inevitably influences L2 learning. This influence can be positive (e.g., cognate recognition, transfer of literacy concepts) or negative (e.g., interference from L1 phonology or orthography). The specific nature of the L1, including its phonological inventory and writing system, plays a critical role. For Chinese learners, the transition from a character-based system (albeit alongside the alphabetic Pinyin) to the English alphabetic system involves navigating different principles of mapping between sound, symbol, and meaning.

- **Orthographic Facilitation in L2:** The applicability of orthographic facilitation to L2 learning is not entirely clear-cut, with empirical findings being somewhat inconsistent. Krepel et al. (2021) investigated whether orthographic availability facilitates English vocabulary learning in Dutch learners of English as an L2. Although orthography facilitated spelling and reading performance, facilitation effects for meaning learning were limited and mainly emerged in forward translation tasks requiring retrieval of English phonology. The authors argued that orthography primarily supported phonological learning rather than directly strengthening form-meaning connections, suggesting that orthographic facilitation effects may depend on methodological factors such as how meaning is taught and assessed. Escudero et al. (2014) found the effect for Spanish learners of Dutch, but only when L1-L2 GPCs were consistent and distractors were dissimilar, suggesting that orthographic inconsistency or high task

difficulty might negate the benefit. It remains an open question whether the potential cognitive load of processing unfamiliar orthography alongside unfamiliar phonology and meaning might sometimes interfere with, rather than facilitate, L2 meaning acquisition, particularly in the early stages or when L1-L2 orthographic/phonological systems differ substantially. Given that L2 learners often rely heavily on written input, understanding whether orthography helps or hinders meaning acquisition is of significant practical importance.

2.10 The Chinese Learner Context Revisited

The specific background of the Chinese learners participating in this research warrants further elaboration within this literature review. Their experience with both Pinyin and Chinese characters provides a unique foundation for learning English.

- **Pinyin Experience:** Having learned Pinyin, an alphabetic system, means these learners are not naive to the concept of letters representing sounds when they begin learning English. This prior experience with alphabetic principles likely facilitates their initial engagement with English orthography compared to learners transitioning from purely non-alphabetic L1 systems. The positive impact of Pinyin on phonological awareness further supports this (Peng, 2023; Liu & Lin, 2022).

- **Character Experience:** Learning Chinese characters involves developing sensitivity to the relationship between visual form and meaning, as many characters contain semantic radicals providing meaning clues. Furthermore, the high frequency of homophones distinguished only by their written characters likely cultivates an awareness that different meanings often correspond to

different written forms. This L1 experience might lead Chinese learners to actively seek or expect form-meaning connections when learning English words, potentially making them receptive to instructional approaches that highlight semantic information. They might expect meaning to be a key factor in determining or remembering spelling.

- **Learning Environment:** As noted, English is typically learned in classrooms, often with significant reliance on textbooks and written materials. This context means that simultaneous exposure to oral and written forms is common, and encounters with written words may precede secure phonological knowledge. This situation makes the investigation of orthographic facilitation and the interplay between reading and spelling practice particularly relevant.

These factors suggest that while Chinese learners face the general challenges of L2 acquisition, their specific L1 background might interact with the learning process in unique ways, potentially influencing the relative effectiveness of different learning strategies focusing on phonology, orthography, and semantics. It makes the replication of L1 findings regarding semantic and orthographic facilitation particularly pertinent in this context.

2.11 Synthesis, Research Gaps, and Methodological Considerations

This review highlights several key themes: the foundational role of phonology, the complexities of English orthography necessitating multi-component models, the integral role of meaning in high-quality lexical representations (LQH/Amalgamation models), the facilitative effects of meaning on spelling and orthography on meaning/phonology (orthographic facilitation) observed primarily in L1 contexts, the

distinct contributions of reading versus spelling practice, the modulating influence of working memory, and the specific challenges and potential influences present in L2 learning, particularly for learners from a Chinese background.

While research based on L1 learners provides valuable theoretical frameworks, significant gaps remain in understanding how these processes operate in L2 learners, especially those navigating substantial L1-L2 differences. Specifically, there is limited research directly investigating:

1. **The contribution of meaning to spelling acquisition** in young L2 learners who are simultaneously learning oral form, written form, and meaning. Does the effect observed by Ouellette (2010) with L1 children using non-words replicate with L2 learners acquiring actual English vocabulary?

2. **The relative effects of different practice types (reading vs. spelling)** on both spelling and meaning acquisition in an L2 context. While spelling practice benefits spelling outcomes, how do these practice types compare in facilitating meaning retention for L2 learners?

3. **The role of orthographic facilitation in L2 meaning acquisition**, given the inconsistent findings in prior L2 research and the potential for increased cognitive load. Does seeing the spelling consistently help young Chinese learners acquire English word meanings, or are there circumstances where it might interfere?

The present thesis aims to address these gaps through three focused experiments. The research draws heavily on the methods and insights from studies conducted with native

speakers, particularly the experimental paradigms used by Ehri, Ouellette, and others, adapting them for the Chinese L2 context. The choice of outcome measures – specifically, spelling production tasks to assess orthographic knowledge and picture identification tasks to assess meaning recognition – is informed by the literature reviewed. Spelling production is considered a robust measure of detailed orthographic knowledge, demanding more precise representation than reading recognition. Picture identification, using different exemplars during testing than during learning, aims to assess conceptual understanding rather than simple picture-word association. By employing these methods within controlled experimental designs, this research seeks to provide clearer insights into the interplay of meaning, orthography, and practice in shaping L2 word learning for young Chinese learners.

CHAPTER THREE – THE EMPIRICAL STUDY: EXPERIMENT ONE

3.1 Introduction

The aim of this first experiment is to find out whether young Chinese English language learners will remember the spellings of English words better when they learn the words with meaning. When Chinese children hear an English word, if they don't know the meaning, it is just a sequence of sounds, not a word. It could be a nonword, something that does not exist. In order to make it into a word, it has to have a meaning, as Vygotsky puts it "A word without meaning is an empty sound" (Vygotsky, 1986, p. 212). It is the meaning that makes the sequence of sounds into a word.

One might think that meaning is not important for learning spelling in alphabetic orthographies because letters represent sounds. However, Ouellette (2010) found that even children who have English as their first language performed significantly better when spelling words that were learned with meaning than words that were learned without meaning. In Ouellette's (2010) study, when children were asked to recall the spellings of nonwords which had ambiguous spellings, meaning was found to help them remember the spelling better. There is also evidence that meaning makes a difference in both word recognition and production. For example, learners were found to be able to pronounce a word more easily and accurately because of prior exposure to a semantically related word (McDonough & Trofimovich, 2009). Awareness of morphemic structures and their meanings were found to be able to facilitate the learning of new words (Anglin, 1993; Nunes et al., 2006).

Meaning is an important component of word specific knowledge. To learn a new word, learners must remember a sequence of sounds, and then attribute a meaning to this

sequence of sounds. Spelling is another important component of word specific knowledge because written form is part of what a word is in a literate world. Take this spelling “trane” for example when you pronounce it, it sounds like a word, but it is not because it is the wrong spelling for “train”. Here is another sort of example that shows how spelling defines a word. We know letters represent sounds. Some words sound the same, but have different spellings. For example, the same sequence of sounds /tu:/ can be spelt as “two” or “too”. These are two different words that sound the same. In order to choose between the two different spellings, even though these are the same sound, learners have to know what the meaning is. Meaning and spelling are interconnected. Meaning helps learners remember the spelling and spelling defines whether a sequence of sounds is a word or not.

The fundamental assumption of this study is that a word in a literate world is defined by three constituents, the sound (oral form), the spelling (written form) and the meaning. This experiment analyses the importance of the binding between meaning and spelling.

Meaning plays a part in the learning of alphabetic orthographies; even though letter-sound correspondences are crucial in alphabetic orthographies, the significance of meaning should not be ignored. For words that follow letter-sound correspondence rules, the mapping between written and oral forms is one to one. A one-to-many link exists in the example of homophones. Meaning plays an important role in helping learners decide what written forms to choose when hearing a sequence of sounds. Homophones sound the same but are spelt differently because meaning defines them as different words. When learners try to spell homophones, like “write” and “right”, learners must refer to their meanings.

Ouellette (2010) took advantage of this interconnection between spelling and meaning, and conducted research to investigate the contribution of meaning to the learning of spelling. In Ouellette's (2010) study, participating children were taught 10 nonwords. In the learning session, half of these nonwords were taught with a short definition and a picture, while the other half were not. All training stimuli were nonwords with ambiguous spelling representations, like "yait", the sound of which corresponds to two different spellings, "yate" or "yait". This means participants could not spell the nonwords correctly simply by following letter-sound correspondence rules. The results of Ouellette's (2010) study showed a significant effect of meaning on the participants' spelling accuracy. Participants in Ouellette's study spelled a word correctly more often when it was learned with meaning, which was an important piece of evidence showing the contribution of meaning in remembering a sequence of sounds with ambiguous spelling representations. The identification of this effect may be because there is a difference between spelling a nonsense sequence of sound, and a sequence of sounds that has a meaning.

Ouellette's (2010) finding that the presence of meaning significantly improved children's performance in the spelling task is very intriguing. When theories of how children learn to read and spell English words focus on the alphabetic principle, they assume that the learners already have a good oral vocabulary and are learning to represent words that they know in print. In the case of Ouellette's experiment, this assumption does not apply. Children in the Ouellette's (2010) experiment were native English speakers, but they were taught nonwords, and thus were learning the oral and written forms at the same time. This parallels the situation of second language learners on many occasions. Chinese children are exposed to oral and written forms at the same time, and much of their vocabulary learning is through print. Learning to read and spell

an English word for Chinese children cannot be reduced to simply applying the alphabetic principle.

Second language learners, such as Chinese English language learners, might not know the words in oral form previously, so they would be learning oral form, written form and meaning at the same time. It is possible that the learning of the written form might be enhanced if meaning is emphasized as what happened in Ouellette's (2010) study. The theoretical significance of these results for second language learners was not articulated explicitly in Ouellette's (2010) study. It is important to replicate Ouellette's (2010) experiment with second language learners like Chinese children.

The contribution of meaning to the learning of the written form might be more salient for Chinese children than it is for English children. Spoken Chinese is highly homophonic with several characters sharing one sound (Tan et al., 2005). The written representation of Chinese characters plays an important role in the learning of the Chinese language. About 90% of the Chinese characters are ideophonetic-compound characters, each consisting of a semantic radical which indicates the meaning and a phonological radical which indicates the sound. Meaning and sound are closely bonded in the written form of Chinese character. For example, "杆" and "肝" both sound the same, sharing the same phonological radical "干". Their meanings are yet different, indicated by different semantic radicals, "木" meaning wood, and "月" meaning part of the human body. Chinese children, therefore, are uniquely aware of this link between written form, oral form, and meaning (Shu & Anderson, 1997). Although this link between written form and meaning in Chinese cannot be directly linked to an alphabetic orthography like English, this awareness may create an expectation that homophones in

English will have different written representations. It is particularly important to find out if this contribution of meaning can be identified among second language learners, such as young English language learners in China.

This experiment investigates the contribution of meaning to the learning of spelling of English words for young Chinese English language learners. In this experiment, the researcher taught children ten words, which were displayed on index cards, and the children were asked to pronounce these words. Children were told that they were going to learn the spellings of these words. These ten words were taught in two blocks of five words each. For one of the blocks of five words, the children received an explanation in Chinese and saw a picture which could help them understand the meaning of the word. For the other block of five words, they only saw the spellings, and were expected to think silently about the words so that they could spell it out later. For both blocks, they practised the words by reading and spelling. They were asked to spell the words after the index card with the spelling was removed from their sight. After the learning session, children were tested immediately on the spelling of these words. The same spelling test was given after a break of about half an hour to see if, after this break, they could still remember the spelling of these words. It was expected that meaning would have a significant impact on the accuracy of the children's spelling and that this effect would be stronger in the second test than in the first, because in the first test they had just practiced, but in the second test, there was some time in between. As meaning is the only variable manipulated by the researcher, any difference in participants' performance would have to result from the presence or the absence of meaning.

A within-participants design was used to control for confounding factors such as the participants' previous knowledge of English. A working memory task was given in the

break between the two post-tests. The role of phonological working memory was examined in the study, because from the cognitive point of view, learning any word involves phonological memory (Verhoeven et al., 2011). If working memory is found to be correlated with vocabulary learning in the first experiment, and if the subsequent experiments or future studies were to be between-participants design, discrepancies in working memory may be an important variable that needs to be controlled for.

The study also made use of the fact that written form is not always entirely predictable from oral form, and used words whose pronunciations can be associated with different spelling patterns. In the experiments, when participants hear a sound, they do not know in which way the word is spelled. Instead of using nonwords, in this study real words which were unlikely to be known by the target population were used for ethical reasons. These are young Chinese children. They will be wasting their time if they are taught nonwords. When unfamiliar real words are used, they will be learning something useful. These words will work the same way as nonwords in Ouellette's experiment.

The experiments took place in a private classroom of a language learning centre in the residential area from which the participants came. Before the experiment, the researcher met the parent and the child briefly to introduce herself and the study to the participants, address some important ethical issues, and reply to questions and concerns from both the parent and the child. The private classroom was inside the learning centre, with a table and a few chairs, as required by the researcher. All participating children were from the neighbouring area and knew the learning centre well. Many of them were taking language lessons in the centre. Therefore, children were not placed in a completely unfamiliar environment. The familiar setting, the professional researcher, combined with the fact that Chinese students are used to taking different sorts of tests,

means that the ecological validity of the experiment is expected to be quite high. According to Bryman, (2012), the ecological validity of studies should be taken into account when one wishes to generalise the findings from the laboratory to the classroom.

Children with a better phonological working memory may be able to recall the sounds of words and their spellings better, but given the within-participant design, this would not interfere with the effect of meaning on the accuracy of spelling.

3.2 Method

3.2.1 Participants

As the experiment used a within-participant design, a statistical test that compares the difference between two dependent means would be used. The relevant *priori* analysis was performed to determine the sample size by using G*Power against the following parameters: a medium effect size of 0.5, power equal to .95, and a significance level of .05. The results suggest a sample size of 54 participants.

Participants (N=53; 22 girls) were recruited from an online parent group in one central residential area in Xicheng District, Beijing, using convenience sampling, and following the opt-in procedure. Invitations for children attending Year 2 or Year 3 at the time were sent to parents online, informing parents of the purpose of the experiment. This was an opt-in consent. There was no exclusion criterion. No children with special needs volunteered to participate in the study.

The children ranged in age from 7.5 years to 9.5 years with a mean age of 8.4 years (SD=0.4 years). At the time of the experiment, all children had been learning how to read and write Chinese characters in formal primary school settings for two to three years. They had also started to learn English in school, with different lengths of formal learning experience ranging from 0.9 years to 4.9 years (SD=0.9 years). Fifty (94.3%) of the participating children were attending Year 2 or Year 3 at the time of the experiment. The benefit of working with this age group is that Year 2 or Year 3 children have some alphabetic knowledge that could be used to learn to spell the English words used in the experiment.

3.2.2 Design

The design was within-participants in order to control for confounding factors due to variation among participants, which could threaten the validity of a between-participants design. Due to the possibility of large variation between participants in previous knowledge of English, the within-participants design is a strong design as it creates a tight control of all influencing factors, such as variation in age, English learning experience and gender. These variations then can be seen as a strength in terms of external validity. Given that there are neurological, affective, cognitive, instructional, and social factors influencing learning a second language (Moyer, 2004; Schumann, 1978), a sufficiently tight control over the experiment conditions provides a useful way to give some insight into how one factor affects word learning.

The 10 training stimuli were real words that were unlikely to be known by the target population, and they were chosen to rely on the same type of possible spelling variation as the nonwords stimuli used in previous studies (Ouellette & Fraser, 2009; Ouellette,

2010). They were divided into two sets of 5 with vowel patterns matched across lists. Details of the training stimuli are presented in the section titled Training Stimuli. Distractors consisting of 10 real words were included in the training session for participants to practise alongside with the training stimuli, mainly because the experimental paradigm that the present study follows included the use of distractors in the training session (Ouellette, 2010). The inclusion of distractors contributes to external validity as distractors are constantly present in the real world; they also help engage selective attention (Craik, 2014). Participants are not immediately reproducing something that they just saw, they are being asked selectively about what they saw.

Meanings were presented in the form of oral Chinese definitions and associated with a picture. Definitions were given orally in Chinese to help children understand the meaning, and no pronunciation of the target novel word would be given to participants, which helped control for the number of auditory exposures across two different teaching conditions.

Word lists were fully counterbalanced across teaching conditions: half of the participants had the presentation of meanings through definitions and drawings paired with Word List A and the other half had the presentation of meanings paired with Word List B. There were no obvious connections between the meanings of the words in the list.

The order of teaching conditions was also counterbalanced. Half of the participants learned words with meaning first, and half learned without meaning first. This counterbalanced design created four experiment cells as shown in *Table 1*. Among all 53 participants, 27 (50.9%) were taught the target words in meaning condition first, and

26 (49.1%) did this in no-meaning condition first. The ten target words were divided into Set A and Set B, and were taught to the participants in different order, with 27 (50.9%) doing Set A first, and 26 (49.1%) doing Set B first.

List A learned with meaning List B learned without meaning	List A learned without meaning List B learned with meaning
List B learned with meaning List A learned without meaning	List B learned without meaning List A learned with meaning

Table 1: Schematic Representation of the Four Cells in the Experimental Design

3.2.3 Procedure

Participants worked in a short training session with the experimenter and then received an immediate post-test and a second post-test after an interval during which they carried out another, unrelated task. Steps in the experiment are shown in Figure 1. Post-tests included the dictation task of the same 10 words taught in the training session in order to assess how well they had been learned. A working memory task was given between the two post-tests to create an interval between the tests and to be used in the analysis of the correlation between working memory and learning of spelling in this experiment.

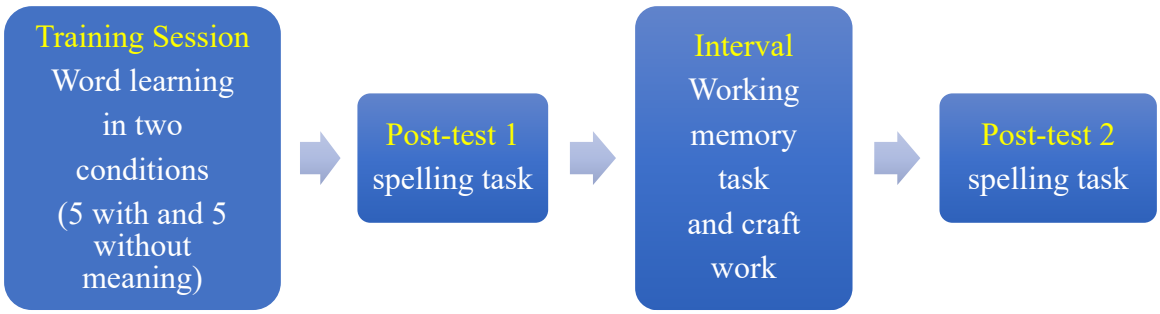


Figure 1. Schematic representation of the steps in the experimental session

There were two types of index cards used in the experiment. One was cards with spellings printed out, hereinafter referred to as spelling cards. The other was cards with associated drawings, hereinafter referred to as picture cards in the description of the experiment.

The training session included exposure and practice, and the details are shown in Table 2. The first spelling test was given after all 10 words were taught.

Exposure: In both teaching conditions, participants were first asked to read aloud the five target words, one at a time on spelling cards. Errors were corrected by the researcher as necessary. The duration of exposure of all words and the number of exposures were held constant across the two teaching conditions. This procedure varied across two conditions as described below.

In the meaning condition: Following the participants' initial reading of each novel word, the spelling card was immediately removed from view and the researcher then read a short Chinese definition aloud and presented a picture card that represented the definition. The researcher then said the target word and presented the spelling card again for participants to read a second time. This exposure procedure was repeated for all five words.

In the no-meaning condition: The definition-reading and showing of the picture card were replaced with 20 seconds' silent thinking of the target words for participants. All other procedures were the same as in the meaning condition.

Practice: After the completion of this initial exposure began the practice session. The researcher mixed the spelling cards for the target words with spelling cards for the five distractors in random order, and took one spelling card at a time for participants to read aloud.

In the meaning condition: On the table, the researcher had the picture cards spread out. When the child read the word, the child needed to identify the picture for the word, or say "no picture for it" when encountering a distractor. The researcher would correct participants' mistakes in both reading and picture identification if there were any. When a taught word was encountered, after the participant had chosen a matching picture, the researcher read aloud the word, and asked participants to spell the word on a blank index card. They were then asked to read aloud the word they had just spelt. If the spelling was incorrect, instead of reading aloud their own spellings, the original spelling card would be presented for them to read a second time. Each item was presented three times for the participants to identify and read aloud in random order. Participants only practised spelling the target words, not the distractors.

In the no meaning condition: The picture identification task was replaced with participants thinking of the word silently and replying to the researcher either "learned" for the target words, or "not learned" for the distractors. When any taught word was encountered, participants were asked to spell the word on a blank index card, and practise reading aloud the words as happened in the meaning condition.

Table 2: Description of the training sessions

Exposure	Five words were taught in this session either paired with meaning or not.

	1. The researcher shows one word at a time, on a spelling card, for participants to read aloud for the 1st time;	
	2. Spelling card removed;	
	3. **In the meaning condition**, the researcher reads a definition, and reveals a picture card at the same time;	3. **In the no-meaning condition**, the researcher asks the participants to think of the word silently for 20 seconds;
	4. The researcher articulates the word, and presents the spelling card again;	
	5. Participants read for a 2nd time.	
	Repeat the whole process for all five words in one condition, then move onto practice.	
Practice	1. The researcher mixes the spelling cards for five taught words with spelling cards for five distractors, and has the picture cards spread out on the table;	
	2. The researcher shows each card 3 seconds in random order for participants to read aloud for the 1st time;	
	3. **In the meaning condition,** participants are asked to match the picture with the word by choosing a picture or indicating that there is no picture.	3. **In the no-meaning condition,** participants are asked to say if the words have been learned or not learned.
	4. When a taught word is encountered, the researcher says the word aloud without displaying the spelling card, and asks the participant to spell the word on a blank index card;	
	5. Participants then read the word they spell for the 2nd time; if the spelling is incorrect, the researcher presents the original spelling card for participants to read aloud.	

	There are three trials for each item with two readings per trial. Spelling practice is only used with the target words, not the distractors. In the last trial, no errors in reading or picture matching are expected.

After completion of exposure and practice for the first set of five words in either meaning or no-meaning condition, the whole process was carried out for the next set of five words in a different teaching condition.

The spelling test was given after completion of the learning of all 10 words.

3.2.4 Measures

Outcome Measure: Dictation Task in Post-tests

Participants were assessed in two post-tests through a written dictation task. A dictation of the same 10 taught words was used in both post-tests. A dictation task was used because 1) contextually, young English learners in China start learning the English language with written forms in textbooks, and they are mainly assessed in written English exams; 2) word production task in the form of spelling has been used as a powerful way to measure the learning of written forms, and most previous studies assessed participants through spelling tasks (Cunningham, 2006; Cunningham et al., 2002; Hilte & Reitsma, 2011; Ouellette, 2010; Ouellette & Fraser, 2009; Shahar-Yames & Share, 2008).

Participants' spellings were scored as either right or wrong, with correct spellings earning one point each and wrong spellings scoring no point. The maximum number of points a participant could achieve by completing each set is 5.

Working memory task

Because there is no standardised measure of working memory for children in China, a counting span task was created for this study. A version of counting span included in the Working Memory Battery for Children (Pickering & Gathercole, 2001), named Counting Recall, has been used with English speaking children, and has a test-retest reliability of r=.74 (Conway et al., 2005). In this Counting Recall task, participants count the number of dots on a computer screen, one by one, out loud by pointing at the dots. After they have counted them, the screen with dots disappears. The level of difficulty of the task increases as participants proceed, from counting and recalling dots on one screen to counting and recalling dots on seven screens. Participants are asked to recall the number of dots on each screen in the order of appearance. The test is discontinued when the participant does not recall 4 trials correctly within a span, which contains six trials.

It was reasoned that this working memory task could be adapted for a Chinese version because counting would place the same demands on the children's working memory. The use of numbers in this task avoids the need for translation and back translation, as the meaning of small numbers can be considered comparable across English and Chinese. The task could be easier for Chinese children as they learn to count significantly earlier to higher numbers than English speaking children (Miller & Stigler, 1987). The counting recall tasks involves the use of numbers 3 to 7. These five numbers in Chinese are single-syllable words, thus should not add to the level of difficulty of the task (*Table 3*). This adapted Counting Recall task will be used in all three experiments.

Table 3: Chinese Pronunciation for Numbers 3 to 7

numbers	3	4	5	6	7
Chinese Pronunciation in *Pinyin*	sān	sì	wǔ	liù	qī

For the working memory test, participants score one point for each trial they recall successfully. A trial involves recalling the correct number of dots in the order of appearance; for example, a trial in span three requires recalling three numbers in the correct order and a trial in span six requires recalling six numbers in the correct order. There are altogether seven spans with six trials in each span. The task was discontinued when participants failed four out of the six trials within a span level, and scores were calculated based on the total number of correctly recalled trials completed prior to discontinuation.

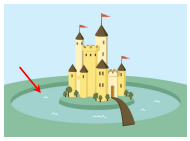
3.2.5 Materials

Training stimuli:

All training stimuli were single morpheme words that could be adequately represented in English in two different ways. The 10 training stimuli were low frequency real words chosen to rely on the same type of possible spelling variation as the nonwords stimuli used in previous studies (Ouellette & Fraser, 2009; Ouellette, 2010). When choosing the training stimuli, the following criteria were followed: a) the words should be real words easy to define and illustrate with pictures; b) no abstract words should be chosen because meanings of abstract words cannot be easily denoted via a picture; c) the chosen words are not likely to be known by children in this age group in Beijing; d) the words' pronunciations allow for more than one appropriate spelling (e.g., BAIT/BATE).

The training stimuli were divided into two sets of 5 with vowel patterns matched across lists: Word List A and Word List B. Meaning is presented in the form of oral Chinese definition and associated with a picture (*Table 4*). The training stimuli from prior studies (Ouellette & Fraser, 2009; Ouellette, 2010) are shown in Appendix 1.

Table 4: Training Stimuli and the Associated Pictures

Set A words	Associated Pictures	Set B words	Associated Pictures
bait		gale	
murk		tern	
beak		beet	
cote		moat	
coop		brume	

The experiment also involves the use of 10 distractors in the training session. The 10 distractors were chosen from the very beginning of the Schonell Reading test (*Table 5*). If any word contained a vowel sound spelt in the same way as the vowels in the taught stimuli, the researcher skipped this one and moved onto the next. The sixth word "play" contains the same vowel sound as two training stimuli "bait" and "gale", but the spelling pattern is different, which is why it is still kept as a distractor.

Table 5: Distractors Chosen from Schonell Reading Test

1. little	2. milk	3. egg	4. sit	5. from
6. play	7. flower	8. clock	9. light	10. think

The same target words, distractors, and pictures were used in all three experiments.

3.2.6 Ethical Considerations

This study (including all three experiments) received ethical clearance through the approval process for research with young children by the University of Oxford Central University Research Ethics Committee (CUREC) (See Appendix 2). The research took place in accordance with Oxford University Protocol 25, and fully complied with the guidelines set by the British Educational Research Association's Ethical Guidelines for Research (2011). The key principles of ensuring informed consent, protecting privacy, and not causing harm were followed and will be followed throughout the research. The experiment took place during school holidays, and thus did not cause disruption to schools. A brief report of findings from the first experiment and suggestions for English learning has been sent to participants' parents. Details of the ethical considerations can be found in the CUREC form (Appendix 3), and information sheets to parents (English version in Appendix 4; Chinese version in Appendix 5).

3.3 Results

This first experiment analyses the contribution of meaning to the learning of the written form, as well as the correlation between working memory and children's performance in the learning of the written form. The predictions are:

1) If participants learn the meaning of the words, they will spell the words correctly more often in a post-test than words that were learned without meaning.
2) Participants' working memory scores are positively correlated with their performance in the spelling task.

This section presents findings from this first experiment. In the first part, descriptive statistics were presented, which gives an overview of the results to see if the means in the meaning condition were higher than those in the no-meaning condition as predicted. In the second part, preliminary analyses were carried out to explore the distributions of variables, and to determine the order effects between different subgroups. The third part presents the main analyses for hypotheses testing.

3.3.1 Descriptive Statistics

The mean and standard deviation are shown in *Table 6*. For spelling task in the first post-test, participants' scores for words that were learned with meaning ranged from 0 to 5, and the mean was 3.83 out of 5; their scores for words that were learned without meaning ranged from 0 to 5, and the mean was 2.85 out of 5. In the second post-test, participants' scores for words that were learned with meaning ranged from 0 to 5, and the mean was 2.87 out of 5; their scores for words that were learned without meaning ranged from 0 to 4, and the mean was 1.96 out of 5. In both post-tests, participants scored higher when spelling words that were learned with meaning than words that were learned without meaning.

Table 6: Means and Standard Deviation in Different Teaching Conditions for Each Testing Occasion (N=53)

Teaching Condition	Mean	Std. Deviation
The 1st Posttest		
Meaning Condition	3.83	1.53
No-meaning Condition	2.85	1.63
The 2nd Posttest		
Meaning Condition	2.87	1.40
No-meaning Condition	1.96	1.16

3.3.2 Preliminary Analyses

Distribution of variables

The aim of the study is to compare the differences between different teaching conditions. If paired sample t-test is to be used, the distribution of the raw scores is not important, but the distribution of the differences between scores should be normal (Field, 2024). Differences between scores in the different teaching conditions were then computed, and a z-test is applied for normality test using skewness and kurtosis. As Table 7 shows, all values of z-scores are below 1.96, suggesting the differences between spelling scores across different teaching conditions can be considered as normally distributed.

Table 7: The z-scores of Skewness and Kurtosis of Differences between Spelling Scores in Different Teaching Conditions

	N	Skewness			Kurtosis		
		Statistic	SE	z-score	Statistic	SE	z-score
Difference in the 1st Post-test	53	.215	.327	.657	-.582	.644	-.904
Difference in the 2nd Post-test	53	.183	.327	.560	-.309	.644	-.480

A second aim of the experiment is to look at the correlation between participants' working memory and their performance in the spelling tasks. A z-test was applied for normality test using skewness and kurtosis. As Table 8 shows, all values of z-scores are below 1.96 except the z-score of Skewness for spelling score in the meaning condition in the first post-test, and the z-score of Kurtosis for score in working memory test. Although for medium-sized samples ($50<n<300$), the null hypothesis can be rejected at absolute z-value over 3.29, which corresponds with an alpha level 0.05 (Kim, 2013), the value of -3.302 (skewness value for children's spelling scores in meaning condition in the 1st post-test), and 3.522 (kurtosis value for children's working memory scores) still suggests these two distributions are non-normal. A non-parametric test will need to be used when examining the correlation between participants' working memory and spelling performance.

Table 8: The z-scores of Skewness and Kurtosis of Spelling Scores in Different Teaching Conditions

	Skewness			Kurtosis		
	Statistics	SE	z-score	Statistics	SE	z-score
The 1st Posttest						
Meaning Condition	-1.080	.327	-3.302	-.021	.644	-.033
No-meaning Condition	-.380	.327	-1.162	-.894	.644	-1.388
The 2nd Posttest						
Meaning Condition	-.497	.327	-1.520	-.245	.644	-.380
No-meaning Condition	-.001	.327	-.003	-.777	.644	-1.207
Scores in the Working Memory Test	.441	.327	1.349	2.268	.644	3.522

Order effects

The experiment is a within-participants design, but the order of teaching conditions and the order of word sets are between-participant factors. Children's performance may differ not just because of the experimental manipulation, but also because of the difference in order of the conditions.

A multivariate analysis of variance (MANOVA) was carried out using the order of teaching conditions and the order of word sets as the independent variables and all four spelling scores (scores in two post-tests across two teaching conditions) as the dependent variables. Using Pillai's trace, no significant effect of orders on participants' spelling performance was detected, $V=.096$, $F(4,46)=1.228$, $p>.05$ for the order of teaching conditions, and $V=.106$, $F(4,46)=1.359$, $p>.05$ for the order of word sets.

From these results, we can conclude that the order of teaching conditions and word sets did not affect participants' performance in spelling tests, which allows for all the results to be analysed together, disregarding the order of different conditions.

3.3.3 Main Analyses

The effect of meaning on learning word spelling

The aim of this experiment is to investigate if the variation in experimental condition, learning with or without meanings, will result in significant differences in children's performance in the two dictation tasks. *Table 6* displays the mean scores for correct spelling when the words were learned in the meaning vs the no-meaning condition. The scores were higher in the meaning condition than in no-meaning condition in the first and the second post-test. In order to test whether these differences can be attributed to chance, a dependent samples t-test was used to compare the means because the difference between scores in the learning conditions met the assumption of normal distribution. Cohen's effect sizes were calculated using the SD for the overall distribution for each post-test.

In the immediate post-test, participants scored significantly higher in spelling words taught in the meaning condition than spelling words taught in the no-meaning condition, $t(52)=3.73$, $p<.001$, and a medium-sized effect, $d=0.60$, was observed.

In the second post-test, participants scored significantly higher in spelling words taught in the meaning condition than spelling words taught in the no-meaning condition, $t(52)=3.73$, $p<.001$, and a larger effect size was observed than in the immediate post-test, $d=0.78$.

In both post-tests, participants scored significantly higher when spelling words learned with meaning than words without meaning representations, which is in line with the prediction and supports the hypothesis that the presence of meaning makes the oral and

written form into a word, which is more memorable than a non-word. Because the sounds and spellings were the same across subjects, these differences cannot be attributed to the stimuli in themselves, but can only result from their association with meaning.

The Association between Working Memory and Performance in the Spelling Task

As one of the participants' scores in the spelling tasks and scores for the working memory test violated parametric assumptions, a Spearman correlation coefficient was used to measure the association between working memory and spelling in this study. The prediction was that participants with higher working memory scores would achieve higher scores in the dictation tasks. Participants' spelling scores in the first post-test were positively correlated with their working memory scores, with a coefficient of r_s=.317 in meaning condition, and r_s=.303 in no-meaning condition, both significant at p<.05. Significant correlations were also found in the second post-test: r_s=.531 in meaning condition and r_s=.439 in no-meaning condition, both significant at p<.01.

Thus, under both conditions, the learning of spellings was associated with working memory, which is again in line with the prediction and supports the hypothesis that working memory plays a role in word learning.

3.4 Discussion

A connection to meaning was found to be favourable for remembering the relation between the sound and spelling of a word.

Single-syllable words with different possible spellings were used in the current study. Meaning was found to facilitate children's recall of the written forms when hearing the sounds. As children in the current study performed spelling tasks under dictation, this experiment provides evidence for how meaning facilitates learners to build a link between the oral and written forms of English words.

This finding of the contribution of meaning is not a prediction one would expect in an alphabetical orthography. Learning an alphabetic orthography like English as a second language involves more than phonological principles. A sequence of sounds only becomes a word if it has meaning. The experiment shows that trying to spell a sequence of sounds that has no meaning is different from spelling one that has meaning and can be conceived of as a word. To build the link between a sound and a spelling, meaning needs to be brought into play.

The experimental design of this empirical study was based on prior experiments with native children (Ouellette, 2010), which investigated the role of meaning in the learning of the written forms of English nonwords for children whose first language is English. In the current study, real words that were unlikely to be known by the target population were used. The significant role of meaning in learning to spell was identified in Ouellette's (2010) study and in the current study. As analysed earlier, Ouellette's experiment created a similar situation to learning a second language where learners are learning oral form, written form and meaning all at the same time. The current study further showed that to establish a stable link between a sound and a spelling, meaning should be activated simultaneously. This applies to native children when they are learning novel words (Ouellette, 2010). It has more significant theoretical implications for second language learning.

In the current study, working memory was found to be significantly correlated with children's spelling performance in both the immediate and the second posttests. Children's ability to remember the sequences of sounds that help form the word was found to be strongly associated with their ability to learn new words (Gathercole et al., 1999; Gathercole et al., 1997; Gathercole et al., 1992). In this study, the children did not have to recall the sounds over time, as the words were written under dictation. A dictation task still requires the children to keep the sounds in mind while they represent them. Although the demands on working memory are likely to be lower, working memory still showed a significant, even if modest association, with spelling accuracy. It is expected that working memory will play a more important role in later experiments, when children will be asked to recall the word they learned in a recognition task, in which they are presented with a set of pictures and asked to identify the correct one.

In this experiment, which used a within-participants design, there is no threat to the internal validity, but the information gathered here indicates that if in subsequent experiments, or future studies, a between-participants design is used, it would be important to measure working memory and use it as a covariate in the analyses.

In the training session, when participants were learning words without meaning, they were given 20 seconds to think of the word silently. It would be worthwhile to ask the participants, at the end of the experiment, what they were thinking actually. They might be practising the sounds or spellings. This could be another variable that helps explain the variation between their scores.

This first one of the series of three experiments provides important lessons for the next two experiments in terms of what experimental design to adopt and what training

stimuli to use. Findings from this experiment point to a connection of the three constituents of a word—oral form, written form and meaning, but further evidence is still needed to understand the link among the three factors. Participants in this first experiment practised learning the new words through reading and spelling. The discrete role of the two practice types, reading and spelling, remains to be analysed. Meaning was found to support the learning of written English words. What practice type would facilitate the acquisition of meaning, spelling versus reading, and auditory only versus reading with visual exposure of printed words? These will be the main research questions for the next two experiments in this thesis.

CHAPTER FOUR – THE EMPIRICAL STUDY: EXPERIMENT TWO

4.1 Introduction

The aim of this second experiment is to find whether two practice types, reading versus spelling, have an effect on the learning of the spelling and of the meaning of English words for young Chinese English language learners. Spelling sometimes is thought of as the reverse of reading: instead of turning letters into sounds, learners turn sounds into letters (Harley, 2014). This view, however, neglects the psychological components of spelling. When learners read a word, they see a word, but are not producing the word. Reading and spelling are two different processes. When reading, learners are just recognizing graphemes, whereas when spelling, they are producing, which requires greater attention and precision. They differ from each other in some important details. One is about recognition, and the other is about production. When learners have to produce, they have to produce the right letters in the right place. More attention and expertise are needed in the process of spelling.

Spelling means converting oral forms to written forms and reading means converting written forms to oral forms. This logical symmetry has no place in the actual process. "In English, there are generally more possible spellings for a particular word than possible readings" (Bosman & Orden, 1997, p. 182). When seeing letter "a" or letter combinations "ai" or "ay", learners may be able to read the words correctly because they would be able to recognise the graphemes, and produce the correct pronunciation /ei/. Spelling a word that contains the /ei/ sound is different. Simply applying phonological principles is not sufficient. The sound /ei/ can be spelt as "a", "ai" or "ay". When learners hear the sound /beit/, simply applying the phonological rules would result in spellings like "bate", "bayt" or "bait". The process of spelling involves more

than applying the phonographic principle. To spell out the right word, a verification process is involved. Learners need to check, often implicitly, that the spelling looks right (Perfetti et al., 1997).

The psycholinguistic processes involved are different. Reading does not require the same degree of knowledge about words that spelling does (Perfetti, 1997). Reading can be accomplished with incomplete word representations. In an experiment done by Laing and Hulme (1999), children could read aloud letter abreviations, like “bskt” for “basket”. Spelling, however, demands more than the recognition of graphemes. To produce an errorless spelling, learners need to memorise the written form precisely, and conquer interferences like different letter sequences that share the same sound. Spelling is always harder than reading (Bosman & Orden, 1997; Kessler & Treiman, 2001).

Bosman and Orden (1997) suggested that practice at spelling should help reading more than practice at reading helps spelling. When spelling out a word, learners need to analyse the incoming sounds, think of its meaning, and convert the sounds into letters. This is not the end. They also need to do a verification of the spelling. This verification process not only involves a visual inspection, but also entails reading. Spelling requires an interation of different knowledge.

There is empirical evidence showing that spelling could lead to significantly greater learning results than reading only in spelling production (Ouellette, 2010; Shahar-Yames & Share, 2008). In Ouellette’s (2010) study, 36 Grade 2 students were taught 10 nonwords. Half of them practised by reading them, while the other half practised by spelling them. They were then assessed one day and seven days later with a dictation task. A significant effect of practice type was identified favouring the spelling practice.

Ouellette's (2010) design was a between-subjects design. Shahar-Yames and Share (2008) adopted a stronger within-subjects design, and examined the contribution of spelling practice, relative to reading, to the learning of writing nonwords in Hebrew. Shahar-Yames and Share (2008) examined, with 45 third grade Hebrew speaking children, the effect of spelling practice on learning to write Hebrew words. Participants were exposed to three different learning conditions, reading, reading-and-spelling composite, and a control condition. In the control condition, target words were neither seen nor heard, only post-tested (Shahar-Yames & Share, 2008). Twelve nonwords in Hebrew were used as the target words with four appearing in each of the three learning conditions. All participants were involved in all three conditions, and all target words appeared in three conditions equally frequently. Target words were embedded in sentences. Participants either practised by reading only, or by reading the sentence first, plus writing the words out from memory. Spelling was found to lead to significantly greater learning results than reading only in spelling production, but not in spelling recognition.

A very important prerequisite of the above-mentioned studies is that learners were asked to spell words, not sequences of sounds, because even when the learners were taught nonwords, these nonwords were given meanings. In Ouellette's (2010) study, learners learned the words with meaning representations. In Shahar-Yames and Share's study (2008), learners learned the target words in meaningful context. The first experiment of the current study found out that meaning contributes to the learning of spelling. However, in the first experiment, all participating Chinese children practised the target words by spelling. It remains to be seen whether a 'reading-only' practice condition would result in the significant spelling performance deficits observed by Ouellette (2010) and Shahar-Yames and Share (2008). Will these two different practice

types also lead to significant difference in the learning of word meaning?

This second experiment investigates the effects of two practice types, reading vs. spelling, on the acquisition of spelling and meaning of English words for young Chinese English language learners. In this experiment, children were taught ten words, and practised either by spelling or by reading only. Children were told that they were going to learn the spellings and the meanings of these words. These ten words were taught in two blocks of five words each. For one block of five words, children practised by spelling them on empty index cards. While for the other block, they practised by reading only, and were expected to think silently about the words so that they could recall its meaning and could spell it later. For words in both blocks, they learned the meaning via a Chinese definition and an associated picture. After the learning session, children were given one immediate and one delayed post-test. They were tested immediately on two tasks, a spelling task and a picture identification task. The same spelling test and picture recognition test were given after a break of about half an hour to see if after this break, they could still remember the spelling and meaning of these words. It was expected that children could spell the words, and recall their meanings correctly more often if they practised by spelling than by reading only. As practice type is the only variable manipulated by the researcher, any difference in participants' performance would have to result from the different practice types.

A counterbalanced within-participants design was used as in the first experiment. The same working memory task was given in the break between the two post-tests to investigate the correlation between working memory and children's learning of word spelling and meaning. The same training stimuli from the first experiment were used in this second experiment.

Participants for this experiment came from two Districts in Beijing. For children from Xicheng District, the experiments took place in a private classroom of a language learning centre in the residential area from which the participants came, whereas for children from Dongcheng District, the experiments were carried out in the office of a children's library. Before the experiment, the researcher met the parent and the child briefly to introduce herself and the study to the participants, address some important ethical issues, and reply to questions and concerns from both the parent and the child. All participating children were from the neighbouring area and knew the venue well (the learning centre or the library). Many of them were taking language lessons in the learning centre or were members of the children's library. Therefore, children were familiar with the venue for the experiment.

4.2 Method

4.2.1 Participants

As the experiment took the same design as the first experiment, the same sample size of 54 participants were recruited.

Participants (N=54; 23 girls, 31 boys) were recruited from two adjacent districts in Beijing, Dongcheng and Xicheng District, using convenience sampling, and following the opt-in procedure. Participants from Xicheng District were recruited from the WeChat group for parents, which is a very common communication platform for Chinese parents. This was also how participants for the first experiment were recruited. As no sufficient response was received through the WeChat group, a second group of participants were recruited from a children's library in Dongcheng District. Invitations for children attending Year 2 or Year 3 at the time were sent to the two WeChat parent

groups online, one for parents in the same residential area, and the other for parents of children from the children's library. There was no exclusion criterion. No children with special needs participated in the study.

Participating children ranged in age from 7.8 years to 8.9 years with a mean age of 8.4 years (SD=0.3 years). At the time of the experiment, all children had started to learn English in school, with different lengths of formal learning experience ranging from 1 year to 4 years (SD=0.7 years). All participating children were attending Year 2 or Year 3 at the time of the experiment, and they had learned sufficient alphabetic knowledge and basic vocabulary to understand English learning.

4.2.2 Design

The design was within-participants. Participants learned the oral and written forms of the target words with meaning in the experiment, and practised them through either spelling, or reading only. As with the first experiment, meanings were presented in the form of oral Chinese definitions and an associated picture.

The 10 training stimuli were the same low frequency real words from the first experiment. They were divided into two sets of five with vowel patterns matched across lists. Distractors consisting of the same ten real words from the first experiment were included in the training session for participants to practise alongside with the training stimuli.

Word lists were fully counterbalanced across teaching conditions: half of the participants learned Word List A through spelling practice, and the other half learned Word List B by reading only. The order of teaching conditions was also

counterbalanced. Half of the participants practised by spelling first, and half practised by reading first.

This counterbalanced design created four experiment cells as shown in *Table 9.* Among all 54 participants, 27 (50%) practised by spelling first, and 27 (50%) practised by reading first. The ten target words were divided into Set A and Set B, and were taught to the participants in different orders, with 27 (50%) doing Set A first, and 27 (50%) doing Set B first.

List A learned through spelling List B learned through reading	List A learned through reading List B learned through spelling
List B learned through spelling List A learned through reading	List B learned through reading List A learned through spelling

Table 9: Schematic Representation of the Four Cells in the Experimental Design

4.2.3 Procedure

Participants worked in a short training session with the experimenter and then received an immediate post-test and a second post-test, after an interval during which they carried out a working memory task and some craft work. Steps in the experiment are shown in Figure 2. One form of post-test included the dictation task of the same 10 words taught in the training session in order to assess how well the written forms were learned. A second form of post-test was the picture identification task to assess how well word meanings were learned. A working memory task was given between the two post-tests to create an interval between the tests and to be used in the analysis of the

correlation between working memory and the learning of word spelling and meaning in this experiment.

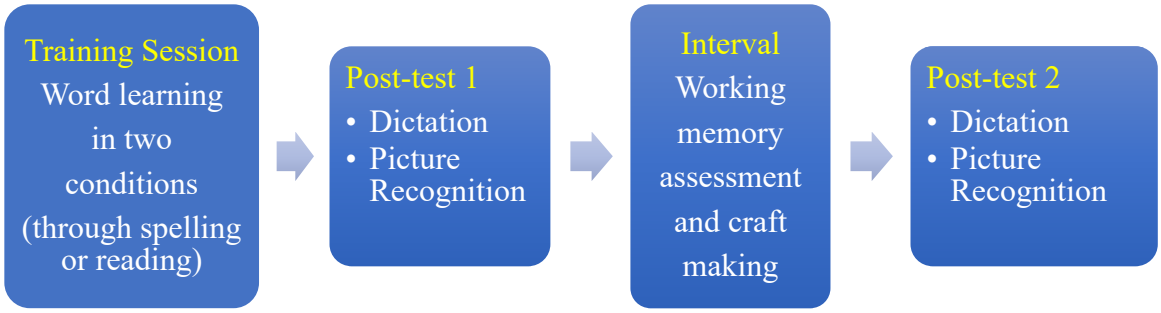


Figure 2. Schematic representation of the steps in the experimental session

Different from the first experiment, this second experiment was carried out using both computer and index cards with pictures.

The training session included exposure and practice, and the details are shown in *Table 10*. The first post-test was given after all ten words were taught.

Exposure: In both teaching conditions, participants were first asked to read aloud the five target words, one at a time on the computer screen. Errors were corrected by the researcher as necessary. The duration of exposure of all words and the number of exposures were held constant across the two teaching conditions.

Following participants' initial reading of each word, the word disappeared from the screen and the researcher then read a short Chinese definition aloud and revealed a picture on the screen that represented the definition. The researcher then said the target word and the word appeared again on the screen for participants to read a second time. This exposure procedure was repeated for all five words.

Practice: After the completion of this initial exposure began the practice session. The 5 target words in one set were mixed with 5 distractors in random order. These 10 words were shown on the screen, one at a time, for participants to read aloud.

Spelling practice: On the table, the researcher had the index cards with printed pictures spread out. When the child read the word on the screen, the child needed to point to the picture card for the word, or say "no picture for it" when encountering a distractor. The researcher would correct participants' mistakes in both reading and picture identification if there were any, but would not repeat the word again. When a taught word was encountered, apart from picture identification, the researcher read aloud the word, and asked participants to spell the word on a blank index card. Each item was presented three times for the participants to identify and read aloud in random order. Participants only practised spelling the target words. The whole procedure was repeated for all 10 words, 5 target words and 5 distractors.

Reading condition: The spelling practice was replaced with participants thinking of the word silently.

Table 10: Description of the training sessions

Exposure	Five words were taught in this session with meaning.
	1. The researcher shows one word at a time, on the computer screen, for participants to read aloud for the 1st time;
	2. Word disappears from the screen;
	3. The researcher reads a definition, and reveals a drawing at the same time on the screen;

	4. The researcher articulates the word, and presents the word on the computer screen again;	
	5. Participants read for a 2nd time.	
	Repeat the whole process for all five words in one block, then move onto practice.	
Practice	1. The researcher mixes the five taught words with five distractors;	
	2. The researcher presents each word 3 seconds in random order for participants to read aloud for the 1st time; index cards with printed pictures of the five taught words are spread out in front of the participants;	
	3. Participants are asked to point out the index card with a matching drawing when seeing the word on the computer screen. When a distractor is encountered, they reply "no picture for it";	
	4. In spelling condition: When a taught word is encountered, the researcher says the word aloud while presenting the word on the screen, and asks the participant to spell the word on a blank index card;	4. In reading only condition, When a taught word is encountered, the researcher says the word aloud while presenting the word on the screen, participants were asked to think of the word silently for 5 seconds.
	5. Participants then read the word they spell for the 2nd time, or the original stimuli in reading only condition; if the spelling is incorrect, the researcher presents the original stimuli for participants to read aloud.	
	There are three trials for each item with two readings per trial. Spelling practice is only used with the target words. In the last trial, no errors in reading or picture matching are expected.	
After completion of exposure and practice for the first set of five words in either reading or spelling condition, the whole process was carried out for the next set of five words with a different practice type. The spelling test was given after completion of the learning of all 10 words.		

4.2.4 Measures

Outcome Measure 1: Dictation Task in Post-tests

Participants in this experiment were assessed in two post-tests through a written dictation task as in the first experiment. A dictation of the same ten taught words was used in both post-tests.

In the spelling task, participants' spellings were scored as either right or wrong, with correct spellings earning one point and wrong spellings scoring no point. The maximum number of points a participant could achieve in the spelling task in one condition (through spelling practice or reading practice) is 5.

Outcome Measure 2: Picture Identification Task

The learning of word meaning was assessed through a picture identification task. After the dictation of one set of five words, participating children were asked to choose a correct corresponding picture for the words they have written down. They were presented one piece of A4-sized paper with ten numbered pictures, and were asked to write down the number of the picture next to the dictated word. No original stimuli appeared in this picture identification task. The five correct choices are pictures that look different from the original pictures used in the training session, but represent the same meaning. The other five pictures are used as distractors. They did not appear in the training session, do not represent the meaning of the taught words, but look

somewhat like the pictures that appeared in the training session (See Table 11 for details of the pictures).

Five different pictures were used for each target word to ensure children were not merely responding based on visual familiarity. This approach required participants to understand the word's meaning rather than simply associating the label with a specific, recurring image.

Table 11: Pictures Used in the Picture Identification Task

Correct choices	Distractors	Correct Choices	Distractors
bait		gale	
			
murk		tern	
			
beak		beet	
			
cote		moat	

			
coop		brume	
			

In the picture identification task, participants' responses were scored using the same procedure. A correct selection of the image denoting the word's meaning earned one point, while an incorrect choice earned zero. Consequently, the maximum possible score a participant could achieve in the picture identification task, across either practice condition, was five points.

Working memory task

The same counting span task from the first experiment, an adapted Count Recall task in Chinese, was used for this second experiment.

For the working memory test, participants score one point for each trial they could successfully recall. There are altogether seven spans with six trials in each span.

4.2.5 Materials

Training stimuli:

The same training stimuli from the first experiment were used in this second experiment. Details of the training stimuli and the associated pictures can be found in *Table 4* in Chapter three.

The experiment also involves the use of 10 distractors in the practice session. They were the same 10 distractors used in the first experiment.

All target words, distractors, and pictures were presented on computer screen with the same font style and size (chalkboard, regular, 96).

4.2.6 Ethical Considerations

Ethical clearance was received through the approval process for research with young children by the University of Oxford Central University Research Ethics Committee (CUREC) for all three experiments.

4.3 Results

This second experiment aims to analyse the effects of different practice types, reading and spelling, on the acquisition of written form and word meaning. A previous study by Ouellette (2010) demonstrated a significant effect in favour of spelling practice. No previous studies have been carried out to investigate the effect of practice types on the acquisition of word meaning. This experiment will explore and may serve as a pilot for the third experiment, which will assess participants' learning of word meaning. The predictions are:

1) The first prediction in this study is that if participants learn the words through spelling, they will spell the words correctly more often in a post-test than words that were learned through reading only.
2) The second prediction is that participants will remember the word meaning correctly more often in the post-test if the meaning of the word is learned through spelling practice than through reading.
3) The third prediction is that participants' working memory scores are positively correlated with their performance in both the spelling task and the picture recognition task.

This section presents findings from the second experiment. In the first part, descriptive statistics are presented to provide an overview of the results, and to determine if the means for spelling practice were higher than those for reading practice, as predicted. In the second part, preliminary analyses were carried out to explore the distributions of variables, and to determine potential order effects between subgroups. Finally, the third part presents the main analyses for hypotheses testing.

4.3.1 Descriptive Statistics

All 54 children participated in the training session, and were tested in two tasks, a spelling task in the form of dictation, and a meaning recall task in the form of picture identification. The mean and the range of the total scores are shown in *Table 12*. For the spelling task in the first post-test, participants' scores through spelling practice ranged from 1 to 5, and the mean was 3.04 out of 5; while their scores through reading practice ranged from 0 to 4, and the mean was 1.76 out of 5. For spelling task in the second post-test, participants' scores through spelling practice ranged from 0 to 5, and

the mean was 2.44 out of 5; while their scores through reading practice ranged from 0 to 3, and the mean was 1.31 out of 5. For picture identification task in the first post-test, participants' scores through spelling practice ranged from 1 to 5, with a mean of 3.67 out of 5; while their scores through reading practice ranged from 0 to 5, with a mean of 2.94 out of 5. For the picture identification task in the second post-test, participants' scores through spelling practice ranged from 0 to 5, with a mean of 3.59 out of 5; while their scores through reading practice ranged from 0 to 4, with a mean of 2.37. The means showed that in both post-tests, participants scored higher in both spelling task and picture recognition task when they practiced through spelling than through reading.

Table 12: Means and Standard Deviation of all Scores for Different Practice Types (N=54)

Teaching Condition	Mean	Std. Deviation
Spelling Score in Post-test 1:		
Spelling practice	3.04	1.273
Reading practice	1.76	1.098
Spelling Score in Post-test 2:		
Spelling practice	2.44	1.383
Reading practice	1.31	.948
Picture Recognition Score in Post-test 1:		
Spelling practice	3.67	1.441
Reading practice	2.94	1.571
Picture Recognition Score in Post-test 1:		
Spelling practice	3.59	1.394
Reading practice	2.37	1.263

4.3.2 Preliminary Analyses

Distribution of variables

A z-test was applied using skewness and kurtosis for normality test for all scores, and differences between scores for two different practice types. The same critical value of 3.29 was used as with the first experiment making reference to Kim's (2013) paper about how to assess normal distribution "for medium-sized samples (50<N<300), the null hypothesis can be rejected at absolute z-value over 3.29, which corresponds with an alpha level 0.05". As Table 13 shows, all values of z-scores are below 3.29. A decision was then made to use paired sample t-test to compare the means between scores for different practice types, and use Pearson's correlation to measure the relationship between children's working memory and their performance in the spelling and picture identification tasks.

Table 13: The z-scores of Skewness and Kurtosis of All Scores and Differences between Scores for Different Practice Types

	N	Skewness			Kurtosis		
	Statistic	Statistic	SE	z-score	Statistic	SE	z-score
Spelling Score in Post-test 1:							
Spelling practice	54	-.015	.325	.046	-1.043	.639	1.63
Reading practice	54	.324	.325	.997	-.825	.639	1.29
Spelling Score in Post-test 2							
Spelling practice	54	.253	.325	.778	-1.298	.639	2.03
Reading practice	54	.697	.325	2.14	-.407	.639	.637
Picture Recognition Score in Post-test 1							
Spelling practice	54	-.446	.325	-1.372	-1.356	.639	-2.122
Reading practice	54	-.420	.325	-1.292	-1.173	.639	-1.835
Picture Recognition Score in Post-test 2							
Spelling practice	54	-.697	.325	-2.144	-.657	.639	-1.028
Reading practice	54	-.163	.325	-.502	-1.003	.639	-1.570
Working Memory Scores	54	-.043	.325	-.132	-.501	.639	-.784
Differences between Spelling Scores in Different Conditions							

Post-test 1	54	.378	.325	1.163	-1.229	.639	-1.923
Post-test 2	54	-.385	.325	-1.184	.121	.639	.189
Differences between Meaning Scores in Different Conditions							
Post-test 1	54	-.852	.325	-2.622	.539	.639	.844
Post-test 2	54	-1.022	.325	-3.145	1.901	.639	2.975

Order effects

As introduced in the method, the overall design of the study was a within-participants design, but the order of learning conditions (through spelling first or through reading first) and the learning order of word sets in the tasks (set A first or set B first) were between-participants factors. Children's scores may vary not only because of the differences in practice types, but also because of the differences in the order of conditions.

A multivariate analysis of variance (MANOVA) was carried out using the order of teaching conditions and the order of word sets as independent variables and all four spelling scores (scores in two post-tests across two practice types) and four meaning scores (scores in two post-tests across two practice types) as the dependent variables. Using Pillai's trace, there was a significant effect of the order of practice types on children's performance, $V=0.42$, $F(8,43)=3.9$, $p<.05$; a significant effect of the order of word sets was also detected, $V=0.391$, $F(8,43)=3.447$, $p<.05$.

From these results, we should probably conclude that the order of practice, and the order of word sets had a significant effect on performance in the two post-tests. The nature of this effect is not clear from the multivariate test statistic. First, it tells us nothing about which groups differed from which, and second it tells us nothing about

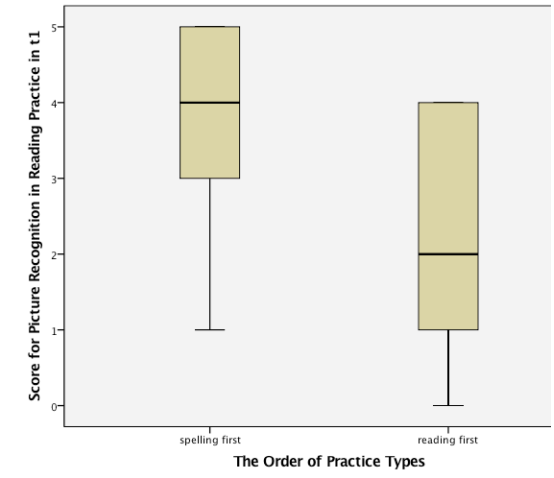
whether the effect of practice order was on spelling test, the picture identification test, or a combination of both. To determine the nature of the effect, subsequent ANOVAs were then carried out on all of the dependent variables.

Results of the subsequent ANOVAs suggested that the scores for meaning of words that were learned through reading practice were significantly affected by the order of practice types, $F(1, 54) = 18.084$, $p<.001$ for the first post-test, and $F(1, 54) = 29.239$, $p<.001$ for the second post-test.

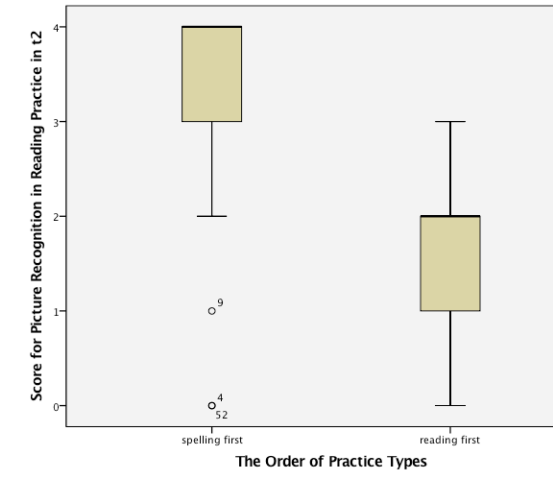
Two boxplots are plotted to display how the order of practice types influenced the distribution of participants' scores in the picture identification tasks for words that were learned through reading practice in the two post-tests. Separate boxplot for scores of words that were learned through different order of practice are shown in *Figure 3*. In both post-tests, spelling first has a higher top score, which means most participants scored higher when a word was learned through spelling first.

Figure 3: Boxplots Displaying Scores in Picture Recognition Task for Words That Were Learned through Reading Practice

Post-test 1



Post-test 2



4.3.3 Main Analyses

The aim of the study is to investigate if the variation in practice types, learning through spelling or through reading only, will result in significant differences in children's performance in the learning of word spelling and the learning of word meaning. Paired sample t-test was used to compare the means of spelling scores between the two practice types as no order effect was detected regarding the learning of spelling. For the learning of word meaning, however, one-way repeated-measures ANOVA was carried out to control for the influence from the order of practice. Results are reported below following the order of the predictions.

The effect of practice type on learning word spelling

Table 12 displays the mean scores for correct spelling when the words were learned through spelling practice vs. by reading only practice. The scores were higher for words that were learned through spelling practice than those learned through reading only practice in both post-tests. In order to test whether these differences can be attributed to chance, a paired samples t-test was used to compare the means. Cohen's effect sizes were calculated using the SD for the overall distribution for each post-test.

In the immediate post-test, participants scored significantly higher in spelling words practised through spelling than spelling words practised through reading, $t(53)=6.27$, $p<.001$, and a large effect, $d=0.85$, was observed.

In the second post-test, participants scored significantly higher in spelling words taught in meaning condition than spelling words taught in no-meaning condition, t(53)=5.38, $p<.001$, and represented a close to a large effect size, $d=0.73$.

In both post-tests, participants scored significantly higher when spelling words learned through spelling than words learned through reading, which is in line with the prediction and supports the hypothesis.

The effect of practice types on learning word meaning

As preliminary analysis found a significant effect of the order of practice types on the learning of word meaning, to examine the effect of practice type on word meaning learning while accounting for order effects, separate mixed-design repeated-measures ANOVAs were conducted for each post-test. Practice type (spelling practice vs reading-only practice) was entered as a within-subjects factor, and order of practice type was entered as a between-subjects factor. Scores on the picture recognition task served as the dependent variable.

In the first post-test, there was a significant main effect of practice type on the learning of word meaning ($F(1, 52) = 7.212$, $p<.05$, $\eta_p^2=.122$). Bonferroni post hoc tests showed that participants scored significantly higher in the picture recognition task for words that were learned through spelling practice (mean=3.67; SD=1.44; $p<.001$) than words that were learned through reading-only practice (mean=2.94; SD=1.57; $p<.001$).

In the second post-test, the main effect of practice type remained significant, $F(1, 52) = 7.051$, $p<.05$, $\eta_p^2=.119$. Bonferroni post hoc tests showed that participants scored significantly higher for words that were learned through spelling practice (mean=3.59;

SD=1.39; p<.001) than words that were learned through reading only practice (mean=2.37; SD=1.26; p<.001).

This evidence supports the prediction that practice type affects the learning of word meaning. Specifically, these findings suggest a significant effect in favour of spelling practice on the learning of word meaning in comparison with reading practice.

Association between Working Memory and the Learning of Word Spelling

A Pearson's correlation coefficient was computed to assess the relationship between working memory and the learning of word spelling. For words that were learned through spelling practice, a positive correlation was found between working memory and spelling scores in the first post-test (r=.605, N=54, p<.001); in the second post-test, no significant correlation was detected (r=.182, N=54, p=.187). For words that were learned through reading practice, a positive correlation was found between working memory and spelling scores in the first post-test (r=.285, N=54, p<.05); in the second post-test, an even stronger positive correlation was detected (r=.707, n=54, p<.001). Overall, there was a positive correlation between working memory and the learning of word spelling, which means participants with higher working memory scores achieved higher scores in the spelling tasks.

Association between Working Memory and the Learning of Word Meaning

As the order of practice types was found to influence participants' performance in the learning of word meaning, a partial correlation was run to understand the relationship between working memory and the learning of word meaning, whilst controlling for the order of practice types. For words that were learned through spelling practice, there was

a positive partial correlation between working memory and the learning of word meaning in the first post-test, which was statistically significant, $r(51)=.623$, $N=54$, $p<.001$; the correlation was significant in the second post-test $r(51)=.540$, $N=54$, $p<.001$. For words that were learned through reading practice, no significant correlation was identified between working memory and the learning of word meaning in the first post-test, $r(51)=.039$, $N=54$, $p=.779$; in the second post-test, however, a positive partial correlation between working memory and the learning of word meaning was found out, which was statistically significant, $r(51)=.280$, $N=54$, $p<.05$. Overall, a positive correlation between working memory and the learning of word meaning existed, especially in the delayed post-test, which means participants with higher working memory scores achieved higher scores in the learning of word meaning.

4.4 Discussion

A significant effect of spelling practice was in favour of remembering the relation between the sound and spelling of a word, and the connection between the sound, the spelling and meaning.

Similar to the first experiment, results from this experiment replicates a prior experiment with L1 children (Ouellette, 2010), which identified a significant effect in favour of spelling practice to the learning of the written forms of English nonwords for native English children. This experiment further showed that to establish a stable link between a sound and a spelling, second language learners benefit more through spelling practice.

A second measure was added to this experiment, using picture identification task to test how well participants recalled the meaning of the trained target words. In this

experiment, a presentation of ten pictures at the same time to the participants brought about one problem. Words that appeared later in the assessment may get a lower probability of correctness as when children made one wrong choice about earlier words, they may have convinced themselves that the chosen picture cannot be chosen again, which means the answers were not independent of each other. A revised assessment needs to be worked out in the third experiment.

In this experiment, when making choices of pictures, participants would murmur to themselves the Chinese definition, and 41 out of 54 participating children asked the researcher to confirm if the picture actually represents that meaning as none of the pictures appeared in the training session.

One choice of assessing how well children remember the meaning would be to ask them to say the translation or explain the meaning. However, the choice task (picture identification task) gives an objective assessment whereas the analysis of definitions or translations might be influenced by the children's verbal ability in Chinese and the scorer's subjective interpretations of the definitions and appropriateness of the translations.

This second experiment provides important information for the next experiment in terms of how to assess participants' learning of word meaning. In this experiment, the children always looked at the same ten pictures, and this could have inhibited a correct choice if they had already chosen the picture previously, as an incorrect choice for another word. A decision was made to modify the task for the third experiment to see whether a different format would alter the results or whether they would be replicated. An array of four pictures would be presented for each of the meanings being tested.

This array contains a picture that is not visually identical and has the same meaning; a picture that is in some sense similar to the one presented for the meaning; a picture that appeared in the training but is not the right one; a 4th picture that hasn't appeared, but could be in the category of some of the meanings in the set. Having this different set of pictures for testing each word meaning is that the answers will be independent of each other. Answering by choosing one picture does not affect the answer for another meaning because that pictures do not appear again (See Chapter Five for details).

CHAPTER FIVE– THE EMPIRICAL STUDY: EXPERIMENT THREE

5.1 Introduction

This third study delves into how encountering the written representation of English words influences meaning acquisition for young learners whose first language is Chinese. The central question is whether simultaneously presenting the spelling alongside the spoken word aids or impedes the process of learning what a new word means, compared to conditions where learners only hear the word and see its associated meaning (e.g., through a picture). The experiment investigates the potential for orthographic facilitation, a phenomenon observed when similarities exist between language scripts, or conversely, orthographic interference, which might arise from significant linguistic disparities (Melby-Lervåg & Lervåg, 2011).

Significant distinctions mark the sound and writing systems of Chinese and English. Pinyin, the romanization system familiar to Chinese children, shares some consonant sound-letter mappings with English but diverges considerably in how vowels are represented (e.g. “ai” in the English word “bait” is pronounced differently as “eye” sound in Pinyin; the same “ai” in “bait” sound is written as “ei” in Pinyin). Because the English words used in this research featured vowels that can be spelled in various ways, exposing learners to these spellings could potentially create confusion rather than clarity. This leads to the core inquiry of this study: For young Chinese learners acquiring English vocabulary, does the presence of the written word alongside its spoken form and meaning result in better learning (facilitation) or poorer learning (interference)?

Building upon the previous two experiments within this thesis, this third study isolates the specific impact of orthography on understanding word meanings. The overarching framework considers a word in a literate society as a composite of sound, spelling, and meaning. Experiment 1 demonstrated that knowing a word's meaning aids in learning its spelling, while Experiment 2 showed that practicing spelling was more effective than practicing reading for learning both spelling and meaning. Study 3 examines the interplay between meaning and spelling from an alternative viewpoint: does merely seeing the written form affect how well meaning is learned when the explicit task is only to connect the sound to the meaning?

We mentioned in the previous experiment that homophones sound the same but are spelt differently because meaning defines them as different words. When learners try to spell homophones, like “too” and “two”, they must refer to their meanings. It cannot be taken granted that this visual experience with the written form would contribute to the learning of word meaning. When acquiring a new language, especially through listening and speaking, learners often concentrate on linking sounds with concepts. Introducing spelling into this process could have divergent effects. It might divert cognitive resources, adding complexity as learners must simultaneously process orthographic information while trying to establish the sound-meaning connection, potentially leading them to prioritize the sound-spelling link over meaning. Alternatively, seeing the word's written form could anchor it more firmly in the lexicon, acting as a helpful visual cue that supports recall by tapping into developing word-specific knowledge (Ehri, 2005).

Not many studies were identified which investigated the contribution that the written form would make to the learning of word meaning when learners practised by reading only. Szumski and Brooks (1977) conducted an experiment with adult native English

speakers, using within-subjects design to investigate the effects of visual exposure on word meaning learning. Participants were taught the meanings of pseudowords – nonsense words with no real-world meaning but plausible English phonology. Half of the words were presented only auditorily, while the other half were presented both auditorily and in printed forms during the training session. Participants were required to complete a sentence judgment task in which they saw each pseudoword in print and were asked to judge whether the word was an appropriate completion for a given sentence. Notably, although learners did not see all words in print in the training session, the target word was always presented on a separate card in print when learners were making the judgment. If visual exposure to the written form during training contributed to the learning of word meanings, it was expected that participants would respond more quickly to the words they had previously seen in print. The results confirmed this prediction, but only in the early trials. The facilitative effect of visual exposure on response speed diminished in later trials, suggesting that the benefits of print exposure are strongest in the initial stages of lexical learning.

Reitsma (1983) conducted an experiment with 16 third graders, teaching them pseudowords with regular spellings. In the training session, participants were presented with pseudowords with pictures, and were asked to make a categorical decision about whether they belonged to animal or fruit. Half of the words were presented only auditorily, while the other half were presented both auditorily and visually. After a 90-minute delay, participants were asked to perform the classification task as quickly and accurately as possible. All items appeared in the task six times in random order. Classification time for the auditorily trained items was found to be significantly slower in the first three trials, but not after the fourth.

Theories of reading highlight different pathways. Baron (1979) proposed distinct mechanisms involved in single word reading: an orthographic mechanism, which involves applying letter-sound correspondence rules to decode unfamiliar words, and a word-specific knowledge mechanism, in which readers recognise words as whole units. Research suggests that Chinese readers tend to rely more on the word-specific mechanism due to the logographic nature of the Chinese writing system. Rather than decoding words phonetically, Chinese readers typically access word meanings by recognizing the entire character or word form. For these learners encountering English, seeing the printed word might therefore activate this holistic recognition process, thereby aiding meaning retrieval. However, the challenge of processing an unfamiliar alphabetic system could still present a significant hurdle.

The third experiment in this thesis was designed to empirically test these competing possibilities. Children learned ten English words, with the focus explicitly on understanding their meanings. For all taught words, learners heard their sounds and learned their meanings. The only difference between the two different conditions was that for half of the words, learners saw their spellings, while for the other half, they didn't. Learning practice involved only reading aloud. After the learning session, children were tested immediately on the meaning of these words. The same test was given after a break of about half an hour to see if, after this break, they could still remember the meaning of these words. It was expected that the presence of the written form would have an impact on the learning of the meaning. As visual exposure to the written form is the only variable manipulated by the researcher, any difference in participants' performance would have to result from the presence or the absence of the written form.

Taken into consideration the word-specific knowledge learners might use to access single word reading, the presence of the printed form might assist learners in recalling other word-specific knowledge like meaning. On the other hand, when learning a language, there are always oral vocabularies when learners do not have to know the written form. The only connection they need to build is the binding between the sound and the meaning. The central hypothesis was that the presence or absence of the written form during learning would demonstrably influence performance on the meaning recall tasks, thereby indicating whether orthographic exposure functions as a help or a hindrance for these learners.

The same within-participants design as in the first two experiments was used to control for confounding factors such as the participants' previous knowledge of English. The experiment used the same training stimuli as used the previous two experiments to keep the consistency of the design.

The experiments took place in the same private classroom of a language learning centre as the first experiment. Ethical issues like the consent form and concerns of both parents and children were addressed prior to the experiment. 40 out of 56 participating children were from the neighbouring area and knew the learning centre well. Many of them were taking language lessons in the centre. The other 16 were friends of the participating children.

5.2 Method

5.2.1 Participants

As with the first two experiments, for a within-participant design, a statistical test that compares the difference between two dependent means would be used. A *priori* analysis was performed to determine the sample size by using G*Power against the following paraeters: a medium effect size of 0.5, power equal to .95, and a significance level of .05. The results suggested a sample size of 54 participants.

Participants (N=56; 22 girls) were recruited using the same approach as in the first two studies, by placing an invitation in an online parent group in one central residential area in Xicheng District, Beijing, following the opt-in procedure. Invitations were for children attending Grade 2 or 3 at the time, but only parents with children in Grade 3 replied. Parents were encouraged to extend the invitation to friends of their children; 16 children were recruited in this way and their parents also received information about the study and signed opt-in forms. There was no exclusion criterion. No children with special needs volunteered to participate in the study. None of them participated in the Study 1 or Study 2.

The children ranged in age from 8 years to 9.4 years with a mean age of 8.8 years (SD=0.3 years). At the time of the experiment, all children had started to learn English in school, with different lengths of formal learning experience ranging between two and four years (Mean = 2.4 years; SD=0.5 years). The benefit of working with this age group is that they are more used to taking assessment than young children, and could understand instructions clearly. They had also started formal learning of English from textbooks, thus the influence from spelling in print may be more noticeable in this group.

5.2.2 Design

A within-participants design for learning condition (with or without exposure to the printed word) was chosen to control for individual differences in learning ability and prior knowledge. The order of learning condition (print exposure first vs. auditory only first) and the word list learned (List A vs. List B) were treated as between-participants factors. These factors were systematically combined and counterbalanced across participants, producing four different experimental cells. Each child was randomly assigned to one of these cells.

Word lists were fully counterbalanced across teaching conditions: half of the participants had visual exposure to the written form with Word List A and the other half had visual exposure to the written form with Word List B. The order of teaching conditions was also counterbalanced. Half of the participants learned words with visual exposure to the written form first, and half learned auditorily only first. This counterbalanced design created four experiment cells as shown in *Table 14*. Among all 54 participants, 27 were taught the target words with visual exposure to the written form first, and the other 27 learned auditorily only first. The ten target words were divided into Set A and Set B, and were taught to the participants in different order, with 27 doing Set A first, and 27 doing Set B first.

1.1 List A learned with visual exposure to the written form List B learned auditorily only	2.1 List A learned auditorily only List B learned with visual exposure to the written form
1.2 List B learned with visual exposure to the written form List A learned auditorily only	2.2 List B learned auditorily only List A learned with visual exposure to the written form

Table 14: Schematic Representation of the Four Cells in the Experimental Design

The same 10 training stimuli were used as they had been piloted, used in the first two experiments and proved to be very unlikely known by the Chinese children of the targeted age group. They were divided into two sets of 5 with vowel patterns matched across lists. Details of the training stimuli are presented in the section titled Training Stimuli in Chapter 3. The same 10 real words distractors were included in the training session for participants to practise alongside with the training stimuli.

5.2.3 Procedure

Participants worked individually with the experimenter. The session involved a training phase, immediately followed by the first post-test (Post-test 1). After post-test 1, there was an interval of approximately 30 minutes, during which the children participated in an unrelated distractor task, an origami task and a working memory test. Finally, the children completed the second post-test (Post-test 2). Steps in the experiment are shown in Figure 1. Post-tests included a meaning recall task of the same 10 words taught in the training session in order to assess how well they had been learned.

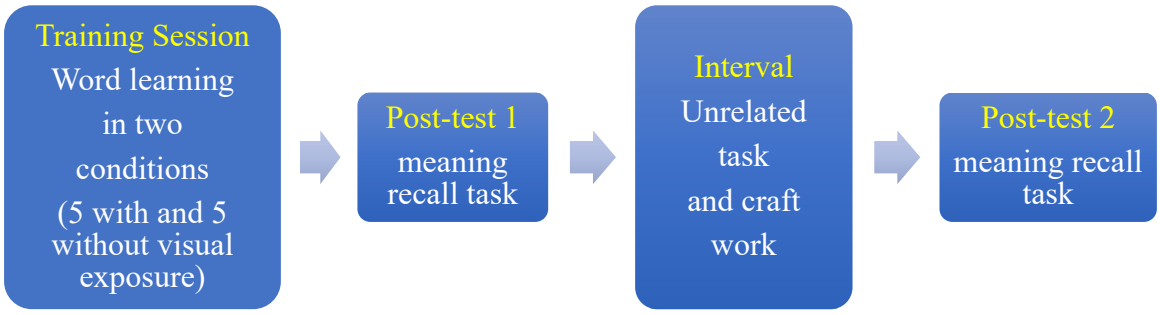


Figure 4. Schematic representation of the steps in the experimental session

The training session included an exposure and a practice phase for two sets of five words each, one set under the print-exposure condition and the other under the auditory-only condition (counterbalanced). Details are shown in Table 15. The first meaning recall test was given immediately after all 10 words were taught. The exposure phase was carried out via slides on computer, and the practice phase was conducted using index cards with pictures representing meanings of the target words. All target words were presented by two different index cards, one with spelling, and one without, for the purpose of the two different learning conditions. Participants were given a pen-and-paper task afterwards.

Exposure: In both teaching conditions, participants saw pictures corresponding to the meaning of the target words on a computer screen. The experimenter read the word aloud and provided an explanation of its meaning in Chinese. Participants were first asked to repeat each word after the experimenter. Each word was repeated twice, one at a time. Errors were corrected by the researcher as necessary. The duration of exposure of all words and the number of exposures were held constant across the two teaching conditions. This procedure varied across two conditions as described below.

In the Print-Exposure Condition: The written form of the target word appeared on the screen along with the picture. Therefore, for each word, participants saw its spelling at the same time when they saw the picture and practised saying the word with the researcher. This exposure procedure was repeated for all five words.

In the Auditory-Only Condition: The procedure was identical, but the written form did not appear on the screen. Only the picture was shown. While practising saying a word with the researcher, participants only saw its picture and heard its pronunciation.

Practice: After the completion of this initial exposure began the practice session. The experimenter spread out on the table five index cards corresponding to the five target words just taught, plus five distractor words, and said aloud ten words in random order by shuffling ten cards face down and picked one at a time. Participants were asked to repeat after the experiment, and point to the corresponding picture when they heard any taught words, or reply "not learned" when a distractor was encountered. The researcher would correct participants' mistakes in both pronunciation and picture identification if there were any.

In the print-exposure condition: All index cards used in this condition showed both pictures representing the meaning, and the written form of the target word.

In the auditory-only condition: Index cards used in this condition showed only pictures, with no printed word. The experimenter took care that the child did not see any written form associated with the target words by reading from a separate list while showing the picture-only card.

Table 15: Description of the training sessions

<table>
<tr><td rowspan="3">Exposure</td><td colspan="2">Five words were taught in this session with meaning.</td></tr>
<tr><td colspan="2">1. The researcher introduces the word by reading out a Chinese definition, and reveals a drawing at the same time;</td></tr>
<tr><td>2. In the visual-exposure condition, the researcher shows one picture (with the word written on it), via slides, and says the word; the participant repeats it;</td><td>2. In the auditorily-only condition, the researcher shows one picture (without showing the spelling of the word), via slides, and articulates a word for participants to repeat aloud for the 1st time;</td></tr>
</table>

	3. Slides remain in sight;	
	4. The researcher articulates the word again;	4. The researcher articulates the word again;
	5. Participants repeat for a 2nd time.	5. Participants repeat for a 2nd time.
	Repeat the whole process for all five words in the same condition, then move onto practice.	
Practice	1. The researcher mixes the five taught words with five distractors;	
	2. Index cards of the pictures corresponding to each of the five taught words are spread out on the table; the researcher articulates each word in random order for the participants to repeat for the 1st time	
	In the visual exposure condition, the researcher shows a card with both picture and spelling, and says one word at a time in random order; the participant repeats it for the 1st time.	In the auditory-only condition, the researcher shows a card without spelling, says aloud one word at a time in random order for participants to repeat for the 1st time.
	3. After the repetition, participants are asked to point to a drawing that represents the meaning of the word, or replying "not belong" when a distractor is encountered.	
	In the visual-exposure condition: all index cards show pictures representing the meaning and the spelling of the taught words. When a taught word is encountered, the researcher says the word aloud while displaying the card, and asks the participant to repeat the word for the 2nd time;	In the auditorily-only condition: index cards only show pictures representing the meaning of the taught words. When a taught word is encountered, the researcher says the word aloud, participants are asked to repeat the word for the 2nd time;

	There are three trials for each item with two readings per trial. In the last trial, no errors in reading or picture matching are expected.
After completion of exposure and practice for the first set of five words in either visual exposure or auditorily-only condition, the whole process was carried out for the next set of five words with a different practice type.	

5.2.4 Measures

Outcome Measure: Meaning-recall Task in Post-tests

The outcome measure was performance on a pen-and-paper meaning-recall task, administered in Post-test 1 (immediate) and Post-test 2 (delayed). The aim was to assess if the children grasped the meanings of the words beyond learning a simple paired association between a phonological form and a specific picture used in training. As developmental psychologists like Piaget (1959; Inhelder & Piaget, 1964) and Vygotsky (1962) noted, word meaning involves understanding classes and relations, not just stimulus-stimulus association.

An array of four pictures is presented for each of the meanings being tested. This array contains:

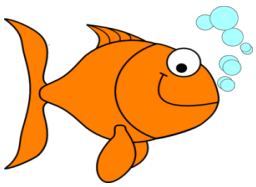
1) Correct choice: a picture representing the same meaning as the training picture but not visually identical (referred to as Correct Choice in Table 16);
2) Semantic Distractor: a picture that is in some sense visually similar to the correct choice or belong to the same general category but incorrect (e.g., a different type of shelter if COTE is the target, referred to as Distractor 1 in Table 16);

3) Training Distractor: a picture that appeared in the training but is not the right one (referred to as Distractor 2 in Table 16);

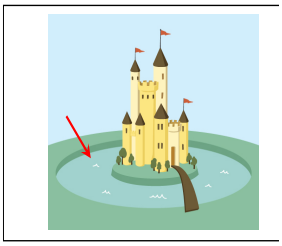
4) Contexual/Unrelated Distractor: a 4th picture that hasn't appeared, but could be in the category or context, or an unrelated item (referred to as Distractor 3 in Table 16).

Having this different set of pictures for testing each word meaning is that the answers will be independent of each other. Answering by choosing one picture does not affect the answer for another meaning because that pictures do not appear again (See Table 16 for details of the pictures).

Table 16: Pictures for Meaning-recall Task in Experiment Three

Correct choice	Distractor 1	Distractor 2	Distractor 3
bait			
			
murk			
			
beak			
			
cote			






coop





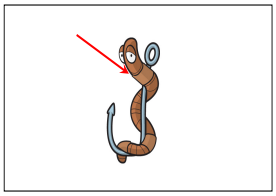

gale






tern






beet






moat






brume



The four pictures for one target word were randomly arranged on the answer sheet. In the post-test session, when the researcher read aloud one word, participants were required to circle the picture which represents the correct meaning of the word. No written words appeared on the answer sheet.

Participants' choices were scored as either right or wrong, with correct identification of the picture earning one point each and wrong identification scoring no point. The maximum number of points a participant could achieve by completing each set is 5.

5.2.5 Materials

Training stimuli:

All training stimuli were the same 10 low-frequency words used in the previous two experiments, and their usage were justified in the first experiment (confirmed by piloting). The experiment also involves the use of the same 10 distractors in the training session.

5.2.6 Ethical Considerations

This study (including all three experiments) received ethical clearance through the approval process for research with young children by the University of Oxford Central

University Research Ethics Committee (CUREC) (See Appendix 2). The research took place in accordance with Oxford University Protocol 25, and fully complied with the guidelines set by the British Educational Research Association's Ethical Guidelines for Research (2011). The key principles of ensuring informed consent (obtained from parents via opt-in forms), protecting privacy, and not causing harm (physical or psychological) were strictly followed throughout the research process.

The experiment was carried out over a span of five months because the researcher was taking care of a very young baby and could not work for long hours in one day. All tests took place either during school holidays, or in after-school hours, and thus did not cause disruption to schools. Sessions took place in a private classroom at a local language learning centre familiar to many participants. Parents received information sheets detailing the study's purpose and procedures (in both English and Chinese) and had the opportunity to ask questions. Children's assent was also considered, ensuring they felt comfortable participating. A brief report summarizing the findings and offering suggestions for English language learning was sent to the parents of participating children upon completion of the data analysis phase.

5.3 Results

This third experiment analyses the contribution of visual exposure to the written form to the learning of word meaning, in comparison with learning words' meaning in auditorily-only condition. As there was not enough evidence from previous research, in this experiment, it was difficult to work out a prediction. Therefore, the aim was to find out:

If participants learn the words in two different conditions, one with written form being presented alongside the oral form, and the other auditorily only, will there be any difference in how well they perform in the meaning recall task? If there is, is this difference statistically significant?

This section presents findings from this experiment. In the first part, descriptive statistics are presented, which gives an overview of the results to see if the means in the visual-exposure to the written form condition were higher than those in the auditorily-only condition as predicted. In the second part, preliminary analyses were carried out to explore the distributions of variables, and to determine the order effects between different subgroups. The third part presents the main analyses for hypotheses testing.

5.3.1 Descriptive Statistics

The mean and standard deviation are shown in *Table 17*. For meaning recall task in the first post-test, participants' scores for words that were learned with visual exposure to the written form ranged from 2 to 5, and the mean was 3.79 out of 5; their scores for words that were learned auditorily only ranged from 2 to 5, and the mean was 4.07 out of 5. In the second post-test, participants' scores for words that were learned with visual exposure to the written form ranged from 1 to 5, and the mean was 3.42 out of 5; their scores for words that were learned auditorily only ranged from 1 to 5, and the mean was 3.36 out of 5. In the first post-test, participants scored higher when words were learned in the auditorily-only condition; in the second post-test, participants scored higher when words were learned with visual exposure to the written form.

Table 17: Means and Standard Deviation in Different Teaching Conditions for Each Testing Occasion (N=54)

Teaching Condition	Mean	Std. Deviation
The 1st Posttest		
With Written Exposure	3.79	0.91
Auditorily-only	4.07	0.87
The 2nd Posttest		
With Written Exposure	3.43	1.17
Auditorily-only	3.36	1.07

5.3.2 Preliminary Analyses

Distribution of variables

The aim of the study is to compare the differences between two different teaching conditions. If paired sample t-test is to be used, the distribution of the raw scores is not important, but the distribution of the differences between scores should be normal (Field, 2013). Differences between scores in the different teaching conditions were then computed, and a z-test is applied for normality test using skewness and kurtosis. As Table 18 shows, all values of z-scores are below 1.96, suggesting the differences between spelling scores across different teaching conditions can be considered as normally distributed.

A further z-test was applied for all scores. Among all 8 scores, 3 exceeded +/-1.96. As with the first two experiments, a critical value of 3.29 was used as the sample size was between 50 to 300 (Kim, 2013).

A decision was made to use paired-sample t-test to compare the means between scores for different learning conditions.

Table 18: The z-scores of Skewness and Kurtosis of Differences between Meaning-recall Scores in Different Teaching Conditions

	N	Skewness			Kurtosis		
		Statistic	SE	z-score	Statistic	SE	z-score
Difference in the 1st Post-test	56	-.330	.319	-1.034	.875	.628	1.393
Difference in the 2nd Post-test	56	.104	.319	.326	-.349	.628	-.556
The 1st Posttest							
With Print Exposure	56	-.157	.319	-.492	-.852	.628	-1.357
Auditorily-only	56	-.827	.319	-2.592	.248	.628	.395
The 2nd Posttest							
With Print Exposure	56	-.067	.319	-.210	-1.260	.628	-2.006
Auditorily-only	56	.063	.319	.197	-.887	.628	-1.412

Order effects

The experiment is a within-participants design with exposure to print vs. no print exposure as a within-participant factor. The order of teaching conditions and the order of word sets, however, are between-participant factors. Children's performance may differ not just because of the experimental manipulation, but also because of the difference in order of the conditions.

A multivariate analysis of variance (MANOVA) was carried out using the order of teaching conditions and the order of word sets as the independent variables and all four

scores in the meaning recall task (scores in two post-tests across two teaching conditions) as the dependent variables. Using Pillai's trace, no significant effect of orders on participants' spelling performance was detected, V=.092, F(4,49)=1.235, p>.05. However, a significant effect of the order of word sets was detected, V=.220, F(4,49)=3.46, .001<p<.05.

From these results, we can conclude that the order of teaching conditions did not affect participants' performance, but the order of word set had a significant effect on participants' performance in the meaning recall tasks. The nature of this effect was not clear from this multivariate test statistic. To determine the nature of the effect, subsequent univariate tests were carried out on all dependent variables.

Results of the subsequent ANOVAs suggested that the order of word sets did not significantly affect participants' scores in any of the subgroups: F (1, 56) =3.454, p>.05 for visual exposure condition in post-test 1; F (1, 56) = .092, p>.05 for auditorily-only condition in post-test 1; F (1, 56) = 1.976, p>.05 for visual exposure condition in post-test 2; F (1, 56) = 1.662, p>.05 for auditorily-only condition in post-test 2.

A decision was then made to analyse the results disregarding the order of different conditions.

5.3.3 Main Analyses

The aim of this experiment is to investigate if the variation in the learning condition, with or without visual exposure to the written forms, will result in significant differences in children's performance in the meaning-recall tasks. *Table 17* displays the mean scores for correct recalls when the words were learned with visual exposure to the

written form vs auditorily only. In the first post-test, the scores were higher when words were presented to the learner auditorily only than with visual exposure to the written form. The same effect did not appear in the second post-test. In the second post-test, scores were higher when words were presented to the learner with exposure to the written form alongside the oral form. In order to test whether these differences can be attributed to chance, a dependent samples t-test was used to compare the means because the difference between scores in the learning conditions met the assumption of normal distribution. Cohen's effect sizes were calculated using the SD for the overall distribution for each post-test.

In the immediate post-test, participants scored higher in recognizing meaning of words taught in the auditory only condition, and this effect was marginally significant, $t(55)=-1.99$, $p=.05$.

In the second post-test, participants scored higher when recognizing meaning of words taught in the print exposure condition, but the effect was not significant, $t(55)=.40$, $p=.69$.

5.4 Discussion

This third study transitioned the research focus to a critical aspect of second language vocabulary acquisition among young learners: the influence of orthographic exposure on the learning of word meanings. Specifically, it investigated whether presenting the written form of a novel English word alongside its spoken form and referential meaning supports or hinders meaning acquisition for young native Chinese speakers learning English. This question is particularly salient given the significant structural differences between the learners' L1 (Chinese, a logographic system) and L2 (English, an

alphabetic system with opaque grapheme-phoneme correspondences), which may lead to orthographic interference rather than the facilitation typically observed in learners whose L1 and L2 share more similarities (Melby-Lervåg & Lervåg, 2011).

Building upon the findings of Experiment 1 -- meaning supports spelling acquisition, and Experiment 2 -- spelling practice benefits both spelling and meaning learning, this study isolated the role of visual orthographic input during a meaning-focused learning task.

Contrary to predictions based on first language research (e.g., Reitsma, 1983; Szumski & Brooks, 1977), the results from the immediate post-test revealed a marginal interference effect. Learners demonstrated slightly poorer recall of word meanings when the written form was present during the learning phase compared to when only the auditory form and meaning referent were provided. This finding suggests that, for this specific population of young Chinese L2 learners, the concurrent processing of novel English orthography alongside auditory input may initially introduce a cognitive burden that detracts from the primary task of establishing a stable sound-meaning connection.

Several factors may underlie this initial interference. Firstly, the inherent complexity and inconsistency of English orthography present a significant challenge. Unlike the character-based system of their L1, English utilizes an alphabetic script where phoneme-grapheme correspondences are often opaque, particularly concerning vowels like those used in the study's stimuli. Secondly, potential cross-linguistic interference from the learners' familiarity with Pinyin, the romanization system for Mandarin, may also have contributed to confusion. While Pinyin uses Roman letters, its sound-symbol

mapping differs significantly from English conventions (e.g., vowel representations), potentially leading learners to misapply L1 phonological or orthographic expectations when encountering English spellings. This discrepancy likely increases cognitive load, diverting resources from meaning consolidation towards deciphering the unfamiliar written form. Even theories suggesting readers of logographic languages may rely more on word-specific visual recognition (Baron, 1979) might not fully apply here, as the unfamiliarity of the alphabetic system itself could initially overwhelm any potential holistic processing advantage when learning entirely new words. The cognitive demand of mapping novel sounds to novel meanings is substantial; adding the simultaneous task of processing unfamiliar and potentially misleading orthographic patterns appears to initially impede, rather than support, this core learning objective for young Chinese L2 learners. This contrasts sharply with findings like those of Szumski and Brooks (1977) and Reitsma (1983), where orthographic presence showed initial benefits for native speakers learning pseudowords, highlighting the crucial role of L1 background and the nature of the L2 orthographic system in modulating these effects.

Intriguingly, this interference was no longer evident in the delayed post-test, conducted approximately 30 minutes later. This suggests a dynamic cognitive adjustment process: once freed from the demands of simultaneous multi-modal processing during the learning phase, learners may have begun to integrate the orthographic information more effectively. The delay may have allowed for implicit learning or a consolidation process wherein the visual form, initially a source of interference, started to function as a potential mnemonic aid, aligning with the concept that orthographic knowledge contributes to a richer lexical representation (Ehri, 2005). The disappearance of the interference highlights learners' cognitive flexibility and capacity to adapt to L2 complexities despite initial challenges.

These findings carry significant implications for both theory and pedagogy in L2 vocabulary acquisition. Theoretically, they underscore the importance of considering L1-L2 linguistic distance, particularly in orthography, when predicting the effects of written input. The results suggest an initial interference phase may precede the orthographic facilitation effects often observed in L1 and typologically closer L2 contexts. Pedagogically, the results suggest caution regarding when and how written forms are introduced in early L2 instruction. For young learners from logographic backgrounds learning English, while orthography is undeniably crucial for literacy, presenting it concurrently with initial sound-meaning mapping might not be the most effective strategy for meaning acquisition itself in the very early stages.

Further research is needed to determine the boundaries and long-term trajectory of this effect. Investigating the impact of prolonged exposure or different instructional approaches that explicitly address English orthographic patterns and potential points of L1 interference could reveal whether the initial hurdle can be overcome more quickly, potentially leading to the anticipated facilitative effect. Longitudinal studies tracking learners over time could clarify when and how orthographic input transitions from a potential hindrance to a support for meaning recall. Additionally, exploring variations in task demands – for instance, comparing reading practice (as used here) with tasks requiring explicit spelling – might further illuminate how different types of engagement with the written form interact with meaning acquisition for this learner population. Identifying the optimal timing and method for integrating orthography into early L2 vocabulary instruction for young Chinese learners remains a critical area for future investigation.

CHAPTER SIX– DISCUSSION

This chapter provides an integrated interpretation of the findings from three experimental studies examining how young Chinese learners of English as a second language establish connections between orthography, phonology, and meaning during word learning. One aim of this thesis has been to extend models of first language (L1) literacy development to an L2 context in which learners often encounter written form, spoken form, and meaning simultaneously, rather than sequentially.

The three studies addressed complementary aspects of this process. Study 1 examined the role of meaning in spelling acquisition, Study 2 investigated the effects of spelling and reading practice on lexical learning, and Study 3 explored the role of orthography in meaning learning. Taken together, the findings provide insight into how lexical representations are formed when phonological knowledge is limited, when learner's first and second languages differ substantially in orthographic structure, and when multiple components of word knowledge are acquired concurrently.

This discussion begins by revisiting two foundational L1 theories of word learning, Perfetti's Lexical Quality Hypothesis (LQH) (Perfetti, 1985; Perfetti & Hart, 2002) and Ehri's Amalgamation Theory (Ehri, 1992, 1995, 2005), and clarifying the relationship between them. It then considers how L2 word learning differs from L1 literacy development, and how these differences may influence the formation of lexical representations. The findings from the three studies are subsequently reinterpreted in light of these theoretical perspectives, with particular attention to how they support, extend, and refine existing accounts of word learning. The chapter concludes with implications for theory, pedagogy, and future research.

6.1 Relating L1 Theories of Word Learning: Perfetti and Ehri

Two theories are particularly relevant for interpreting the present findings: Perfetti's Lexical Quality Hypothesis (LQH) (Perfetti, 1985; Perfetti & Hart, 2002) and Ehri's Amalgamation Theory (Ehri, 1992, 1995, 2005). Although both frameworks emphasise the integration of orthography, phonology, and semantic information in word learning, they differ in focus and explanatory scope. Perfetti's framework was developed primarily to explain skilled reading and reading comprehension, whereas Ehri's theory focuses on the developmental processes through which learners acquire word reading ability.

Perfetti's Lexical Quality Hypothesis proposes that efficient reading depends on the quality of lexical representations (Perfetti, 1985; Perfetti & Hart, 2002). Lexical representations are considered high quality when orthographic, phonological, and semantic constituents are precisely specified and tightly interconnected. High-quality representations support rapid and reliable retrieval during reading, whereas imprecise or weakly integrated representation hinder efficient processing and comprehension. Importanly, meaning is not treated as an optional addition to word knowledge but as a central component of lexical quality. As Perfetti argued, "a name without meaning and a meaning without a name are both low quality" (Perfetti, 1985, p.118; Perfetti & Hart, 2002, p.190), highlighting the interdependence of form and meaning within lexical representations.

Ehri's Amalgamation Theory (Ehri, 1992, 1995, 2005), in contrast, is fundamentally developmental. The theory describes how learners gradually acquire the ability to read words through the formation of connections between graphemes, phonemes, and

meanings (Ehri, 1992, 1995, 2005). Through repeated exposure and practice, grapheme-phoneme connections become bonded with semantic information, eventually forming integrated lexical units that can be recognised automatically. This developmental process culminates in sight word reading, in which words are recognised rapidly and with minimal conscious decoding. Meaning therefore plays an important role in Ehri's account because semantic knowledge contributes to the stabilization and retention of lexical representation.

Although the two theories differ in orientation, they can be understood as complementary and conceptually related. Perfetti's framework characterizes the properties of lexical representations that support skilled reading, whereas Ehri's theory describes the developmental processes through which those representations are formed. In this sense, the theories operate at different levels of explanation. Ehri's account specifies how repeated encounters with words lead to increasingly integrated representations, while Perfetti's framework describes the quality of the resulting representations once they become efficient and stable. The endpoint of Ehri's developmental trajectory, sight word reading, therefore closely resembles the high-quality lexical representations described in LQH.

A further point of convergence between the two theories concerns the relationship between form and meaning. In both frameworks, meaning is not viewed as separate from word recognition but as integral to lexical representation itself. In Ehri's theory (Ehri, 1992, 1995, 2005), semantic information supports the formation and consolidation of grapheme–phoneme bonds. In Perfetti's account, semantic specification contributes directly to lexical quality, such that a representation lacking semantic content, or lacking a stable link between form and meaning, is inherently

incomplete. Both theories therefore imply that successful word learning depends on the integration of orthographic, phonological, and semantic information into a coherent representation.

Importantly, however, both models were developed primarily from research on L1 English-speaking learners and share a common assumption that phonological and semantic representations are already established before literacy learning begins. In typical L1 development, children generally know spoken words prior to encountering their written forms, meaning that learning to read involves mapping orthography onto existing phonological and semanticknowledge.

This assumption does not necessarily hold in the L2 context examined in the present thesis. Young L2 learners may encounter unfamiliar orthographic forms, unfamiliar phonological forms and meanings simultaneously. Phonological representations may also be weak or unstable due to limited exposure to spoken input. Under these conditions, it is unclear whether the representational principles proposed by Perfetti and the processes proposed by Ehri operate in the same way as they do in L1 literacy acquisition. The present findings therefore provide an opportunity to examine how these theories apply to L2 word learning contexts in which lexical representations are constructed through the concurrent acquisition of form and meaning.

It is also important to clarify how meaning is conceptualised in the present thesis. Meaning is not treated as a simple association between a word and a specific picture or referent. Consistent with developmental perspectives proposed by Piaget (1952) and Vygotsky (1962), word meaning involves conceptual and relational knowledge that extends beyond individual exemplars. The pictures used in the present studies therefore

served as supports for concept identification rather than constituting the meanings themselves. This distinction is important because learners may recognise a concept across multiple representations while still developing increasingly abstract and stable semantic knowledge.

6.2 L2 Word Reading Development: Extending L1 Models

A fundamental difference between L1 and L2 word learning lies in the nature of the mappings that learners must establish. In L1 development, children typically learn to map novel orthographic forms onto already known phonological and semantic representations. In L2 learning, however, learners may need to establish connections between unfamiliar orthographic and unfamiliar phonological forms, while simultaneously linking these forms to concepts that are already known through the first language. In some cases, all three components of lexical knowledge, orthography, phonology, and meaning, are acquired concurrently.

This difference has important implications for the development of lexical representations. When phonological representations are weak or unstable, they cannot function as reliable anchors for orthographic learning. Under these conditions, semantic information may assume a more central role in structuring lexical representations. The findings of the present thesis are consistent with this possibility, as Study 1 demonstrated that access to meaning facilitated spelling acquisition even when learners' phonological knowledge remained limited.

The role of prior linguistic experience further complicates this process. Literacy experiences in the first language shape learners' expectations about how written language functions and what types of information written forms encode. Chinese and

English differ substantially in their writing systems, phonological structures, and orthographic principles. Chinese characters often contain semantic radicals that provide cues to meaning, and distinctions between homophones are typically represented orthographically rather than phonologically. As a result, Chinese learners may develop an expectation that written forms are closely linked to meaning and that meaning plays a role in differentiating visually distinct words, even when they share phonological properties.

The findings of the present thesis suggest that such expectations may influence how Chinese learners approach English word learning. The facilitative effect of meaning on spelling observed in Study 1 can partly reflect transfer from prior experiences with the Chinese writing system, in which semantic information plays an important role in differentiating written forms. Rather than relying primarily on phonological mediation, young Chinese learners of English may draw more heavily on semantic information to support the encoding and retention of orthographic forms particularly when English grapheme-phoneme correspondences appear inconsistent or unfamiliar.

At the same time, prior orthographic knowledge may also generate interference. Study 3 showed that the presence of orthographic information initially hindered meaning learning, suggesting that unfamiliar written forms may compete for attentional and cognitive resources during the early stages of lexical acquisition. This interference may reflect both increased processing demands and conflicts between existing expectations about written language and the structural properties of English orthography.

These findings therefore suggest that L2 word learning cannot simply be understood as a reduced or delayed version of L1 literacy development. Instead, L2 lexical learning

may involve a reorganisation of the relative contributions of orthographic, phonological, and semantic information, with greater reliance on meaning when phonological knowledge is limited and greater influence from prior literacy experience.

6.3 Orthography, Facilitation, and the Role of Implicit Learning

The present thesis also prompts a reconsideration of the notion of orthographic facilitation in L2 vocabulary learning. Much of the existing literature assumes that orthographic information facilitates lexical acquisition by strengthening connections between phonology and meaning. However, many of these claims are based on studies involving L1 readers or learners whose first languages use alphabetic writing systems similar to the target language.

The findings of the present study suggest a more complex and dynamic account. Orthographic information did not uniformly facilitate learning. Instead, its effects appeared to vary across stages of learning. In Study 3, the presence of orthography initially interfered with meaning acquisition. This interference likely reflected the additional processing demands associated with unfamiliar and inconsistent grapheme–phoneme correspondences, as well as competition between orthographic processing and semantic learning during the early stages of lexical acquisition.

Over time, however, the interference effect diminished. This pattern suggests that learners gradually develop more efficient strategies for processing orthographic information, allowing written forms to contribute positively to lexical learning. Orthographic facilitation may therefore emerge developmentally rather than being immediately available from the outset of learning. The role of orthography in lexical

learning may consequently be better understood as dynamic and context dependent rather than uniformly facilitative.

This developmental trajectory also highlights the possible role of implicit learning proesses. The improvement observed between immediate and delayed post-tests suggests that learners may gradually internalise aspects of English orthography through repeated exposure, even without explicit instruction. Through continued encounters with written forms, learners may become increasingly sensitive to regularities in grapheme–phoneme correspondences and orthographic patterns. This process is consistent with accounts of implicit statistical learning, whereby learners extract distributional regularities from input through repeated exposure and progressively adapt their processing strategies over time.

From this perspective, orthographic facilitation may emerge not because written forms are inherently beneficial, but because learners gradually learn how to interpret and integrate orthographic information more efficiently. As orthographic regularities become more familiar, processing demands decrease and orthographic information can contribute more effectively to the formation of stable lexical representations.

These issues may be particularly relevant for Chinese learners of English because learners are simultaneously exposed to multiple systems for representing phonology, including English orthography and Chinese Pinyin. Some evidence of cross-linguistic orthographic interference was observed in participants' spellings in Study 1, although this was not a primary focus of the research. For example, several learners represented the English vowel combination "ai" using the spelling "ei", consistent with the corresponding representation in Pinyin. Similarly, the vowel pattern "ur" in *murk* was

sometimes written as “er”, reflecting Pinyin conventions. Interestingly, the frequency of some of these spellings increased in the delayed post-test, suggesting that learners may rely on familiar orthographic conventions when English grapheme–phoneme mappings remain unstable.

At the same time, words containing more transparent or familiar orthographic patterns, such as *tern*, *coop*, and *beet*, appeared easier for participants to retain accurately. Although exploratory, these observations suggest that orthographic transfer from Pinyin may influence early English spelling development in young Chinese learners. Such findings indicate that orthographic knowledge itself may function as both a source of facilitation and a source of interference, depending on the degree of alignment between existing orthographic expectations and the target language.

6.4 Reinterpreting the Empirical Findings

The findings from the three studies can now be reconsidered within this broader theoretical framework.

The semantic facilitation effect observed in Study 1 supports the central claim of both Perfetti’s Lexical Quality Hypothesis (Perfetti, 1985; Perfetti & Hart, 2002) and Ehri’s Amalgamation Theory (Ehri, 1992, 1995, 2005) that successful lexical learning depends on the integration of form and meaning. However, the findings also extend these frameworks by demonstrating that meaning can facilitate orthographic learning even when semantic, orthographic, and phonological information are acquired concurrently. Meaning therefore appears not only to form part of lexical representations but also to contribute actively to the organisationand stabilization of those representations during L2 learning.

This interpretation is particularly important in light of the assumption, present in many L1 models, that phonological knowledge precedes literacy development. In the present studies, learners often lacked fully established phonological representations. Under these conditions, semantic information may have served as a compensatory or organising resource that supported the encoding of orthographic forms. The findings therefore suggest that meaning may play a more central role in L2 lexical development than is typically assumed in L1-based models of reading acquisition.

The findings from Study 2 further support the importance of active engagement in lexical learning. Spelling practice produced greater benefits than reading practice, indicating that productive retrieval strengthens lexical representations more effectively than receptive exposure alone. This finding is consistent with Perfetti's emphasis on representational precision and integration and with Ehri's emphasis on grapheme–phoneme bonding.

Importantly, spelling may place greater demands on representational precision than reading because successful spelling requires the retrieval and production of complete orthographic sequences, whereas successful word recognition can sometimes occur with only partial orthographic specification (Ehri, 1997). The advantage observed for spelling practice therefore suggests that productive retrieval strengthened the specificity and interconnectedness of orthographic, phonological, and semantic representations more effectively than reading practice alone.

The benefits of spelling practice also extended beyond orthographic learning to include meaning retention, suggesting that active production promotes integration across multiple components of lexical knowledge. These findings extend previous research on

spelling and vocabulary learning conducted with L1 learners (e.g., Ouellette, 2010) to an L2 context involving young Chinese learner of English.

The findings of Study 3 provide a more complex perspective on the role of orthography in lexical learning. The initial interference effect observed when orthographic information was present challenges the assumption that orthography is inherently facilitative. Instead, the findings suggest that orthographic learning may initially involve competition between multiple sources of information, particularly when learners are confronted with unfamiliar grapheme–phoneme correspondences and limited phonological knowledge.

From the perspective of the Lexical Quality Hypothesis, this early interference may reflect the formation of imprecise or weakly integrated lexical representations. Over time, however, the disappearance of the interference effect suggests that learners gradually reorganised and integrated orthographic information into more stable lexical representations. These findings may therefore suggest that lexical quality develops through phases of instability and reorganization before more fully integrated representation emerge.

Across the three studies, several consistent patterns emerge. First, meaning appears to play a central role in supporting lexical development, particularly when phonological representations are weak or incomplete. Second, active production through spelling practice strengthens lexical representations more effectively than passive exposure alone. Third, orthographic information appears to follow a dynamic developmental trajectory, functioning initially as a potential source of interference before becoming increasingly facilitative over time.

Taken together, these findings suggest that L2 lexical development is not simply a replication of L1 literacy development. Instead, the relative contributions of orthography, phonology, and meaning may be weighted differently depending on learners' prior linguistic experience, the nature of the target language, and the conditions under which lexical representations are formed..

6.5 Limitations and Future Research

Several limitations of the present research should be acknowledged. First, the studies focused primarily on concrete vocabulary and operationalised meaning through pictorial support. Although care was taken to ensure that learners acquired concepts rather than associations with specific images, the findings may not generalise to more abstract vocabulary or to more complex semantic relationships.

Second, the studies primarily examined short-term learning outcomes. Although delayed post-tests provided some insight into retention over time, the research design did not allow for examination of longer-term developmental trajectories. Longitudinal studies would therefore be valuable for investigating how lexical representations continue to develop and reorganise over extended periods of exposure and instruction.

Third, the analysis of responses focused primarily on overall accuracy rather than on the detailed characteristics of learner errors. More fine-grained analyses of spelling and reading errors could provide additional insight into the cognitive processes underlying lexical learning. Future studies could adopt qualitative and quantitative coding approaches that distinguish between phonological, orthographic, semantic, and cross-linguistic transfer errors. Such analyses may clarify how lexical representations evolve

over time and whether reading and spelling rely on fully shared or partially distinct cognitive processes.

Another methodological consideration concerns the use of low-frequency real words as learning stimuli. This approach was adopted primarily to enhance ecological validity, as participants engaged with authentic English vocabulary rather than experimentally constructed nonwords. However, the use of real words inherently introduces variables, such as orthographic transparency, phonological complexity, and morphological structure, that are difficult to eliminate entirely. Furthermore, despite rigorous vocabulary pre-testing and stimulus selection aimed at minimizing prior exposure, the potential for partial familiarity through media or previous instruction remains. For instance, while some targets possessed highly familiar orthographic or phonological neighbors (e.g., *beet-beat*), others involved less systematic competition (e.g., *brume*), potentially affecting the relative difficulty of individual items and the cues learners prioritized. While such variation reflects the naturalistic conditions of L2 vocabulary acquisition, it may have introduced item-level noise. Consequently, future research could more systematically investigate these item-level characteristics, perhaps through a direct comparison between tightly controlled real words and nonwords. Such investigations would clarify the extent to which these findings generalize across different lexical neighborhood structures and varying levels of phonological competition.

An additional methodological issue concerns the format of the picture recognition assessment used in Study 2. Because multiple target pictures were presented simultaneously, participants' responses may not have been fully independent across items. For example, after selecting a picture for one target word, some children may

have assumed that the same picture could not be selected again for later items, potentially influencing subsequent responses. This raises the possibility that later responses in the assessment sequence were affected not only by lexical knowledge but also by task-related response strategies. Although this issue was not directly examined in the present analysis, future research could investigate potential order or response-dependency effects within picture selection tasks.

In Study 3, although the order of word sets did not significantly affect performance in any subgroup analyses, the size of the effects varied across conditions. The largest effect was observed in the visual exposure condition in the first post-test, $F(1, 56) = 3.454$, $p > .05$, whereas the corresponding effect in the auditorily-only condition was minimal, $F(1, 56) = .092$, $p > .05$. Smaller non-significant effects were also observed in both conditions in the second post-test. Although these differences did not reach statistical significance, they may tentatively suggest that order effects were somewhat more pronounced when orthographic information was available during the earlier stages of learning. Future studies with larger samples would be needed to determine whether this pattern reflects a meaningful effect or random variation.

The findings also raise important questions regarding the relationship between reading and spelling. Although both appear to rely on interconnected orthographic, phonological, and semantic representations, the present findings suggest that spelling may require more fully specified orthographic knowledge than reading. Reading practice primarily provided repeated visual and phonological exposure to the target words, whereas spelling practice required learners to actively retrieve, maintain, and reproduce orthographic sequences while coordinating phonological and semantic information. In this sense, spelling practice may have promoted deeper processing and

greater attention to orthographic detail than reading alone. Future research could investigate this distinction more directly through behavioural, intervention, or longitudinal methodologies examining how reading and spelling abilities influence one another across development.

The present findings additionally highlight the need for further investigation into the role of implicit learning in L2 literacy development. Repeated productive retrieval may also have supported implicit learning by increasing learners' sensitivity to orthographic regularities and grapheme-phoneme correspondences across exposures. The findings therefore suggest that orthographic learning may be strengthened not simply through exposure, but through active reconstruction of written forms during production. Understanding how learners gradually internalise orthographic regularities, and how implicit learning interacts with explicit instruction, may help explain why orthographic interference diminishes over time and why facilitative effects emerge gradually rather than immediately.

Finally, future research should continue to explore the role of prior linguistic and orthographic experience in shaping L2 literacy acquisition. The exploratory evidence of Pinyin-related interference observed in the present studies suggests that learners' existing orthographic systems may influence how new grapheme-phoneme correspondences are interpreted and learned. Examining these processes across different language pairings may contribute to a broader understanding of how cross-linguistic transfer influences lexical development.

6.6 Conclusion

This chapter has provided an integrated interpretation of the findings from the present thesis, situating them within existing theories of word learning while extending these frameworks to account for L2 contexts. The findings suggest that meaning plays a central role in the formation of lexical representations, that active engagement through spelling practice strengthens the integration of orthographic, phonological and semantic information, and that the effects of orthography are dynamic, involving an initial phase of interference followed by increasing facilitation over time.

These findings support key assumptions of Perfetti's Lexical Quality Hypothesis (Perfetti, 1985; Perfetti & Hart, 2002) and Ehri's Amalgamation Theory (Ehri, 1992, 1995, 2005) while also suggesting that these frameworks require refinement when applied to L2 contexts. In particular, the present research indicates that lexical representations can develop even when phonological, orthographic, and semantic information are acquired simultaneously rather than sequentially, and that meaning may assume a particularly important role when phonological knowledge is limited.

More broadly, the findings demonstrate that L2 lexical development is shaped not only by general cognitive mechanisms involved in word learning but also by learners' prior linguistic experience and by the structural properties of the target writing system. The present thesis therefore contributes to a more nuanced understanding of how orthography, phonology, and meaning interact during L2 literacy acquisition and provides a foundation for future theoretical and empirical work in this area.

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APPENDIX 1: CUREC APPROVAL

Dear Zhen Zheng,

Application Approval

Title: *The Contribution of Meaning to Chinese Children's Single English Word Reading and Spelling*

The above application has been considered on behalf of the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants. Thank you for submitting such clear application! I am pleased to inform you that, on the basis of the information provided to DREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly, approval has been granted to you.

If your research involves participants whose ability to give free and informed consent is in question (this includes those under 18 and vulnerable adults), it is advisable to read the following NSPCC professional reporting requirements for cases of suspected abuse: http://www.nspcc.org.uk/Inform/research/briefings/reporting_child_abuse_wda74908.html

Please note that CUREC approval does not guarantee access to participants, and it is your responsibility to check whether countries or contexts in which you plan to conduct your research might impose additional requirements (such as DBS checks).

Should there be any subsequent changes to the project which raise ethical issues not covered in the original application you should submit details to research.office@education.ox.ac.uk for consideration.

Good luck with the project!
Nikki

Nikki Luke
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APPENDIX 2: CUREC /1A CHECKLIST

The University of Oxford places a high value on the knowledge, expertise, and integrity of its members and their ability to conduct research to high standards of scholarship and ethics. The research ethics clearance procedures have been established to ensure that the University is meeting its obligations as a responsible institution.

They start from the presumption that all members of the University will take their responsibilities and obligations seriously and will ensure that their research on human subjects is conducted according to the established principles and good practice in their fields and in accordance, where appropriate, with legal requirements. Since the requirements of research ethics review will vary from field to field and from project to project, the University accepts that different guidelines and procedures will be appropriate.

- Please check the **CUREC flowchart and NHS flowchart** first to see if you need ethics approval.
- Please complete this form using a word processor and email it, together with your supporting documents, to your **Departmental Research Ethics Committee (DREC)** (**if applicable**). If you don't have a DREC please email this form to **ethics@socsci.ox.ac.uk** using your official **ox.ac.uk email** address. **Only emailed applications will be accepted.**

WHAT THIS CHECKLIST IS DESIGNED FOR
This **CUREC 1A checklist** is designed largely for research that falls within the Divisions of Social Sciences and Humanities where ethical issues are relatively few and straightforward. Interviews, field work and oral history are also included in the CUREC process. The **full CUREC 2 application** is only required where certain project characteristics (e.g. type of participants, or procedures) result in a more complex set of ethical issues. It is expected that only in a limited number of cases will it be necessary for researchers to complete a CUREC 2 application. The checklist below will direct you to a CUREC 2 application if needed.

WHAT THIS CHECKLIST WILL NOT ASSESS
This checklist does not cover research governance, satisfactory methodology, or compliance with the requirements of publishers when administering their tests or questionnaires. As principal researcher, it is your responsibility to ensure that requirements in these areas are met. CUREC does not review studies classed as **audit** (see Glossary and Decision Flowchart for CUREC on our website). Further information on the University's research ethics procedures are available from the CUREC website: www.admin.ox.ac.uk/curec.

SECTION A: Filter for CUREC2 application This section determines whether your study raises more complex issues which require the completion of a full application for ethical review, known as the CUREC 2 application. **(Please mark 'X' in the Yes/No column as appropriate to indicate your response.)**		
1. Are research participants classed as **people whose ability to give free and informed consent is in question**? (This may include those under 18 (though see "competent youths" in **FAQ C12**), prisoners, or adults "at risk".) Your attention is drawn to the University's **Safeguarding Code of Practice** and its implications for researchers involving children or adults at risk, including the need for the work to be risk assessed and for researchers to undertake related training. (**Note**: If any of your participants are aged 16 or under, please answer 'Yes' here **and** also answer question 4 below.)	Yes X	No

2. By taking part in the research, will participants be at serious risk of criminal prosecution (e.g. by providing information on drug abuse or child abuse)?	Yes	No X
3. Does the research involve the **deception** of participants?	Yes	No X
If you have answered 'No' to all of the questions above please go to **Section B**. If you have answered 'Yes' to any question above continue to question 4 below.		
4. Is your project covered by a CUREC approved procedure (formerly known as "CUREC Protocols")?	Yes X	No
If yes, please give research procedure number(s): 25		
If you answered '**Yes'** to ANY of questions **1-3**, **and** answered '**No'** to question **4**, **please stop completing this checklist and do not submit it for ethical review**. Instead, please complete the CUREC 2 application form from the CUREC website. Then submit the CUREC 2 form for ethical review. If you answered 'Yes' to ANY of questions 1-3, **and** answered 'Yes' to question 4, please go on to **Section B**.		

SECTION B: Contact details and project description (NB: must be typed not handwritten)	
Contact details:	
1. **Principal researcher**/supervisor (title and name) (if student research):	Professor Terezinha Nunes
2. Name of student (if student research):	Zhen Zheng
3. Degree programme, e.g. DPhil, BA, MPhil, BSc, MSc (if student research):	DPhil
4. Department or Institute name:	Department of Education
5. Address for correspondence (if different from 4 above):	Wolfson College, Linton Road, Oxford. OX2 6UD
6. University e-mail (**not** private email) and telephone contact:	zhen.zheng@education.ox.ac.uk; 07440469430
7. Name and status of others taking part in the project, e.g. third year undergraduate; postdoctoral research assistant:	N/A

SECTION B continued	
Project description:	
8. Title of research project:	The Contribution of Meaning to Chinese Children's Single English Word Reading and Spelling
9. List of location(s) where project will be conducted:	Beijing, China
10. If your research involves overseas travel or fieldwork, by the time the research starts, will you have completed and returned a travel risk assessment form? (This has to be approved by your department before you travel. If you are travelling overseas, you are strongly advised to take out University travel insurance.)	Yes X No N/A
11. Anticipated duration of research project overall:	24 months (maximum 5 years)
12. Anticipated start and end dates of the research project involving human participants:	From: (01/08/16) To: (30/07/18) Please note that you will need ethics approval **before** you start your research. CUREC1As may take up to 30 days to process.

13. Title and very brief and simple lay description of **research** (about 150 words), plus description (about 200 words) of the nature of participants.

a) Title and brief lay description of research (150 words). When describing the research, please include your methodology, how you are applying professional guidelines, and the use to which results/data will be put. **Please also declare any conflicts of interest here.**

Title: The Contribution of Meaning to Chinese Children's Single English Word Reading and Spelling

The **aim** is to investigate if meaning facilitates accurate retrieval of word specific information such as spelling and pronunciation for young Chinese English learners.

Method: This is an experimental study consisting of three experiments, each comprising three sessions: a training session, and two post test sessions (one immediate post test, and one 3-day-after post test). The design of the first experiment is presented here. During the training session, all participants will be taught 10 new words, 5 of which will be paired with meaning, and 5 without (see Appendix III for list of the training stimuli). Participants will practice spelling these words. The two post tests will be an oral dictation of the 10 trained new words. The experiment adopts researcher-designed paper and pencil tasks. The purpose is to analyse whether the presence of meaning helps children to spell the trained words correctly. In the next two experiments, the researcher will manipulate the linguistic context through which meaning is presented to the participants.

There are no known risks associated with participating in this research project. Participants will not miss lessons as the study will be carried out outside school hours.

SECTION B continued

b) Description of participants and obtaining informed consent (200 words). When describing participants, please include

- criteria for inclusion/exclusion
- method of recruitment
- processes for consent to participate

Please ensure you attach as separate documents (if applicable, in English translation):

- your recruitment and advertisement material e.g. a poster or brief invitation letter/ email
- information for participants to read (or hear) before they agree to take part e.g. written participant information sheets or (only if applicable) oral information scripts
- a document to record informed consent. Templates for written consent forms and/or oral consent scripts (in case of an oral consent process) are available from the CUREC website
- a guide to interview questions (this may be a list of questions to be asked, or a preliminary scope of questions), or a sample of other instruments (such as a sample questionnaire)
- (if relevant) debriefing document after participants have taken part

For each experiment, forty **Participants** will be recruited from Xicheng District, Beijing, using convenience sampling, following the opt-in procedure. Recruitment will draw on neighbourhood associations that are connected through the internet, which is not an uncommon network in China. The invitation will be displayed using the network; parents who wish their children to participate will be able to reply directly to the researcher. Parents whose children participate will be encouraged to invite other parents, using a snowball technique for recruitment. This approach to recruitment allows for participation without the children having to miss lessons in school.

Children will be attending grade 2 or 3 at the time of the experiment. There is no exclusion criterion; all children within the district use the same English textbooks, and children with special needs attend special schools.

Consent: This research will take place in accordance with Oxford University Procedure_IDREC_25_Version 2.0. Informed consent will first be obtained from parents/guardians. The researcher will send out to parents/guardians the Information Sheet and consent form in Chinese (Appendices II). Parents/guardians will be informed of the aims and procedures of the study, and will be fully informed of their right to withdraw. Specific details are provided to parents/guardians (see the translated version of Information Sheets in Appendix I). A consent form will be obtained from parents and they will be asked to sign and return the form if they agree for their children to take part. Children will give verbal assent to their participation.

In order to investigate the factors that may influence children's vocabulary learning, two working memory tests (Appendix IV) will be given to all participants between the training session and the two post tests. These will be short and fun games for children. The researcher has discussed with her supervisor the content; the activities have been found in previous research to be appropriate for the age group.

14. What are the ethical issues connected with your research and what steps have you taken to address them? Please do not answer 'none'. The committee needs to see evidence that you have identified potential ethical issues with respect to your research and have taken steps to address them. These issues could relate to:
    - your own physical and psychological safety as a researcher (please see the University's and Social Science Division's Safety in Fieldwork guidance
    - participant burdens and/or risks, and
    - data protection/ confidentiality.

For more guidance on ethical issues, please see www.admin.ox.ac.uk/curec/resources/.

1. Potential physical and psychological safety as a researcher:

The fieldwork will be undertaken between August 2016 and August 2017 in Beijing, China. On 25 January 2016, the researcher attended a two-hour fieldwork session held by Department of Education, University of Oxford, that offer staff and students orientation on how to carry out safe, effective and successful fieldwork. The researcher has also checked the information from the website of Social Science Division as well as UK government concerning the safety in doing fieldwork in foreign countries, followed the checklist (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35941/checklist-for-travellers1.pdf).

The location is the researcher's hometown where her family lives, so the researcher knows about local laws and customs and psychological safety can be reached. The researcher will check with her GP that all vaccinations are up to date and make sure that necessary health precautions are taken. The researcher will apply for the travel insurance in the University of Oxford (http://www.admin.ox.ac.uk/finance/insurance/travel/) before conducting the fieldwork.

The researcher has enough financial support to cover travel expenses and any emergencies. The researcher will apply for a College Travel Grant before travelling.

2. Participant burdens and/or risks

As the current study will be conducted with primary school children, it will be necessary to consider carefully the challenges that arise in research with young people prior to performing the investigation. The research will comply with BERA (2011) guidelines for conducting research with human participants.

The research will not cause harm or any emotional distress to the participants. Prior to the start of the assessments, the researcher will explain to the child participants in simple language what is involved in the study and how it helps teachers and researchers to improve teaching. The children will be told by the researcher that it is not a test for them, but collecting information for research purpose, and they will not be identified in the study. Voluntary participation will be made clear to children at the same time. The researcher will make every effort to make each child participant comfortable throughout the sessions. Both children and parents have the right to withdraw at any stage of the study without explaining the reason and by informing the researcher.

3. Data protection/ confidentiality.

All data will be kept in a password-protected computer, which when not in use is locked in the researcher's home or supervisor's locked office. The researcher will also maintain confidentiality consistent with current UK and PRC law. The participants' parents/guardians will not have access to the data, and no one other than the researcher herself, and the supervisor (Professor Terezinha Nunes) will see the data. The data will not be used for any other purpose. A report on the research will appear in the researcher's thesis at Department of Education, University of Oxford at the end of the project, and it will comprise group data; no individual children will be identifiable in the report. All non-anonymised data generated as part of the study will be destroyed once the research has been successfully completed and anonymised data will be kept indefinitely for use by academic researchers. A short summary of the findings will be sent to the participating parents/guardians.

Section B continued

15. Will you obtain informed consent according to CUREC guidelines and good practice in your discipline before participation?	Yes X	No

If you have marked '**No**', please give a brief explanation and justification for this decision here:

16. Will your research involve discussing sensitive issues? This could be information relating to race or ethnic origin, political opinions, religious beliefs, physical/mental health, trade union membership, sexual life or criminal activities.	Yes	No X

If you have marked '**Yes**', please make sure that you have included some **supporting information** (as directed in question 13 of this section) showing the range of questions covering these issues.

17. Will you ensure that **personal data** collected directly from participants or via a **third party** is held and processed in accordance with the provisions of the Data Protection Act?	Yes X	No

18. How will you ensure that any personal or sensitive data are captured, transferred and stored securely?

In particular if data are to be captured electronically, please consult with your local IT department and, with respect to University IT security policies, please comment on how you will capture such data in the first instance, how you will transfer them over networks or via portable media and how and where data will be stored. For more information please see the University's web pages on research data management:

http://researchdata.ox.ac.uk/university-of-oxford-policy-on-the-management-of-research-data-and-records/

According to CUREC Approved Procedure_IDREC_25_Version 2.0, the data collected in the study are anonymised. Each child will be given a code number, and this, rather than the name, is used to label all electronic data from the study. The key linking codes to personal details will be kept in a locked filing cabinet.

The researcher's notes during the project, and named data will be stored in a locked cabinet in the researcher's home. The researcher will also maintain confidentiality consistent with current UK and PRC law. The children's parents will not have access to the data, only the researcher and the supervisor will see the data. The data will not be used for any other purpose. The consent forms will be kept separate from the data, also in a locked cabinet, and will be kept till the submission. All non-anonymised data generated as part of the study will be destroyed once the research has been successfully completed and anonymised data will be kept indefinitely for use by academic researchers.

SECTION C: Methods and procedures to be used

Method used: Please ensure you have addressed any potential ethical issues related to these methods in Section 14 and in your Participant Information Sheet	**Please mark 'X'**
1. Analysis of existing records	
2. Snowball sampling (recruiting through contacts of existing participants)	X
3. Use of casual or local workers e.g. interpreters	
4. Participant observation	
5. Covert observation	
6. Observation of specific organisational practices	
7. Participant completes questionnaire in hard copy	
8. Participant completes online questionnaire or other online task	
9. Using social media	
10. Participant performs paper and pencil task	X
11. Participant performs verbal or aural task (e.g. for linguistic study)	
12. Focus group	
13. Interview	
14. Audio recording of participant (you will generally need specific consent from participants for this)	
15. Video recording of participant (you will generally need specific consent from participants for this)	
16. Photography of participant (you will generally need specific consent from participants for this)	
17. Others (please specify):	



SECTION D: Professional guidelines and training		
In this section, please mark 'X' against at least one of the following professional guidelines you aim to adhere to. You should use the principles listed in your chosen guideline(s) in conducting your own research. **Note**: this is not an exhaustive list.		**Please mark 'X'**
Research specialism/ methodology	**Association and guidance document**	
Anthropology	Association of Social Anthropologists of the UK and Commonwealth	
Criminology	British Society of Criminology: Code of Ethics for Researchers in the Field of Criminology	
Education	British Educational Research Association Ethical Guidelines for Educational Research	X
Geography	Association of American Geographers Statement on Professional Ethics Royal Geographical Society: Research Ethics and Code of Practice	
History	Oral History Society of the UK Ethical Guidelines	
Internet-based Research	British Psychological Society: Conducting Research on the Internet Association of Internet Researchers Ethics Guide Also see our Best Practice Guidance on internet-based research	
Law (Socio-Legal)	Socio-Legal Studies Association: Statement of Principles of Ethical Research	
Management	Academy of Management's Professional Code of Ethics	
Political Science	American Political Science Association (APSA) Guide to Professional Ethics in Political Science	
Politics	Political Studies Association. Guidelines for Good Professional Conduct	
Psychology	British Psychological Society Code of Ethics and Conduct British Psychological Society: Conducting Research on the Internet Also see "Internet-based Research" guidance above	X
Social Research	Social Research Association: Ethical Guidelines	
Sociology	The British Sociological Association: Statement of Ethical Practice	
Visual Research	ESRC National Centre for Research Methods Review Paper: Visual Ethics: Ethical Issues in Visual Research	
Other professional guidelines. Please specify the other guidelines used here:		

1. Please indicate what training in research ethics the researchers involved with this study have received, e.g. the title of the course and date completed (online training available at www.admin.ox.ac.uk/training).

If no formal training has been undertaken, please indicate any discussions of research methodology between researchers and supervisors here.

I received formal training in research ethics when I was reading for the MSc Education between 2013 and 2014.

On 24 November, with all other first-year DPhil students, we discussed ethics of educational research in Philosophy of Educational Research. We reflected on questions such as if educational research requires particular virtues, or if the researcher should possess certain "general dispositions to do the right thing at the right time" (Pring, 2004, p. 152), and what these dispositions are.

On 10 February, we had a group discussion about ethics in research in Research Training Session. We examined the practicalities and administration of ethics at Oxford as well as reflected on ethical issues we may encounter in our work, what questions we need ask ourselves and how this contributes to reflective research practice.

SECTION E: Signatures

- 'Electronic signatures' sent as email confirmations from a University of Oxford email address can be accepted. Separate emails should come from each of the relevant signatories as outlined below, indicating acceptance of the relevant responsibilities.
- If you have obtained handwritten (wet-ink) signatures, please scan them and the rest of the checklist pages to create a single PDF document and email through.

Please ensure this checklist is signed by:

For staff research:	**For student research**:
1. **Principal researcher**	1. **Principal researcher (project supervisor)**
2. **Head of Department (or nominee)**	2. **Head of Department (or nominee)**
	3. **Student researcher**

1. **Principal researcher signature/supervisor signature (if student research)**

I understand my responsibilities as **principal researcher** as outlined in the CUREC glossary and guidance on the CUREC website.

I declare that the answers above accurately describe the research as presently designed, and that a new checklist will be submitted should the research design change in a way which would alter any of the above responses so as to require completion of CUREC 2 (involving full scrutiny by an IDREC). I will inform the relevant IDREC if I cease to be the principal researcher on this project and supply the name and contact details of my successor if appropriate.

Signature: …… 

Print name (block capitals): …Terezinha Nunes.. **Date**: ……22/05/2016……...

2. **Departmental endorsement signature**

I have read the research project application named above. On the basis of the information available to me, I:

(i) consider the principal researcher to be aware of her/his ethical responsibilities in regard to this research;
(ii) consider that any ethical issues raised have been satisfactorily resolved or are covered by relevant professional guidelines and/or CUREC approved procedures, and that it is appropriate for the research to proceed (noting the principal researcher's obligation to report should the design of the research change in a way which would alter any of the above responses so as to require completion of a CUREC 2 full application);
(iii) am satisfied that: the proposed project design and scientific methodology is sound; the project has been/will be subject to appropriate **peer review**; and is likely to contribute to existing knowledge and/or to the education and training of the researcher(s) and that it is in the **public interest**.

Signed by Head of Department or nominee *(example nominees for student research include the Director of Graduate Studies/ Director of Undergraduate Studies)*:

Signature: ……..

Print name (block capitals): ……..... **Date**: ……...

3. **Student signature (if student research)**

I understand the questions and answers that have been entered above describing the research, and I will ensure that my practice in this research complies with these answers, subject to any modifications made by the principal researcher properly authorised by the CUREC system.

Signed by student: …….

Date: ……05/03/2016……...

Print name (block capitals): ……ZHEN ZHENG 郑真…….....

SECTION F: SUBMITTING THE COMPLETED CHECKLIST	Please mark 'X'
1. Check you have completed all sections (A-E)	X
2. Ensure your application is signed by you, your supervisor (if student) and department	X
3. **Please attach all supporting documents (see section B, question 13b for details).** If the appropriate supporting documentation is not included with your application, you will then be asked to provide this separately. **This may well delay the ethical review process, and thus the start of your research.**	X
4. Ensure you have declared conflicts of interest (if any) in Section B, question 13.	X
5. If your department has a Departmental Research Ethics Committee (DREC), submit this checklist and supporting information to the appropriate departmental officer.	X
6. If your department does not have a DREC, submit the checklist and supporting information to the SSH IDREC (email ethics@socsci.ox.ac.uk).	X
7. Applications must be sent by email from your official ox.ac.uk email account. Please do not send applications by post.	X

APPENDIX 3: INFORMATION SHEET AND CONSENT FORM FOR

PARENTS/GUARDIANS

Department of Education, University of Oxford
15 Norham Gardens, Oxford OX2 6PY
Researcher: Zhen Zheng, DPhil candidate
Email: zhen.zheng@education.ox.ac.uk
Tel: +44 (0)7440469430 (UK), +86 13910716662 (China)

Dear *Parent/guardian*,

I am writing to invite your child to participate in a study about ***The Contribution of Meaning to Chinese Children's English Word Reading and Spelling***, which will be part of my doctoral thesis at the University of Oxford. I am writing to seek your permission. I very much hope you would like to take part; before you decide, it is important that you understand why the study is being done and what it will involve. Please feel free to ask me any questions. My contact details are provided at the top of the page.

What is the purpose of the study? The study investigates whether the presence of meaning will help Chinese children learn to read and spell English words. Your child's participation will provide valuable information as to how children of the same age learn English as a second language.

What will the study involve? The study will take place in August, 2016. If you agree for your child to participate, I will work with your child for two one-to-one sessions, with the first lasting about 30 minutes, and the second about 5 minutes. The second session will take place three days after the first session. I will first teach your child some English words using different methods, and then test them to see whether the method of teaching affects how many words they learn. May I ask you not to talk with your child about the tasks between the two session? This could give the child extra practice with the words and influence their recall in the second session. The assessment I carry out is not of the children, but of the method, so if parents give the children extra practice, the results will not be valid. The tasks are designed to be fun and won't put pressure on your child. I will also collect your child's birth date for data analysis only.

Once you child has completed the tasks, I will delete the name from the file so that all the data will be anonymous. All data will be kept in a password-protected computer. Only I and my supervisor will have access to the data on the computer. All non-anonymised data will be destroyed once the research has been successfully completed, and anonymised data will be kept indefinitely for use by academic researchers.

What will happen to the results of the study? The results will be presented in my thesis. I also aim to publish the findings in scientific journals, but this may be two to three years from the end of the study. A brief report of the research will be available and can be sent to you upon request. The tasks are not intended to provide information about individual children nor to evaluate the teaching or learning in the school. No information about any individual child will be given to anyone.

Who is carrying out this study? I am a DPhil student at Department of Education, University of Oxford. Professor Terezinha Nunes from the University of Oxford supervises my research. She has published books and articles about children learning English. My research has received ethical clearance from the University of Oxford.

Next steps. Participation is voluntary. You do not have to agree for your child to participate. If you do agree, you and your child have the option of withdrawing at any time during the study, without having to give a reason.

If you agree to your child's participating in the study, please fill in the enclosed consent form and return it to me via email by Friday, 1 July. Unfortunately, no child will be able to participate in the research without this consent form. If you need any more information before making a decision, please do not hesitate to contact me. If you have any concerns about the ethical aspects of this study at any time, you can contact the head of the Ethics Committee, Dr Liam Gearon by email: liam.gearon@education.ox.ac.uk.

Thank you.

Name of Study:

The Contribution of Meaning to Chinese Children's Reading and Spelling English Words

Name of Child: _____ Date of Birth: _____

I have read and understood the details of the above study, and have had the opportunity to ask questions and have received satisfactory answers to any questions. I understand that the project has received ethics clearance through the University of Oxford's ethical approval process for research involving human participants, and understand who will have access to the data, how it will be stored and what will happen to the data at the end of the study. I understand that participation is voluntary and that I and my child are free to withdraw at any time, without giving any reason and without my child's education being affected in any way. I understand where and how the research will be reported. I understand what to do if I have a concern or a complaint.

I give permission for my child to take part in the above study,

Name of parent/guardian:

_____

Signature: _____

date:_____

Name of researcher:

_____

Signature: _____

date:_____

If you would like to receive a brief report summarising the research, please fill in your address:

_____

_____

Please return this form to the researcher by Friday, 1 July.

THANK YOU!

APPENDIX 4: INFORMATION SHEET AND CONSENT FORM IN CHINESE

课题名称：关于语义在儿童词汇学习中的作用
研究者：郑真
牛津大学教育系
地址：15 Norham Gardens, Oxford OX2 6PY
电子邮箱: zhen.zheng@education.ox.ac.uk
电话: +44 (0)7440469430 (英国), +86 13910716662 (中国)

尊敬的孩子父母／监护人，

您好。我很高兴邀请您的孩子参加本研究项目：关于语义在儿童词汇学习中的作用。在您做出决定之前，很重要的一点是先要了解本项目的相关信息。请您仔细阅读我在下文“给予自愿参与者的信息”中向您提供的内容。如果您有任何问题，可以联系研究者，联系方式在本页上方。

一、研究目的

本研究诣在了解语义是否以及如何帮助孩子学习英文词汇，您孩子的参与将有助于我们了解同龄孩子学习词汇的特点。

二、需要参与者做什么

本研究将在 2016 年 8 月进行。您如果同意您的孩子参加，我将和您的孩子进行两次一对一的词汇学习活动，第一次大概持续 30 分钟，第二次 5 分钟。两次活动之间间隔三天，希望在这三天里，您不要和孩子谈论我们研究中词汇学习的内容。任务设置趣味性都很强，不会给孩子任何压力。研究者会收集孩子的出生日期，但只用于数据分析。

在孩子们完成任务之后，每个孩子的完成情况都会被收集记录到电脑中，以便进行数据分析，但使用的将是编码而非孩子的姓名。所有姓名信息会在信息录入后删去。匿名信息将被保存于一台设有密码的电脑，只有研究者本人和研究者的导师可以使用这台电脑。所有实名的信息在研究结束后都会被销毁。

三、关于研究结果

研究结果将记录在研究者的论文中，并可能在期刊上发表。发表时间可能在研究结束后两到三年。研究者会在研究结束后提供一份概要，您如果需要，可以留下联系方式，我把相关报告发送给您。研究中的任务并非对孩子的水平测试，也不是对学校教学的评估。研究者无法提供孩子所做任务及活动的细节信息。

四、研究者介绍

我是一名牛津大学的在读博士，我的导师牛津大学心理学和儿童教育的知名教授 Terezinha Nunes。她撰写了大量关于孩子发展以及语言学习的著作和文章。本研究通过了牛津大学研究伦理委员会的审查。

五、下一步

本研究是建立在自愿参与的基础之上。如果您决定参加，您仍有权力在研究进行过程中随时退出。如果您不参加，或者之后退出，将不会对您或您的孩子现在或将来的状况有任何影响。

如果您同意孩子参加，请签署下一页的知情同意书，并在 7 月 1 日周五前以电子邮件对形式发给我。没有签署知情同意书的孩子将不能参加本研究。如果您需要任何其他

的信息，或有任何疑问，请您随时联系我。您也可以和我的导师联系，联系方式：terezinha.nunes@education.ox.ac.uk。如果您有任何关于科研伦理方面的问题，您可以联系牛津大学教育系科研伦理委员会的负责人 Liam Gearon 博士，他的联系方式如下：liam.gearon@education.ox.ac.uk。

非常感谢您的协助。

此致

知情同意书

课题名称：关于语义在儿童词汇学习中的作用

孩子姓名： _____ **出生日期：**

_____

我已阅读并充分了解了研究者给我提供的相关信息，并了解自己有机会询问对研究项目的疑问。如果我有问题，我的问题得到了满意的解答。我了解该研究通过了牛津大学研究伦理委员会的审查，也了解该研究对资料和数据的保密措施。我知道该研究是建立在自愿参与的基础之上，并且我和我的孩子可以在任何时候退出研究而不必要向研究者解释或承担责任。我和我的孩子不会因为不参加或退出承担任何责任或受任何影响。我了解研究结果将如果呈现，也了解我该怎么样对研究提出疑问。

我同意我的孩子参与该研究 。

监护人姓名：_____

签字：_____ 日期：

_____

研究者姓名：

_____

签字：_____ 日期：

_____

如果您需要研究结果的报告，请在此处留下您的联系方式：

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_____

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请将这份知情同意书在 7 月 1 日周五前交给研究者。

非常感谢!

APPENDIX 5: LIST OF TRAINING STIMULI IN OUELLETTE'S (2010) STUDY

List A in Ouellette's (2010) study	List B in Ouellette's (2010) study
yait	cale
lurt	vern
veak	zeet
wote	poan
roop	jume