

ABSTRACT

Title of Document: CROSS-LINGUISTIC TRANSFER OF
SPELLING SKILLS IN SPANISH-SPEAKING
ADULT ESL LEARNERS

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Spelling is an important literacy skill, and learning to spell is an important component of learning to write. Learners with strong spelling skills also exhibit greater reading, vocabulary, and orthographic knowledge than those with poor spelling skills (Ehri & Rosenthal, 2007; Ehri & Wilce, 1987; Rankin, Bruning, Timme, & Katkanant, 1993). English, being a deep orthography, has inconsistent sound-to-letter correspondences (Seymour, 2005; Ziegler & Goswami, 2005). This poses a great challenge for learners in gaining spelling fluency and accuracy. The purpose of the present study is to examine cross-linguistic transfer of English vowel spellings in Spanish-speaking adult ESL learners.

The research participants were 129 Spanish-speaking adult ESL learners and 104 native English-speaking GED students enrolled in a community college located in the South Atlantic region of the United States. The adult ESL participants were in classes at

three different levels of English proficiency: advanced, intermediate, and beginning. An experimental English spelling test was administered to both the native English-speaking and ESL participants. In addition, the adult ESL participants took the standardized spelling tests to rank their spelling skills in both English and Spanish.

The data were analyzed using robust regression and Poisson regression procedures, Mann-Whitney test, and descriptive statistics. The study found that both Spanish spelling skills and English proficiency are strong predictors of English spelling skills. Spanish spelling is also a strong predictor of level of L1-influenced transfer. More proficient Spanish spellers made significantly fewer L1-influenced spelling errors than less proficient Spanish spellers. L1-influenced transfer of spelling knowledge from Spanish to English likely occurred in three vowel targets (/aɪ/ spelled as *ae*, *ai*, or *ay*, /aʊ/ spelled as *au*, and /eɪ/ spelled as *e*). The ESL participants and the native English-speaking participants produced highly similar error patterns of English vowel spellings when the errors did not indicate L1-influenced transfer, which implies that the two groups might follow similar trajectories of developing English spelling skills. The findings may help guide future researchers or practitioners to modify and develop instructional spelling intervention to meet the needs of adult ESL learners and help them gain English spelling competence.

CROSS-LINGUISTIC TRANSFER OF SPELLING SKILLS IN SPANISH-
SPEAKING ADULT ESL LEARNERS

By

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Dedication

To my grandparents, who trusted me, felt proud of me, and patiently waited for my return, but whom I did not have a chance to say good-bye.

To mom and dad, who hold my hands through the years and who always love and forgive.

To my little brother, who protects me as a big brother, and to my sister-in-law and my three adorable nephews.

To all my relatives, who care about me dearly.

To my husband and my two boys, whom I spend life with everyday and whom I call home.

I love you all with all my heart and soul. Thank you for supporting me unconditionally. I am finally able to dedicate this work to you.

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Table of Contents

Dedication	ii
Acknowledgments	iii
Table of Contents	v
List of Tables	vii
List of Figures	viii
Chapter 1: Introduction	1
Statement of the Problem	1
Background	3
Purpose	5
Research Questions	5
Chapter 2: Literature Review	7
A Brief History of English Spelling	7
Theoretical Approaches to English Spelling Development	8
Major Factors that Influence First-language Spelling Development	10
Phonological awareness	10
Letter-sound knowledge	14
Orthographic knowledge and orthographic consistency	16
Major Factors that Influence Second-language Spelling Development	22
Cross-linguistic Transfer	25
Phonological awareness, letter-sound, and orthographic knowledge transfer	25
English and Spanish orthography and phonology	26
English orthography and phonology	26
Spanish orthography and phonology	31
Comparison and contrast	32
Transfer in Spanish-speaking young ESL learners	34
Transfer in Spanish-speaking adult ESL learners	38
Transfer in ESL learners from various language backgrounds	40
Summary	42
Spelling Intervention for Bilingual Learners (Empirical Studies)	43
Training of bilingual children developing spelling skills in L2	43
Training of bilingual adults developing spelling skills in L2	45
Summary	45
Bilingualism and Bilingual Education	47
Bilingualism	47
Simultaneous vs. sequential bilingualism	48
Brief review of bilingual education in the United States	50
The Facilitation Theory	55
Linguistic Interdependence Hypothesis	55
The SUP and the CUP Models	55
Psychological Modularity and the Facilitation Effect	58
Discussion	61
Chapter 3: Method	65
Role of the Researcher	65
Participants	65

Measures	67
English spelling.....	68
Spanish spelling	69
Scoring and coding	69
Procedure	77
Chapter 4: Results	78
Research Question 1	78
Research Question 2a.....	81
Research Question 2b	82
Research Question 2c	87
Chapter 5: Discussion	90
Findings	90
Significance of the Study	92
Limitations	94
Implications for Research and Practice.....	95
Conclusion	99
Appendices.....	101
Appendix A: Background Questionnaire for Spanish-speaking Participants	101
Appendix B: Background Questionnaire for English-speaking Participants.....	103
Appendix C: Selected English Pseudoword Spelling Items	105
Appendix D: Spelling Coding (Old Paradigm).....	106
Appendix E: Spelling Coding (New Paradigm).....	107
Appendix F: Frequency Distributions of Non-L1-influenced Transfer Spelling Errors	110
References.....	116

List of Tables

Table 1 <i>The vowels of Spanish and American English</i>	71
Table 2 <i>Coding Scheme</i>	75
Table 3 <i>Summary of Robust Regression Analysis Using the Beginning Level as the Reference Group</i>	79
Table 4 <i>Summary of Robust Regression Analysis Using the Advanced Level as the Reference Group</i>	79
Table 5 <i>Summary of Robust Regression Analysis with Dummy Coded English Proficiency Variable Only (Using the Beginning Level as the Reference Group)</i>	79
Table 6 <i>Summary of Robust Regression Analysis with Dummy Coded English Proficiency Variable Only (Using the Advanced Level as the Reference Group)</i>	80
Table 7 <i>Summary of Robust Regression Analysis with Spanish Spelling Variable Only</i> ..	80
Table 8 <i>The Mann-Whitney Test Result Showing Differences between Groups</i>	82
Table 9 <i>Most Frequent /i/ Sound Spelling Errors</i>	83
Table 10 <i>Most Frequent /ɪ/ Sound Spelling Errors</i>	83
Table 11 <i>Most Frequent /u/ Sound Spelling Errors</i>	83
Table 12 <i>Most Frequent /eɪ/ Sound Spelling Errors</i>	83
Table 13 <i>Most Frequent /ɛ/ Sound Spelling Errors</i>	84
Table 14 <i>Most Frequent /ʌ/ Sound Spelling Errors</i>	84
Table 15 <i>Most Frequent /ɔɪ/ Sound Spelling Errors</i>	84
Table 16 <i>Most Frequent /o/ Sound Spelling Errors</i>	84
Table 17 <i>Most Frequent /ɔ/ Sound Spelling Errors</i>	85
Table 18 <i>Most Frequent /æ/ Sound Spelling Errors</i>	85
Table 19 <i>Most Frequent /aɪ/ Sound Spelling Errors</i>	85
Table 20 <i>Most Frequent /aʊ/ Sound Spelling Errors</i>	85
Table 21 <i>Most Frequent /ɑ/ Sound Spelling Errors</i>	86
Table 22 <i>Summary of Most Frequently Produced Error Patterns by Participants</i>	86
Table 23 <i>Summary of Poisson Regression Analysis Using the Advanced Level as the Reference</i>	88
Table 24 <i>Summary of Poisson Regression Analysis Using the Beginning Level as the Reference</i>	89

List of Figures

Figure 1. <i>Phonological Awareness Complexity</i>	11
Figure 2. <i>Syllabic Complexity and Orthographic Depth</i>	18
Figure 3. <i>Psychological Grain Sizes</i>	21
Figure 4. <i>The Separate Underlying Proficiency (SUP) model of bilingualism</i>	56
Figure 5. <i>The Common Underlying Proficiency (CUP) model of bilingualism</i>	56
Figure 6. <i>The ‘iceberg’ representation of language proficiency</i>	57
Figure 7. <i>The ‘dual-iceberg’ representation of bilingual proficiency</i>	58
Figure 8. <i>Psychological Modularity</i>	59
Figure 9. <i>Spanish and English vowel phonemes</i>	73

Chapter 1: Introduction

Statement of the Problem

Generally speaking, spelling involves the process of segmenting the spoken word into sounds and then selecting the appropriate letters to represent the sounds. Spelling is an important literacy skill and learning to spell is an important part of learning to write. Treiman and Kessler (2005) stated that spelling “provides a foundation for higher-level writing skills” (p. 133), and Abbott, Berninger, and Fayol (2010) posited that “spelling may from the very beginning be the critical skill for developing word wizards and competent composers” (p. 296). In addition, a number of researchers found a reciprocal relationship between reading and spelling (Carver, 2003; Conrad, 2008); others found that spelling influences reading, vocabulary learning, and writing (Ehri & Rosenthal, 2007; Ehri & Wilce, 1987; Rankin, Bruning, Timme, & Katkanant, 1993). Shahar-Yames and Share (2008) provided further evidence that spelling can lead to greater learning outcomes than reading alone. Gentry (2007) reported evidence from neuroscientists that there is a neurological basis for the utility of spelling skills; individuals who store and activate knowledge of correct spelling patterns are better able to focus on meaning and ideas when writing.

In the adult ESL (English as a Second Language) program in which I taught, students often expressed their concerns about difficulty with spelling. In one of my previous writing classes, when a student replied to her peer’s feedback, she wrote, “thank you for think abaou my healt but is very dificoltd because is complicaete siknes.” Later when we worked together to correct the spelling errors, she told me that she would love to receive spelling instruction since she was embarrassed by her spelling errors. The ESL

curriculum where I taught did not explicitly teach spelling skills, although I had noticed that spelling errors often hindered students' writing fluency and accuracy as well as my ability as a teacher to understand the content of their writing. Nevertheless, the literature shows that English vowel sounds can be especially difficult for Spanish-speaking ESL learners to spell (Casas, 2001; Coe, 2001; Whitley, 2002) and ESL learners tend to apply spelling rules from their native language to English spelling (Fashola, Drum, Mayer, & Kang, 1996; Sun-Alperin & Wang, 2008), which may cause errors. For this reason, I chose to investigate what areas in English spelling poses the most difficulty for Spanish-speaking adult ESL learners in order to inform future instructional interventions designed to support students' spelling skills.

Despite the importance of spelling in literacy development, previous research has tended to focus on reading rather than spelling (e.g., Caravolas, Hulme, & Snowling, 2001; Manrique & Signorini, 1994; Nation & Hulme, 1997; Treiman & Kessler, 2005). Moreover, of the studies focused on spelling development and spelling intervention, very few investigated adult learners, especially adult ESL learners, with the majority instead focusing on young learners. The limited number of studies on cross-linguistic transfer of spelling skills from Spanish to English does not systematically examine the effects of transfer on spelling vowel sounds. Considering the complexity and inconsistency of English vowel spelling patterns, this study aims to fill in the gap found in literature by examining cross-linguistic transfer in the spelling of English vowel sounds by adult Spanish-speaking ESL learners.

Background

It is generally well accepted that phonological awareness, particularly phonemic awareness, and letter-sound knowledge are strong predictors of successful spelling in alphabetic writing systems among both normally developing learners and learners with learning disabilities or difficulties (e.g., Caravolas, 2004; Cornwall, 1992; Friend & Olson, 2008; Mannai & Everatt, 2005; Porpodas, 1999; Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998; van Bysterveldt, Gillon, & Moran, 2006). Other than phonological awareness and letter-sound knowledge, orthographic consistency, which ranges from consistent to inconsistent, can impose different cognitive processing demands on spelling development and performance. Several studies reported a feedforward consistency effect in the direction of phonology-to-orthography on spelling accuracy (Alegria & Mousty, 1996; Le'te', Peereman, & Fayol, 2008; Weekes, Castles, & Davies, 2006). Caravolas (2004) found that the degree of orthographic consistency plays a mediating role in determining the rate of spelling acquisition, such that acquisition of less consistent orthographies is slower. Defior and Serrano (2005), as well as Zaretsky, Kraljevic, Core, and Lencek (2009) supported Caravola's finding by stating that learning to spell in more transparent orthographies such as Spanish takes less time than more opaque orthographies such as English. As a result, children learning to spell in Spanish tend to have a higher percentage of spelling success earlier than children learning to spell in English.

Lesaux, Koda, Siegel, and Shanahan (2006) synthesized multiple studies investigating factors that affect second language (L2) spelling. One finding was that

phonological awareness skills, letter-sound knowledge, and orthographic knowledge affect L2 spelling performance just as they affect first language (L1) spelling performance. Another important finding was that certain spelling errors in L2 reflect the L1 sound-letter correspondence rules. These findings highlight the importance of considering the influence of cross-linguistic transfer on spelling acquisition in L2 and incorporating this into the design of intervention programs to help learners enhance their second language spelling skills.

Several studies on bilingual children or adults acquiring literacy in English (L2) showed evidence of cross-linguistic transfer. Some of the studies found evidence of two-way transfer, both from L1 to L2 and from L2 to L1 (Branum-Martin et al., 2006; Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004; López & Greenfield, 2004; Quiroga, Lemos-Britton, Mostafapour, Abbott, & Berninger, 2002). L1 can have both positive and negative influence on L2 performance by either enhancing it or causing errors. Specifically in this study, L1-influenced transfer indicates the errors that adult Spanish-speaking ESL participants made in English vowel spellings due to Spanish spelling influence. Fashola et al. (1996) generated and tested eight categories of predicted errors in English spelling influenced by Spanish. Carlisle (1997), Casas (2001), and Goldstein (2001) reported L1-influenced transfer in phonology from Spanish to English such as vowel sound substitution (e.g. replacing lax vowel /ɪ/ with tense vowel /i/) and epenthesis insertion (e.g. saying *stigma* as *estigma*). L1-influenced transfer in phonology and sound-letter correspondence can affect Spanish-speaking ESL learners' English pronunciation and spelling, as they may produce errors when mapping sounds to letters. Coe (2001) suggested that the most difficult areas in English spelling acquisition for Spanish-

speaking learners are learning to spell English vowel sounds and consonant clusters that are different from or do not exist in Spanish.

Purpose

The purpose of the study is to examine cross-linguistic transfer of spelling skills in Spanish-speaking adult ESL learners and identify implications of the findings for spelling interventions. Research on cross-linguistic transfer of spelling skills in Spanish-speaking adult ESL learners is very limited. The study aims to fill a gap in the literature by providing more insights into whether L1-influenced transfer in spelling English vowel sounds likely happens and if so, what kind of English vowel sound spelling errors are produced by Spanish-speaking adult ESL learners. Furthermore, based on a literature review, the phenomenon of cross-linguistic transfer, which has been studied widely in psycholinguistic studies, has received little attention in intervention studies. Hopefully the findings of this study will aid ESL teachers in supporting adult learners gain knowledge of cross-linguistic transfer in spelling and inform ESL teachers who design spelling intervention programs to help learners enhance this important literacy skill.

Research Questions

There are three research questions to be addressed. The second research question contains three subquestions.

1. What is the nature of the relationship between Spanish-speaking adult ESL learners' English spelling skills and two potential predictors: Spanish spelling skills and English proficiency? What implications does this relationship have for accurate prediction of the learners' English spelling skills?

2. What types of errors do Spanish-speaking adult ESL learners produce when spelling English vowel sounds?

2a. Do the spelling errors indicate the possible presence of L1-influenced transfer from Spanish to English?

2b. Do the spelling errors indicate something other than L1-influenced transfer from Spanish to English? If so, what do such errors indicate?

2c. If L1-influenced transfer possibly happens, do Spanish-speaking adult ESL learners' Spanish spelling skills and English proficiency influence the degree of L1-influenced transfer?

3. What implications can be drawn from the findings for designing effective spelling interventions for Spanish-speaking adult ESL learners?

Answering these research questions will hopefully shed light on designing or modifying spelling intervention to help Spanish-speaking adult ESL learners develop and strengthen English spelling skills. In the next chapter, literature on spelling development, cross-linguistic transfer, spelling intervention, bilingualism and bilingual education, and the facilitation theory will be discussed. The review of the literature will set up both theoretical and empirical backgrounds for the methods used in this study.

Chapter 2: Literature Review

This chapter reviews the history of English spelling, the theoretical approaches to English spelling development, the major factors that influence L1 and L2 spelling development, cross-linguistic transfer of phonological awareness, letter-sound, and orthographic knowledge, empirical studies that are relevant to spelling intervention and that address the aforementioned influencing factors to help bilingual learners enhance English spelling skills, bilingualism and bilingual education, and the facilitation theory.

A Brief History of English Spelling

Upward and Davidson (2011) reviewed the evolution of English spelling over four language periods: (a) Old English (5th century – c. 1150); (b) Middle English (c. 1150 – c. 1476); (c) Early Modern English (c. 1476 – c. 1660); and (d) Modern English (c. 1476 – present). Currently the 26 letters of the Roman or Latin alphabet used in spelling modern English, known as the “English alphabet” is different from the set of Roman letters used in German or Spanish. The English alphabet has evolved gradually throughout history. Old English used the Roman alphabet, each letter of which almost always represented one spoken Latin sound. For certain sounds in Old English that the Roman alphabet had no letters to match, a few new letters were introduced from a Germanic alphabet. Overall, Old English maintained high sound-to-letter/letter-to-sound consistency. However, after the Norman Conquest in 1066, several factors affected the simplicity of English spelling; some French spelling rules were applied to English, for instance, replacing *cw* by *qu*; Flemish printers introduced Flemish spellings for English speech-sounds, for instance, *gh* for /g/; and many 16th century scholars added words and letters to English that reflect the Latin and Greek words, for instance, the word *doubt* reflecting the *b* of Latin *dubitum*. Influences like these gradually led to the irregularity and unpredictability that are manifested in the Modern English spelling system.

Modern English started to form in the early 15th century during the reign of King Henry V. Despite the need for “official” and “standardized” English spelling, England did not establish an authorized agency to guide the standardizing process. As a result, Modern English spelling was not standardized until 1755 when Samuel Johnson’s *Dictionary of the English Language* became widely accepted as the standard. By the 19th century, English spelling had become more uniform.

Upward and Davidson (2011) stated that Modern English consists of “four main word-stocks: a Germanic base (mostly Anglo-Saxon but with some Scandinavian elements), overlaid with French and with some elements from Latin and Greek” (p. 7). Each of these word-stocks has its own spelling system, which causes the “chaotic and unsystematic nature” of Modern English spelling (p. 8). Other than the four main word-stocks, other languages such as Spanish, Italian, Russian, and Turkish have also contributed to English vocabulary and spelling.

Theoretical Approaches to English Spelling Development

Treiman (1998) introduced two major theoretical approaches to explain spelling development of English. The first approach involves stage theories, which propose that children go through qualitatively different stages in learning to spell. Children use their knowledge of letter names and phonology in the early stages and their knowledge of orthographic and morphological relationships in the later stages. Gentry (1982) discussed five stages of spelling: “precommunicative,” “semiphonetic,” “phonetic,” “transitional,” and “correct.” Children first use symbols from the alphabet to represent words, then they develop “prephonetic” awareness in realizing letter-sound correspondences (e.g., spell BRZ for birds). In the “phonetic” stage, children invent systematic spelling rules. Although the invented rules do not conform to conventional English spelling for some sounds, children start to map letter-sound correspondences. During the “transitional”

stage, children rely more on orthographical and morphological representations rather than just on phonology. Finally, children can spell correctly at their grade level based on educational assessments. A number of studies in the 1980s and early 1990s supported Gentry's stage theories (e.g., Ehri, 1986; Ehri, 1992; Frith, 1985; Marsh, Friedman, Welch, & Desberg, 1980; Nunes, Bryant, & Bindman, 1997).

The second approach is called the "strategy approach." Treiman (1998) proposed that spelling development is more continuous and children's ability to use orthographical and morphological representations emerges earlier than proposed by the stage theories. She used the example of how first graders, who are at the early stage of acquiring spelling skills, can get the concept that *ck* does not appear at the beginning of words. A number of studies in the middle and late 1990s supported the strategy approach (Goswami, 1988; Lennox & Siegel, 1994; Nation & Hulme, 1996; Rittle-Johnson & Siegler, 1999; Snowling, 1994; Varnhagen, McCallum, & Burstow, 1997). For example, Bosse, Valdois, and Tainturier (2003) investigated the use of analogies among French first to fifth graders. They found that when spelling new words, children were able to make reference to what they already knew and draw analogies based on grapheme similarities. Bosse et al. provided evidence that beginning learners could use orthographic knowledge to acquire spelling skills, and they do not have to wait until alphabetic knowledge is fully developed.

The main difference between the two approaches falls in the time frame as when orthographic and morphological knowledge starts to influence children's spelling development. The stage approach proposed at a later time, while the strategy approach proposed at an earlier time. However, the strategy approach does not say that children have strong orthographic and morphological knowledge from the very beginning. It states that

children make continuous progress in strengthening orthographic and morphological knowledge. As Treiman (1998) stated, “the ability to use orthographic and morphological information improves over time” (p. 7).

Major Factors that Influence First-language Spelling Development

In this section I review three major factors that influence first-language spelling development, which are phonological awareness, letter-sound knowledge, and orthographic knowledge and orthographic consistency.

Phonological awareness. Stahl and Murray (1994) defined phonological awareness as “an awareness of sounds in spoken (not written) words that is revealed by such abilities as rhyming, matching initial consonants, and counting the number of phonemes in spoken words” (p. 221). Castles and Coltheart (2004) indicated that phonological awareness encompasses “awareness of the most basic speech units of a language – phonemes – as well as larger units such as rimes and syllables” (p. 78). They further emphasized that phonological awareness skill “involves, not simply unconsciously discriminating speech sounds (such as in speech perception), but explicitly and deliberately processing and acting upon them” (p. 78).

Phonological awareness is usually measured by three major categories of tasks: syllable awareness tasks, rime awareness tasks, and phonemic awareness tasks. Syllable awareness tasks can include *syllable counting* (e.g., count how many syllables in the word *tiger*), *syllable segmentation* (e.g., segment the word *maybe* into two syllables), *syllable blending* (e.g., blend the syllables *ro-bot* into the word *robot*), *syllable deletion* (e.g., say *forget* without *for*), and so forth.

Rime awareness tasks can include *rhyme recognition* (e.g., tell if *funny* and *bunny* rhyme), *rhyme production* (e.g., tell a word that rhymes with *cake*), and so on. Phonemic

awareness tasks can include *initial sound identification and comparison* (e.g., tell the first sound in the word *top*; tell if the first sound is the same as in the word *pop*), *final sound identification* (e.g., tell the last sound in the word *tooth*), *phoneme counting* (e.g., count how many sounds in the word *run*), *phoneme segmentation* (e.g., segment the word *hat* into three phonemes /h/, /æ/, and /t/), *phoneme blending* (e.g., say /m/ / ʌ / /s/ /t/ which leads to *must*), *phoneme deletion* (e.g., say *can* without /k/ and say *seat* without /t/), *phoneme substitution* (e.g., replace the first sound in *soon* with /m/), and so on.

Schuele and Boudreau (2008) diagrammed the level of complexity of phonological awareness tasks in Figure 1.

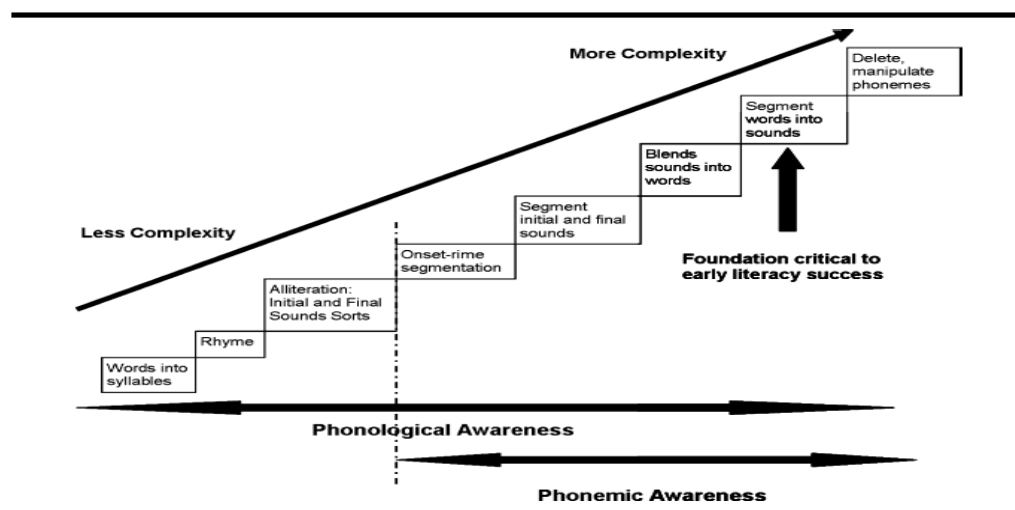


Figure 1. Phonological Awareness Complexity from Schuele and Boudreau (2008, p. 6)

Phonological awareness is generally believed to be an important precursor to successful spelling acquisition of languages that utilize an alphabetic writing system such as English, Spanish, and French (e.g., Cornwall, 1992; Friend & Olson, 2008; MacDonald & Cornwall, 1995; Mannai & Everatt, 2005; Manrique & Signorini, 1994; Nation & Hulme, 1997; Plaza & Cohen, 2006; Porpodas, 1999; Shatil, Share, & Levin, 2000; Vandervelden & Siegel, 1995; Vellutino, Fletcher, Snowling, & Scanlon, 2004).

Castles and Coltheart's (2004) review of studies even suggested a possible causal link from phonological awareness skills to successful spelling acquisition.

Cornwall (1992) studied 54 nine-year old English-speaking children who had reading disabilities. After controlling for age, social economic status, behavior issues, and IQ, Cornwall found that phonological awareness contributed significantly to the prediction of spelling. MacDonald and Cornwall (1995) followed 24 Canadian children from kindergarten till they became teenagers (mean age of 17 years) and found that phonological awareness (especially phoneme deletion) was a significant predictor of the children's spelling skills 11 years later. Nation and Hulme (1997) examined predictors of children's early spelling skills in the United Kingdom. They recruited 75 children, 25 each from primary year 1, year 3, and year 4. The findings showed that phonemic segmentation skills were strongly related to spelling. Vandervelden and Siegel (1995) found a trend in children's development of spelling skills. For kindergartners final phoneme recognition was the most significant predictor of spelling accuracy, but for first and second graders phoneme deletion and substitution were the strongest predictors.

Studies in alphabetic languages other than English confirmed the role of phonological awareness in spelling development as well. Mannai and Everatt (2005) studied 171 normally developing children from grade 1 through grade 3 who were Arabic speakers and found that phonological processing skills such as decoding and rhyming were the best predictors of spelling. Manrique and Signorini (1994) studied 39 Spanish-speaking children in Argentina and found that their phoneme counting skill was highly correlated with their Spanish spelling performance.

Shatil et al. (2000) conducted a longitudinal study to examine Israeli children's spelling skills in kindergarten and the end of first grade. A total of 317 children completed pre- and posttests. Findings revealed that children's phonemic awareness and letter knowledge in kindergarten were strong predictors of spelling performance at the end of first grade. Plaza and Cohen (2006) worked with 75 French-speaking children (mean age of six years) and found that syllable awareness was one of the most important predictors of early spelling development in French and that phoneme awareness predicted pseudoword spelling.

There is research showing that children with reading and spelling difficulties also tend to have phonological awareness deficits. After comparing 77 eleven-year old children who had spelling disabilities with 77 eight-year children without spelling disabilities, Friend and Olson (2008) found that the older children had significantly lower phonological accuracy than their younger counterparts. This also implies that phonological awareness deficits in younger children may persist to older ages. Porpodas (1999) conducted a similar comparison study of normally developing children to children with literacy deficits. The study participants were 32 first grade children who were native Greek speakers. The results showed that children with reading and spelling difficulties had significantly lower phonological awareness skills than their normally progressing peers. Vellutino et al. (2004) reported that spelling problems of the dyslexic college students studied were partly due to a core phonological deficit.

Fewer studies have investigated adult learners, but their findings are consistent with those from studies on children. Evidence shows that phonological awareness remains an important precursor to successful spelling for adults. Furthermore, spelling

problems of adult learners might result from deficiencies in phonological abilities, deficiencies in instruction, or combination of the two.

Durgunoglu and Oney (2002) worked with 59 Turkish-speaking non-literate or low-literate women and tried to help them improve Turkish literacy. The study findings indicated that phonological awareness predicted spelling. Greenberg, Ehri and Perin (1997) compared 72 English-speaking adults from adult literacy classes to 72 third to fifth graders. Although both groups were matched for grade-level reading, the results showed that the adult group performed significantly worse than the children group on segmenting and deleting phonemes and on reading pseudowords. The deficit also affected adults' spelling.

It is noteworthy that although the reviewed articles and studies showed evidence of phonological awareness as a significant precursor to spelling acquisition, the tasks used for assessment differed among them. Thus, it is not exactly clear which specific aspect of phonological awareness played the most critical role. It is plausible that phonemic awareness is more important than syllable awareness and rime awareness since phonemic awareness tasks were used in most of the reviewed studies.

Letter-sound knowledge. *Letter-sound knowledge* is defined as “a knowledge base of the letters of the alphabet and their links with sounds” (Schuele & Boudreau, p. 306). A related concept, *letter-sound correspondence* or *letter-sound mapping*, has the similar meaning as *letter-sound knowledge*. Treiman et al. (1998) investigated how children between 3½ and 7½ years old developed letter-sound knowledge, and found that at the early stage, children learned letter sounds based on their letter name knowledge. If the sound of a letter occurred in the name of the letter (e.g., v and k) and at the same time

was in the initial position (onset), children tended to learn the letter-sound correspondence easily. If the sound of a letter occurred in the name but was at the final position (e.g., l and f), children learned the letter-sound correspondence more slowly. Children had the most difficulty if the sound of a letter was not in the name (e.g., h and w). The study suggested that letter name knowledge and phonological awareness of onsets were fundamental to letter-sound knowledge.

A number of studies have shown that letter-sound knowledge plays an important role in spelling development. Caravolas et al. (2001) studied spelling development among 153 British children in their first three years of schooling. Caravolas et al. found that phoneme segmentation and letter-sound knowledge were the most important precursors of spelling ability. They further reported that letter-sound knowledge was a more independent factor to influence spelling ability and phoneme segmentation was influenced by letter-sound knowledge.

Fricke, Szczerbinski, Stackhouse, and Fox-Boyer (2008) assessed 69 German-speaking children in kindergarten and followed them up to the first grade. After examining the factors, the researchers found that phonological awareness and letter knowledge were the most important predictors of spelling development. In this study, letter knowledge was defined as the understanding of letters representing sounds and of grapheme-phoneme (or letter-sound) correspondences.

Quellette and Sénéchal (2008) and He and Wang (2009) studied the factors that influence invented spelling (early nonconventional spelling attempts) by kindergarten and first grade children either in an English speaking country or a non-English speaking country where English is learned as a foreign language. Both studies confirmed that invented spelling is a sophisticated developmental skill. Furthermore, the results showed

that children's letter-sound knowledge and phonological awareness predicted their invented spelling outcomes. Perry and Ziegler (2004) separated sound-letter correspondence into smaller-size (phoneme-grapheme) and larger-size (rime-body) mappings. After conducting five experiments with college students, the major finding was that people predominantly used phoneme-grapheme mappings in English spelling.

Treiman (2005) reviewed studies that examined the importance of letter knowledge (visual forms, names, and sounds of letters) in children's spelling development. The results showed that at the initial stage, children use letter name knowledge to learn and develop letter-sound knowledge. For example, children may produce /vi/ for the letter v. Then they progress to develop letter-sound knowledge by producing /v/ for the letter v. Children need phonological skills to detect letter sounds based on the letter names.

In general, the findings suggested that phonological awareness and letter-sound knowledge are closely correlated and they should be examined together when assessing spelling outcomes. Both factors provide a foundation for spelling development.

Orthographic knowledge and orthographic consistency. Orthographic awareness refers to “the ability to perceive and recall letter, letter strings, and words” (Mather & Goldstein, 2001, p.165). Orthographic knowledge dictates what characters are legal in a writing system and how they can be legally combined. When explaining the role of orthography in spelling development, Bourassa and Treiman (2001) provided the examples of knowledge of position and knowledge of allowable consonant doublets. For instance, if a learner knows that the digraph *ck* occurs in the middle or at the end of English words, but not at the beginning, he or she would use this orthographic knowledge

to avoid certain spelling errors. Similarly doublets such as *mm* in *summer* and *nn* in *inn* rarely occur at the beginning of English words.

Kemp, Parrila, and Kirby (2009) compared the spelling of 29 adult dyslexics with 28 normally developing students. After controlling for vocabulary and nonverbal intelligence, the dyslexics showed difficulty in memorizing orthographic patterns. The consequence is that they could use some phonological skills to spell familiar words, but failed to spell unfamiliar words consistently. This finding implies that knowing orthographic patterns and rules could enhance spelling accuracy and fluency. Figueredo and Varnhagen (2004) asked 53 first-year undergraduate students to identify and correct errors which fell into three categories: (a) phonological (e.g., *incredibul*); (b) orthographic (e.g., *decisian*), and (c) morphological (e.g., *extention*). The participants detected significantly more phonological errors than orthographical and morphological errors. The researchers inferred that good spellers should be more familiar with orthographic conventions than average and poor spellers. In other words, orthographic knowledge helps a learner to enhance his or her spelling skills.

Other than orthographic knowledge, orthographic consistency also plays an important role in spelling development of consistent or inconsistent orthographies. Seymour (2005) characterized a *shallow/transparent/consistent orthography* (i.e. Italian) as having “very consistent correspondences between letters and sounds,” whereas a *deep/opaque/inconsistent orthography* (i.e. English) as having “complex and inconsistent relations between letters and sounds” (p. 297). Le’te’ et al. (2008) and Davies and Weekes (2005) further specified *feedforward consistency* in spelling in the direction of phonology-to-orthography or phoneme-to-grapheme (multiple ways to spell a

pronunciation), and *feedback consistency* in the direction of orthography-to-phonology or grapheme-to-phoneme (multiple ways to pronounce a spelling). Seymour found that “shallow orthographies, such as Greek or Spanish, tend to display few or no feedforward inconsistencies but a number of feedback inconsistencies” (p. 301). Seymour, Aro, and Erskine (2003) compared children’s early reading acquisition from 13 European orthographies. They found that children who learned more consistent orthographies took less time acquiring foundational reading fluency and accuracy than children learned more inconsistent orthographies. The explanation is that children may have to implement both “logographic” and “alphabetic” knowledge when acquiring literacy in inconsistent orthographies. But children learning consistent orthographies only need to implement “alphabetic” knowledge. The researchers classified the 13 orthographies being studied into dimensions of syllabic complexity and orthographic depth in Figure 2. As can be seen in Figure 2, among the 13 orthographies, English is classified as the most complex and inconsistent orthography.

		Orthographic depth				
		Shallow			Deep	
Syllabic structure	Simple	Finnish	Greek Italian Spanish	Portuguese	French	
	Complex		German Norwegian Icelandic	Dutch Swedish	Danish	English

Figure 2. Syllabic Complexity and Orthographic Depth from Seymour et al. (2003, p. 146)

Le’te’ et al. (2008) specified that English and French have similar levels of feedforward inconsistency, whereas French vowels are much more consistent than English vowels in the feedback direction. Le’te’ et al. synthesized studies that explored

the influence of orthographic consistency and found that it has been widely explored in reading research, but not in spelling research.

Zaretsky et al. (2009) assessed 21 English-speaking kindergarteners and 23 Croatian-speaking kindergarteners on their decoding and spelling skills. The findings showed that the Croatian children performed significantly better than the English children on phonological awareness, decoding, and invented spelling. Zaretsky et al. reasoned that orthography played a distinct role in early literacy development. Croatian orthography is more consistent than English orthography, thus it better enhances kindergarteners' ability to acquire early reading and spelling skills.

Manrique and Signorini (1994) compared skilled and less skilled Spanish-speaking first graders' performance on phoneme segmentation, word spelling and word reading. The comparisons of the two groups showed that the skilled readers performed near perfectly on all measures and the less skilled readers performed better on spelling than on reading, but 90% of all reached phoneme segmentation criterion set by the researchers meaning correct answers to six consecutive trials. The researchers considered that the consistent orthography of Spanish permits the early development of Spanish children's mastery of phonemic awareness and sound-letter correspondence rules.

Weekes et al. (2006) conducted three experiments with 100 children (aged seven to eleven years) in England and Australia to investigate the orthographic consistency effects on reading and spelling. The researchers found that phonology-orthography consistency affected spelling, but the effect diminished over time when children became more experienced learners. Spelling was found to be a more challenging task than reading, as

phonology-orthography mappings are less consistent than orthography-phonology mappings in the English vowel system.

Alegria and Mousty (1996) examined spelling development of 38 reading-disabled and 75 normally developing children aged seven to fourteen years matched at reading level in Belgium. The pseudoword spelling measure showed that both groups of children had basic letter-sound knowledge but were insensitive to inconsistent sound-letter mappings in French. The same result was obtained in the spelling of inconsistent non-dominant graphonemes (e.g. /s/ spelled *c* as in *cigarette*) where both groups performed poorly. There were no effects of word frequency on spelling outcome. When spelling context-dependent graphonemes (e.g. /g/ followed by *i*), both groups performed poorly, although the normally developing children showed stronger word frequency effects than the reading-disabled children. Alegria and Mousty concluded that since French is a relatively inconsistent orthography, when children start to acquire spelling skills, they first apply simple rules to all spelling patterns, which will lead to occasional errors. In order to become more accurate spellers, other than phonological skills, children also need to develop efficient orthographic lexicon.

The studies reviewed above regarding how orthographic consistency influences spelling acquisition confirm that consistent orthographies provide an easier path for children to learn sound-letter mapping rules in spelling. In contrast, inconsistent orthographies create more difficulties for children since applying simple sound-letter rules will not always produce correct spellings. Ziegler and Goswami's (2005) *psycholinguistic grain size* theory explains the cognitive effect of orthographic consistency by positing that different degrees of orthographic consistency imposes developmental differences in the grain size of lexical representations. Figure 3 depicts this model.

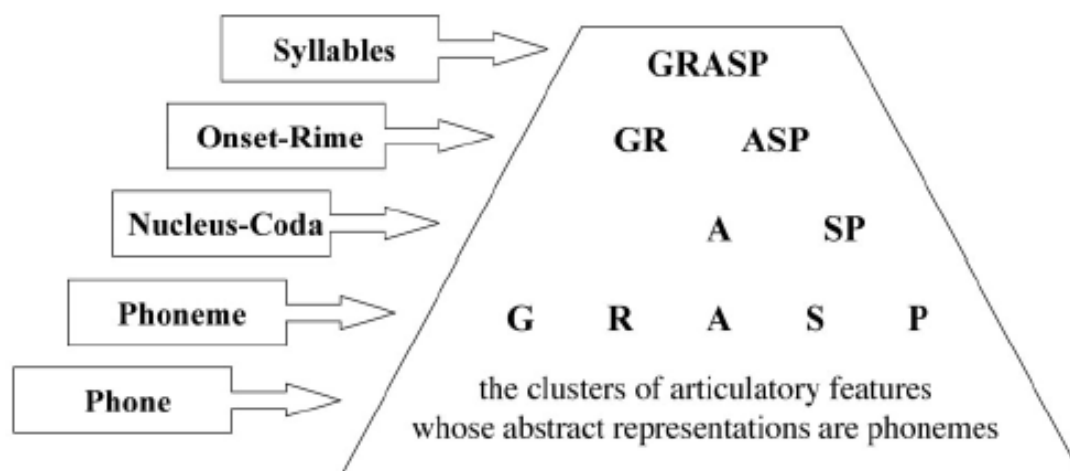


Figure 3. Psychological Grain Sizes from Ziegler and Goswami (2005, p. 5)

As Ziegler and Goswami (2005) explained, “Syllable awareness is usually present by about age 3 to 4, and onset–rime awareness is usually present by about age 4 to 5. Phoneme awareness only develops once children are taught to read and write” (p. 4). They further stated that in English smaller grain sizes are likely to be more inconsistent than larger grain sizes. For example, consistency at the phoneme level is more inconsistent than at the syllabic level. There are multiple graphemes which can map to the sound /i:/, but there is only one set of graphemes which map to the syllable *grasp* (as exemplified in Figure 3). As a result, children learning English need to use encoding and decoding strategies at multiple levels of grain size, whereas children learning more consistent orthographies such as Italian and Spanish can primarily focus on the smaller grain size at the phoneme level. Indeed Ziegler and Goswami reported that reading accuracy in orthographically consistent languages is close to 100% by the middle of first grade. The more inconsistent an orthography is, the longer it takes for children to attain accuracy and fluency in reading during the early stages of literacy acquisition.

Although psycholinguistic grain size theory was constructed to explain reading development, it might also be used to explain spelling development across orthographies with different levels of consistency since spelling and word reading are highly correlated (e.g., Abbott et al., 2010; Adams, 1990; Cooke, Snee, & Young, 2008; Ehri, 2000; Foorman & Francis, 1994; Graham, Harris, & Chorzempa, 2002; Mehta, Foorman, Branum-Martin, & Taylor, 2005).

Major Factors that Influence Second-language Spelling Development

Research has indicated that the factors that affect first-language spelling development, namely phonological awareness, letter-sound knowledge, and orthographic knowledge and orthographic consistency, also influence second-language spelling development. Arab-Moghaddam and Sénéchal (2001) tested 55 Iranian-Canadian second and third graders' word reading and spelling skills in both English and Persian. The findings showed that phonological awareness and orthographic processing skills predicted the children's spelling accuracy in English (L2).

Chiappe, Siegel, and Gottardo (2002) investigated the factors that influenced beginning literacy development of kindergarten children from different language backgrounds including Farsi, Japanese, Spanish, Tagalog, Chinese, French, Slovakian, and Korean. They recruited 540 native English speakers, 59 bilinguals, and 60 ESL learners. The literacy skills were assessed in November and the following May. The findings revealed that alphabetic knowledge and phonological awareness, especially rhyme awareness, were important predictors of spelling skills in English.

Verhoeven (2000) studied how children developed reading and spelling skills in first language and second language. One thousand eight hundred and twelve native Dutch

children and 331 minority children (e.g., Turkish and Moroccans) from primary schools in the Netherlands were assessed on word decoding, vocabulary, and reading comprehension skills. Spelling, grapheme, word blending, and cipher knowledge were administered to subsamples of the total participants. The study results indicated that the second language learners performed poorly on spelling compared to the Dutch native speaking children. The second language learners lacked phonemic segmentation skill and the knowledge of the target language's orthographic patterns. Wang and Geva (2003) examined how Chinese speaking primary level children learned English phonemes /θ/ and /ʃ/, which are not present in Chinese. When the Chinese children spelled both sounds in English, they made errors that reflected the lack of phonemic and orthographic knowledge of the phonemes. Both studies' results imply that phonological awareness and orthographic knowledge play an important role in second language spelling acquisition.

Jongejan, Verhoeven, and Siegel (2007) worked with children from first grade through fourth grade. Forty-two percent of the children were native English speakers and 58 percent were ESL learners, the majority being native speakers of Chinese, Gujarati, Urdu, and Greek. After examining the factors that influenced the ESL children's English spelling skills, the researchers reported that phonological awareness and rapid naming were the strongest predictors.

Wade-Woolley and Siegel (1997) recruited 79 second graders, of which 33 were native English speakers and 40 were ESL learners whose native languages were Cantonese, Mandarin, Gujarati, Urdu, and Punjabi. The remaining six students' data was excluded from the analyses. The researchers administered a comprehensive set of assessments, including real and pseudoword spelling, real and pseudoword reading,

phoneme deletion, oral cloze, syntactic judgment, and rapid automatized naming to examine the factors that influenced the children's performance and to compare the native English group to the ESL group. The findings indicated that phoneme deletion and segmentation and sound-letter knowledge predicted how well spelling tasks were performed.

van Berkel (2004) recruited 1,400 Dutch learners of English who were in the last year of primary school or the first year of secondary school in the Netherlands,. After examining the participants' English spelling performance, the researcher found that knowledge of allowable sequences of graphemes, also known as graphotactic patterns, played a critical role in spelling.

Geva, Wade-Woolley, and Shany (1993) explored how kindergarten children concurrently acquire reading and spelling skills in English (L1) and Hebrew (L2). The researchers found that the developmental trajectories between the two languages were highly similar. With regards to spelling, phonological awareness and orthographic knowledge made the strongest positive impact.

In summary, the studies reviewed above investigating factors that influence spelling development show how phonological awareness, letter-sound knowledge, and orthographic knowledge and orthographic consistency play critical roles in both first- and second-language spelling development. In other words, second-language spelling development follows a similar trajectory to the first-language spelling development. In order to help second language learners of English improve spelling skills, all factors reviewed above should be considered since they interact with one another to affect the learning outcome.

When looking at literacy development among bilingual learners, many researchers studied the phenomenon of cross-linguistic transfer, which Leafstedt and Gerber (2005) conceptualized generally as “the access and use of linguistic resources in L1 by students while learning other languages” (p. 227). Transfer can occur on the phonological, lexicosemantic, morphosyntactic, pragmatic, and metalinguistic/metacognitive levels. Usually learners’ L1 and L2 interact during the second language acquisition process and, typically, one language is likely to be dominant over the other for a certain period of time. This study focuses on cross-linguistic transfer in sound-letter correspondences in spelling from Spanish to English where Spanish is the dominant language and English is the target language.

In the following section, empirical studies and reviews about phonological awareness, letter-sound knowledge, and orthographic knowledge transfer are discussed to exhibit how cross-linguistic transfer affects second language spelling development.

Cross-linguistic Transfer

Phonological awareness, letter-sound, and orthographic knowledge transfer.

Since Spanish-speaking ESL learners are the target group of the study, this section focuses on the Spanish-speaking population learning English. A few studies on other language populations are also included to provide better evidence of cross-linguistic transfer. Before reviewing empirical studies and review articles on phonological awareness, letter-sound correspondence, and orthographic knowledge transfer, it is important to review the similarities and differences between English and Spanish orthography and phonology. The comparison and contrast will help demonstrate the circumstances in which cross-linguistic transfer in orthography and phonology can occur.

Furthermore, examining the sound-letter mappings in both languages can illustrate how spelling acquisition is influenced by the orthographic system of each language.

English and Spanish orthography and phonology. Joshi and Aaron (2005) defined orthography as a “visual representation of language as conditioned by phonological, syntactic, morphological, and semantic features of the language” (p. xiii). McMahon (2002) further explained that there are two subdisciplines in linguistics which deal with sound, namely phonetics and phonology. Phonetics describes the “range of sounds” (p. 1) in human languages. Articulatory phonetics identifies which speech organs and muscles are involved in producing different sounds, and acoustic and auditory phonetics focus on sound waves and their effects on a hearer’s ears and brain. Therefore, phonetics is strongly associated with “anatomy, physiology, physics and neurology” (McMahon, 2002, p. 1). While phonetics describes the sounds of languages from a universal perspective, phonology is more language-specific and considers the “sound patterns of particular languages” and is “close to psychology” (McMahon, 2002, p. 2). Treiman (1993) stated that vowels are “pronounced with a relatively open vocal tract” whereas consonants are “produced with a more constricted vowel tract” (p. 13). When looking at Spanish and English phonology in the following sections, the focus will be on the discussion of vowels and consonants.

English orthography and phonology. Venezky (1999) described English orthography as alphabetic, which means that it contains symbols that mostly relate to speech sounds. English orthography has 26 letters that are commonly deployed for English sounds. There are more than 40 basic sounds or phonemes in general American speech. Doubled vowel spellings, such as *aa* and *ii*, are not generally used in English, nor

are the consonants *h, j, k, q, v, w, x, y, and z* generally doubled. Doubled consonants are almost never used at the beginning of words. Single letters, such as *u, v, j, and q* rarely occur in final position of words. Venezky discussed that English orthography contains both *relational units* and *markers*. Relational units map directly into sound such as *b* in *bird* and *ch* in *such*. A marker is a letter that marks the pronunciation of another letter, such as *u* marking hard *g* in *guide*. The patterns within English orthography require attention to morphology and phonotactics, apart from phonology.

Venezky (1999) stated, “Visual identity of meaningful word parts takes precedence over letter-sound simplicity” (p. 9). One example provided is the retention of silent letters such as *sign-signal* and *hymn-hymnal*. Venezky also showed that homophones reveal the vast variability of English letter-sound patterns; for example, doubling a final consonant as in *ad-add*, adding a final *e* as in *by-bye*, doubling a final consonant and adding a final *e* as in *bar-barre*, changing final *c* to *k* as in *disc-disk*, and so on. When looking at English reading and spelling, it can be concluded that English orthography makes the language’s reading and spelling systems asymmetrical in that some letters have two or more pronunciations, and often, these pronunciations have two or more other spellings.

McMahon (2002) stated, “All the sounds of English, both consonants and vowels, are produced on pulmonic egressive airstream, where the initiator is the lungs and the rest of the respiratory system, and the direction of airflow is outwards” (p. 25). Pulmonic egressive air flows through the trachea and up into the larynx, stretched across which are the vocal cords. When the vocal cords are pulled back and drawn apart, they leave a free space for air to flow and thus produce voiceless sounds like /s/. When the vocal cords are

drawn together, parted by the airflow, and put together again, they produce vibration which in turn produces voiced sounds like /z/. The dichotomy of voiced and voiceless is a “major division among speech sounds which is relevant for all languages” (McMahon, 2002, p. 26).

Another division is between oral and nasal sounds. Most English sounds are oral sounds, for which air passes from the lungs and up through a tube consisted of the trachea, the larynx, and the pharynx. However, for three sounds (/m/, /n/, and /ŋ/ as in *ham*, *ran*, and *ring*), which are called nasal sounds, air passes through the nasal cavity. Another important concept is articulation, which is determined by the closeness between the active and passive articulators. There are three main states of articulation: (a) stops, when the active and passive articulators touch and stop airflow completely for a short period of time, for example, /p/, /d/; (b) fricatives, when the active and passive articulators are brought close together but do not totally block the oral cavity, for example, /s/, /z/; and (c) approximants, when the active and passive articulators are not sufficiently close to produce audible friction, for example, /j/, /w/, /r/, /l/.

Parker and Riley (2005, p. 108) listed 14 vowel phonemes: (a) /i/ in *seat*, (b) /ɪ/ in *sit*, (c) /eɪ/ in *say*, (d) /ɛ/ in *said*, (e) /æ/ in *sad*, (f) /ʌ/ in *but* (unstressed /ə/ in *soda*), (g) /ɑ/ in *pot*, (h) /u/ in *food*, (i) /ʊ/ in *book*, (j) /o/ in *boat*, (k) /ɔ/ in *sought*, (l) /aɪ/ in *light*, (m) /aʊ/ in *south*, and (n) /ɔɪ/ in *soy*. The vowel phonemes can be described in four dimensions: (a) tongue height, which is either relatively high (/i/, /u/), middle (/eɪ/, /ɛ/), or low in the mouth (/æ/, /ɑ/); (b) frontness, where the tongue is relatively at the front (i, /æ/) or the back of the mouth (/o/, /ʊ/); (c) lip rounding, when the lips are either relatively

round (/u/, /o/) or spread (/ʌ/, /ɪ/); and (d) tenseness, when vocal musculature is either relatively tense (/i/, /u/) or lax (/ɪ/, /ʊ/).

Parker and Riley (2005, p. 111) listed 24 consonant phonemes: (a) /p/ in *pat*, (b) /b/ in *bat*, (c) /t/ in *tea*, (d) /d/ in *door*, (e) /k/ in *cap*, (f) /g/ in *gap*, (g) /f/ in *safe*, (h) /v/ in *victory*, (i) /θ/ in *three*, (j) /ð/ in *either*, (k) /s/ in *peace*, (l) /z/ in *zoo*, (m) /ʃ/ in *rush*, (n) /ʒ/ in *treasure*, (o) /h/ in *ham*, (p) /tʃ/ in *chain*, (q) /dʒ/ in *edgy*, (r) /m/ in *swim*, (s) /n/ in *neat*, (t) /ŋ/ in *sing*, (u) /l/ in *coal*, (v) /r/ in *right*, (w) /w/ in *wet*, and (x) /y/ in *layer*. The consonant phonemes can be described in three dimensions: (a) place of articulation, which includes bilabial, labiodental, interdental, alveolar, palatal, velar, and glottal; (b) manner of articulation, which includes stops, fricatives, affricates, nasals, liquids and glides; and (c) voicing.

Venezky (1999) indicated that English orthography has two sets of vowel patterns. The first set consists of *primary vowel spellings*, which are the single-letter spellings of *a*, *e*, *i/y*, *o*, *u*. This set appears with high frequency in English words and has the most complicated correspondence patterns. The second set is called the *secondary vowel spellings*, which are the digraph and tri-graph spellings such as *ea*, *ou*, and *eau*. This set appears less frequently and has rather simple correspondence patterns. Each of the primary vowel spellings corresponds regularly, but not limited, to two different phonemes. For example, *a* corresponds to /eɪ/ in *table* or to /æ/ in *math*, *e* corresponds to /i/ in *athlete* or to /ɛ/ in *met*, *i* corresponds to /aɪ/ in *title* or to /ɪ/ in *sit*, *o* corresponds to /o/ in *robe* or to /ɑ/ in *comic*, and *u* corresponds to /u/ in *rubric* or to /ʌ/ in *rubber*.

Other than the primary patterns, there are several sub-patterns such as final-e pattern (*cute-cut*) and geminate consonant pattern (*o* before *ff* corresponds to /ɑ/ as in

coffee). There are also consonants' influences on primary vowel spellings such as postvocalic *r*, *i* before final *nd*, *ld*, *gn*. For each primary vowel spelling, there are exceptions to the major vowel patterns presented above.

The secondary vowel spellings have several main differences from the primary vowel spellings. Each secondary vowel spelling generally has a single major correspondent phoneme. Unlike the primary vowel spellings, which can be traced back to the time of Old English, the secondary vowel spellings were introduced during the late Middle English period and thus have experienced much fewer sound changes. The major secondary vowel patterns include several digraphs.

The digraphs *ai* and *ay* commonly correspond to /eɪ/, as in *aim* and *day*. The digraphs *au* and *aw* commonly correspond to /ɔ/, as in *cause* and *thaw*. The digraph *ea*, if not occurring before *r*, commonly corresponds to /i/, as in *beam*. The digraph *ee* commonly corresponds to /i/ before *r*, and /i/ otherwise, as in *beer* and *seed*. The digraphs *ei* and *ey* commonly correspond to /eɪ/ if not preceding *r*, as in *reign* and *obey*. If preceding *r*, *ei* commonly corresponds to /ɛ/ or /i/, as in *heir* and *weird*. Final, unstressed *ey* almost always corresponds to /i/, as in *alley*. The digraphs *eu* and *ew* generally correspond to /u/ or /o/, as in *pseudo* and *sew*. The digraph *ie* commonly corresponds to /i/, as in *achieve*. The digraph *oa* almost invariantly corresponds to /o/, as in *oak*. The digraphs *oi* and *oy* generally correspond to /ɔɪ/, as in *oil* and *boy*. The digraph *oo* most commonly corresponds to /u/, as in *boot*. The digraphs *ou* and *ow* have a major correspondence, /aʊ/, as in *cow* and *ounce*. Other than the aforementioned major secondary patterns, there are several minor ones, such as digraphs *ae*, *eau*, *eo*, *iew*, *oe*,

ue, ye, gh, and so on. For each secondary vowel spelling, there are also exceptions to the major vowel patterns presented above.

Spanish orthography and phonology. Hualde (2005) explained that in the conventional orthography of Spanish, there is an almost perfect mapping from letter to sound so that there is generally only one correct way to read a given sequence of letters. There are very few exceptions, such as the different pronunciation of the letter *x* in *Mexico* and *taxi* and the segmentation of the word *duelo* into two syllables (*due-lo*) but *dueto* into three syllables (*du-e-to*). However, the mapping from sound to letter in Spanish is slightly less consistent. The same sound or sound combination can be spelled in multiple different ways depending on the context. For example, the sound /k/ is spelled as *qu* (with silent *u*) before *e* and *i* as in *queso* and *quiso*, but is spelled as *c* in other contexts as in *casa* and *cosa*. The sound /g/ is spelled as *gu* before *e* and *i* as in *guerra* and *guiso*. To indicate that the *u* is pronounced after *g*, a dieresis is used as in *agüita* and *cigüeña*. The letter *y* can be used after a vowel in word-final diphthongs, but cannot be used in diphthongs in the middle of a word, as manifested in the words *rey* and *reina*. There are two ‘r sounds’ in Spanish, trilled /r/ as in *guerra* and *roca*, and tapped /ɾ/ as in *pero*. The two sounds only contrast between vowels inside a word, where the trill /r/ is spelled as *rr* and the tap /ɾ/ is spelled as *r*.

Other exceptions to the regularity of Spanish spelling include the different spelling patterns of the same sound /h/ in *dije* and *gente*. Spanish learners also need to memorize which words are spelled with *ge* or *gi* and which with *je* or *ji*, and that *ge/ji* is pronounced /j/ but *gue/gui/ga/go/gu* is pronounced /g/. Although Spanish orthography distinguishes between *b* and *v*, and between *y* and *ll*, the great majority of Spanish

speakers pronounce each pair of letters in the same manner. Knowing which words are spelled with which letters can thus pose some difficulties for learners of Spanish.

Additionally, most speakers of Peninsular Spanish have a phonemic contrast between /s/ and /θ/, however, speakers from Latin America lack this phonemic contrast awareness, therefore spelling the sound /s/ in different ways for them can be challenging. Hualde (2005) said that other than the aforementioned exceptions, “conventional Spanish orthography is phonemic” (p. 6).

Hualde (2005) listed five Spanish vowel sounds, each of which maps to one or two letters. The sound /a/ maps to *a* as in *casa*, /e/ maps to *e* as in *mesa*, /i/ maps to *i* or *y* as in *pino* and *y*, /o/ maps to *o*, as in *copa*, and /u/ maps to *u* as in *cunar*. There are six plosive consonants: (a) /p/ maps to *p* as in *pelo*, (b) /b/ maps to *b* or *v* as in *boca* or *vaca*, (c) /t/ maps to *t* as in *toro*, (d) /d/ maps to *d* as in *dama*, (e) /k/ maps to *c*, *qu*, or *k* as in *capa*, *queso*, or *kilo*, and (f) /g/ maps to *g* or *gu* as in *garra* or *guerra*. There is one affricate consonant: /tʃ/ maps to *ch* in *chico*. There are four fricative consonants: (a) /f/ maps to *f* as in *foca*, (b) /s/ maps to *s*, *c(e,i)*, or *z* as in *saco*, *cena*, or *azul*, (c) /x/ maps to *j*, *g(e,i)*, or *x* as in *jota*, *gente*, or *mexicano*, and (d) /j/ maps to *y* or *ll* as in *yeso* or *llano*. There are three nasal consonants: (a) /m/ maps to *m* as in *mes*, (b) /n/ maps to *n* as in *nada*, and (c) /ɲ/ maps to *ñ* as in *año*. There is one lateral consonant: /l/ maps to *l* as in *loco*. There are two rhotic consonants: tap /ɾ/ maps to *r* as in *coro*, and trill /r/ maps to *rr* or *r* as in *corro* or *honra*.

Comparison and contrast. Both English and Spanish belong to the alphabetic writing system. Thus, they share some common features in that each letter of the alphabet represents a particular sound or sounds, usually grouped into vowel spellings (e.g., *a*, *e*, *i*,

o, u) and consonant spellings (e.g., *b, p, d, t*). Letters may cluster to produce distinct sounds (for example, *st* in *stand*), or no sound (for example, the silent *gh* in *high* and *through*). Despite the similarities, Spanish and English have different levels of consistency between letter-sound and sound-letter mappings. Spanish has pretty regular letter-sound and sound-letter correspondences, while English has quite irregular correspondences. Thus, Spanish is classified as a more consistent (or transparent) orthography and English is classified as an inconsistent (or opaque) orthography.

Fashola et al. (1996) and Defior, Martos, and Cary (2002) indicated that Spanish has 30 graphemes, of which five are vowels, 21 are single-lettered consonants, and four are consonants in digraphs. The 30 graphemes generally represent 30 sounds. Each of the five Spanish vowel spellings (*a, e, i, o, u*) and each of the 19 consonants/consonant clusters (*b, d, f, ch, j, k, l, ll, m, n, ñ, p, rr, qu, s, t, v, w, z*) maps to a single phoneme. There is also the silent *h*. Five of the graphemes (*c, g, r, x, y*) may map to two or more phonemes, but the mappings are highly predictable based on the grapheme that follows and/or their position in a word. English has 26 graphemes, of which five are vowel spellings and 21 are consonant spellings. English has at least 35 phonemes.

Helman (2004) compared the sound systems of English to Spanish. English and Spanish share some common consonant sounds, as in the following sounds represented by English phonemes: /p/, /b/, /t/, /d/, /k/, /g/, /m/, /n/, /f/, /s/, /w/, /y/, /tʃ/, and /l/. However, these sounds are sometimes spelled differently in Spanish. The two orthographies also share the following consonant-cluster sound letter mappings: /pl/, /bl/, /cl/, /gl/, and /fl/. Regarding initial consonant clusters, some are legal in English but not in Spanish such as *st, sp, sk/sc, sm, sl, sn, sw, tw, scr, spl, spr, str*, and *squ*.

The Spanish vowel system is much simpler than that of English. Both languages share some similar sounds, but the spellings can be vastly different. English has certain vowel sounds that do not exist in Spanish such as the short vowels (e.g., in *man*, *up*), *r*-controlled vowels (e.g., in *her*), schwa (e.g., in *away*), and the vowel sound in *caught*. Each vowel in Spanish maps to one sound, but each vowel in English maps to at least two sounds. Whitley (2002) specifically stated that for Spanish-speaking ESL learners, the contrasts between English “*beat*” and “*bit*,” “*pool*” and “*pull*,” “*boat*” and “*bought*,” and “*cat*,” “*cot*,” and “*cut*” could be very difficult to distinguish because Spanish does not contrast between tense and lax vowels as English does; Spanish vowels tend to be tense.

Since both English and Spanish monolinguals need to develop phonological awareness and letter-sound/sound-letter mapping skills when learning to read and spell, it is plausible that Spanish-speaking ESL learners who are literate in Spanish will transfer their phonological awareness, letter-sound, and orthographic knowledge in Spanish while acquiring English literacy. The following empirical studies and review articles provide evidence of cross-linguistic transfer. Although the focus is on Spanish-English bilinguals, research on ESL learners from other language backgrounds is also discussed to provide a more in-depth view of cross-linguistic transfer in spelling.

Transfer in Spanish-speaking young ESL learners. A substantial number of studies have indicated that phonological awareness in children’s L1 (Spanish) predicts phonological awareness and word reading in L2 (English). In other words, there is a positive correlation between phonological awareness in Spanish and phonological awareness and word reading in English.

Several studies examined phonological awareness transfer from both Spanish to English and English to Spanish. Quiroga et al. (2002) sampled 30 ESL first graders who were administered blending, segmenting and matching tests at the syllable, onset and rime, and phoneme levels with both Spanish and English measures of phonological awareness. Results showed that phonological awareness in Spanish predicted phonological awareness in English and English word reading. Phonological awareness in English also predicted phonological awareness in Spanish and Spanish word reading.

Dickinson et al. (2004) tested 123 ESL four-year-old ESL children on phonological awareness. The children were assessed in the fall and the following spring in both English and Spanish. The Early Phonological Awareness Profile (EPAP) was used to test deletion detection and rhyme recognition. The results showed that the best predictor of phonological awareness in each language in the post-test was the child's phonological awareness in the other language, which indicated a significant two-way transfer between Spanish and English.

Both López and Greenfield (2004) and Branum-Martin et al. (2006) conducted correlational studies and reported that English and Spanish phonological awareness were significantly correlated with one another as well as with oral proficiency or word reading within and across languages. López and Greenfield examined 100 Spanish-speaking children (with a mean age of 56 months) learning English. The children's phonological awareness was measured using rhyming, alliteration, and sentence segmenting in both English and Spanish. Branum-Martin et al.'s study included a sample of 812 Spanish-speaking kindergarten children from 71 transitional bilingual education program

classrooms. Phonological awareness tasks of blending pseudowords, segmenting words, and phoneme elision were administered in both Spanish and in English.

Other than two-way transfer of phonological awareness, three studies (Cárdenas-Hagan, Carlson, & Pollard-Durodola, 2007; Lindsey, Manis, & Bailey, 2003; Riccio et al., 2001) reported unidirectional phonological awareness transfer from Spanish to English. The researchers in these studies worked with children of different ages and used tasks with different levels of complexity. All of the studies confirmed the predictive role of phonological awareness in Spanish and its significant correlation with phonological awareness and word reading skills in English. Cross-linguistic transfer was also manifested in letter name and sound knowledge, print concepts, and so on. Furthermore, the studies suggested that at the initial stage of acquiring English literacy, strong Spanish phonological awareness had positive effect on helping learners establish English phonological awareness. These findings suggest that literacy instruction in Spanish is helpful before transitioning to complete instruction in English.

Lindsey et al. (2003) conducted a longitudinal study of Spanish-speaking ESL learners from kindergarten through Grade 1. They tested the children during first semester of kindergarten, at the end of kindergarten, and at the end of first grade. The phonological awareness tasks administered in Spanish were sound matching and sound categorization. The tasks administered in English were sound matching and phoneme elision. Cárdenas-Hagan et al. (2007) conducted a study with 1016 Spanish-speaking ESL learners in kindergarten. The children were administered a comprehensive battery of tests in both English and Spanish such as elision (phoneme and syllable deletion), blending phonemes into words, blending phonemes into non-words, segmenting words

into phonemes, and sound matching (first sound and last sound). Riccio et al. (2001) recruited 149 Spanish-English bilingual students with an average age of 7.93 years and an average grade level of 2.44. Assessments of sound matching (initial and ending sounds), sound categorization, and elision in both Spanish and English were administered.

The reviewed research studies suggest that transfer can occur two ways, either from Spanish and English or from English to Spanish. For children who have not established strong Spanish phonological awareness, before exposing them to extensive English instruction, it would be a good practice to provide them with Spanish instruction first and then emerge them to English instruction gradually. During the transitional period, bilingual education would be helpful since both Spanish and English literacy can be strengthened due to positive transfer in both directions. In addition to phonological awareness transfer, Durgunoglu, Nagy, and Hancin-Bhatt (1993) hypothesized that phonological awareness enables a child to see and reflect on the components of a language and this metalinguistic ability might be transferred. Besides positive transfer, it is possible that Spanish can have negative influence on English performance, which is usually manifested in errors that second language learners make when performing L2 tasks due to the influence of L1.

Fashola et al. (1996) conducted a dictation task to examine children's predicted errors in spelling. Forty words were chosen for the test. Nineteen Spanish-speaking and 14 English-speaking second and third graders and 19 Spanish-speaking and 20 English-speaking fifth and sixth graders participated in the study. The participants were divided into a younger group and an older group. The researchers analyzed the participants' spelling errors and generated eight categories of predicted errors in English spelling

influenced by Spanish. The eight categories were *cc* or *ck* spelled as *c*, *k*, or *qu* (e.g., soccer -> socer), *h* spelled as *j* (e.g., happy -> japi), *sk* spelled as *sc* or *squ* (e.g., asking -> asquing), *b* spelled as *v* (e.g., cable -> cavul), *all* spelled as *oll*, *ol*, *o*, or *al* (e.g., wall -> wal), *a* spelled as *ei*, *ell*, or *ey* (e.g., case -> ceis), *oo* spelled as *o* or *u* (e.g., took -> toke), and *ea* or *ee* spelled as *i* (e.g., beetle -> bitul). These predicted errors reflected Spanish phonological and orthographic rules. Another finding was that the younger group made significantly more predicted errors than the older group. Fashola et al. (1996) did not investigate why the older group outperformed the younger group. The bilingual students in both groups were described as having limited English proficiency as they lacked “basic communication skills” in English. In addition, the type of program that the bilingual students received was not clarified.

Sun-Alperin and Wang (2008) tested 26 native Spanish-speaking and 53 native English-speaking children in second and third grades on real-word and pseudoword spelling, focusing on the spelling of four English vowel sounds, /eɪ/ as in *maid*, /i/ as in *seed*, /u/ as in *food*, and /aɪ/ as in *bye*, that are spelled differently in Spanish and English. The findings confirmed the hypothesis that the Spanish-speaking children made significantly more errors than the English-speaking children and the errors were consistent with Spanish orthography. This shows evidence of L1-influenced transfer from Spanish to English.

Transfer in Spanish-speaking adult ESL learners. Two studies and one review article reported L1-influenced transfer of phonology from Spanish (L1) to English (L2). Carlisle (1997) examined how community college adult Spanish-speaking ESL learners modified English onsets by transcribing their recorded oral reading of 176 sentences.

Half of the sentences contained words with 3-member onsets as *spr* or *skr* and the other half contained words with 2-member onsets as *sp* or *sk*. The results showed that the participants more frequently inserted an epenthesis for 3-member onsets than for 2-member onsets when pronouncing the words. As a result, a word was re-syllabified in a manner that is not only incorrect according to normal English syllabification of these words, but is also consistent with Spanish syllabification rules.

Casas (2001) sampled 65 Spanish-speaking undergraduates who had learned English as a foreign language. Two staff members conducted individual interviews and asked the participants to freely talk about their life experiences. The tape-recorded data was later transcribed and analyzed. The findings showed vowel sound substitution such as /ɑ/ replacing /ə/ for *police*, /ɛ/ replacing /ə/ for *the*, /ɪ/ replacing /ə/ for *family*, /aɪ/ replacing /æ/ for *can*, /ɑ/ replacing /ʌ/ for *blood*, /ɛ/ replacing /eɪ/ for *afraid*, and so forth. There was also evidence of consonant substitution such as /β,ð,ɣ/ replacing /b,d,g/ when being next to vowels, /n/ replacing /ŋ/, /n/ replacing /m/, and so forth, as consistent with Spanish phonological rules.

Goldstein's (2001) review article provided information about how Spanish influences pronunciation in English, such as replacing /z/ with /s/, replacing /ʃ/ with /tʃ/, replacing /dʒ/ with /tʃ/, replacing lax vowel /ɪ/ with tense vowel /i/, and so forth, as consistent with the phonemes of Spanish. The L1-influenced transfer in phonology can affect Spanish-speaking ESL learners' English pronunciation and English spelling since they may make errors when mapping sounds to letters. The English word reading may also be influenced.

The research reviewed above on Spanish-speaking adult ESL learners' cross-linguistic transfer is limited to transfer in phonology as evidenced by pronunciation changes. Research on adult ESL learners' cross-linguistic transfer in letter-sound knowledge and orthographic knowledge is scarce. Furthermore, the research reviewed above did not report the participating adults' Spanish (L1) literacy skills. Given the close relationship between L1 and L2 literacy, accounting for learners' L1 literacy level is essential to helping researchers more accurately address specific aspects of difficulties and errors that adult ESL learners are likely to commit during the process of second language literacy acquisition.

Transfer in ESL learners from various language backgrounds. De Sousa, Greenop, and Fry (2010) recruited 30 Zulu-speaking English emergent Zulu-English bilingual second graders in South Africa. Zulu is a more orthographically transparent language than English. The participants were tested on letter knowledge of Zulu, syllable segmentation, onset-rime detection, and phoneme deletion only in Zulu, and real-word and non-word spelling in both English and Zulu. Test results revealed that both Zulu phonological processing skills and Zulu spelling skills were positively correlated with English spelling skills for both real words and pseudowords.

Figueredo (2006) reviewed 27 studies dated between 1970 and 2003, the majority of which investigated ESL K-12 students whose native languages were Arabic, Bahasa-Indonesia, Cantonese, Dutch, French, German, Japanese, Mandarin, Persian, Portuguese, Spanish, Vietnamese and Welsh. Sixteen of the total studies reviewed analyzed ESL learners' English spelling errors, three studies compared spelling skills of ESL learners from various L1 backgrounds, seven studies correlated ESL learners' L1 spelling skills

with English spelling skills, and one study used both descriptive and correlational analyses. In synthesizing the results of the reviewed studies, Figueredo proposed two schemas to describe the steps that ESL learners take in spelling English, namely *pronunciation of English phoneme* and *graphemic representation of phoneme*. For an ESL learner who has no or little reading and writing skills in L1, when spelling an English sound, if the pronunciation of the sound is consistent with that in the learner's L1, then there will be positive phonological transfer, otherwise there will be negative phonological transfer where the learner may replace the English sound with a L1 sound or drop the English sound. While writing the spelling of the sound down, due to the learner's low L1 literacy, no transfer occurs.

For an ESL learner who has well established reading and writing skills in L1, when spelling an English sound, if the pronunciation of the sound is consistent with that in the learner's L1, then there will be positive phonological transfer, otherwise there will be negative phonological transfer where the learner may replace the English sound with a L1 sound or drop the English sound. When positive phonological transfer occurs, if the grapheme representation of the English sound is also consistent with that in the learner's L1, there will be positive phoneme-grapheme correspondence (PGC) transfer which results in correct spelling. If the grapheme representation of the English sound is not consistent with that in the learner's L1, then there will be negative PGC transfer which results in incorrect spelling. When negative phonological transfer happens and when the learner replaces the English sound with a L1 sound, if the learner chooses a grapheme to represent the sound following L1 PGC rule, then there could be either positive or negative PGC transfer. However, the positive transfer is artificial since the L1 PGC rule

only coincidentally matches with the English PGC rule. If the learner drops the English sound and does not represent it with a grapheme, then there will be no transfer in spelling.

When taking English literacy development into consideration, Figueredo (2006) found from the review that when ESL learners continue to strengthen their English literacy skills, they tend to depend less on L1 knowledge and their English spellings become more conventional. Seeff-Gabriel (2003) reached a similar conclusion from the study with 22 eighth-grade ESL learners whose native languages are “African black languages (Northern or Southern Sotho, Setswana, Zulu, Xhosa).” Gabriel found that the ESL learners, at the early stage of English spelling acquisition, had great difficulties in spelling English vowel sounds that are not in their L1, but longer exposure to English instruction had positive effect on their spelling outcomes. The implication that can be drawn from the findings is that when English literacy skills increase, transfer in spelling from an ESL learner’s L1 decreases.

Summary. The literature review on cross-linguistic transfer indicates that phonological awareness, letter-sound knowledge, and orthographic knowledge and orthographic consistency are the major factors that influence spelling acquisition and development in both first language and second language. Knowledge of these factors shows cross-linguistic transfer from first language to second language and also from second language to first language, and transfer can be either positive or negative.

When looking at Spanish and English specifically, the literature review shows that phonological awareness in Spanish predicts Spanish-speaking ESL learners’ performance on English phonological awareness, word reading, and spelling tasks. Spanish sound-

letter knowledge influences ESL learners' English spelling performance. When transfer is positive, it facilitates English literacy acquisition. Otherwise when it is negative, errors will be produced when ESL learners apply rules of Spanish to English inappropriately.

Durgunoglu (2002) suggested educators use cross-linguistic transfer as a diagnostic tool. Some ESL learners are wrongly judged to have cognitive/developmental deficits. However, their weakness in L2 is due to limited L2 exposure and proficiency. With increased vocabulary and familiarity with the sounds of L2 and by building on L1 skills, ESL learners will gradually develop literacy skills in L2. For learners who have not developed strong L1 due to low home literacy or insufficient school support, they will experience greater difficulties when acquiring L2. However, with effective instruction and intervention, they can master literacy skills in both languages. In the following section I review empirical studies that are relevant to spelling intervention to help bilingual learners enhance English spelling skills.

Spelling Intervention for Bilingual Learners (Empirical Studies)

Training of bilingual children developing spelling skills in L2. The two studies reviewed below reported that combining sound-letter training with phonological awareness training would help English learning bilingual children develop spelling accuracy. Lesaux and Siegel (2003) conducted a longitudinal study from kindergarten to second grade. After taking attrition into account, by the end of second grade, there were 790 English-speaking and 188 ESL children stayed through the whole study period. The dominant languages that the ESL children spoke were Cantonese, Mandarin, Korean, Spanish, Persian, Polish, and Farsi. When the participants were at kindergarten, they were provided phonological awareness training three to four times a week for 20 minutes

during each training session. The training had an explicit emphasis on sound-letter correspondences as well as story and journal writing. Some participants continued to receive the training in Grade 1 due to being at risk for reading failure. Posttesting at the end of second grade indicated that the ESL normally developing children performed significantly better than the native English-speaking children on the Wide Range Achievement Test (WRAT) 3's spelling subtest, on real word spelling, and on pseudoword spelling. The learning disabled children in both groups had similar performance. Lesaux and Siegel attributed the ESL children's better performance at the end of second grade to the advantage of bilingualism and the increased metalinguistic awareness in the process of acquiring the second language. The results also implied that ESL children developed English literacy skills in a similar way as the native English-speaking children.

Stuart (1999) divided 112 five-years-old children from six classes into two conditions: experimental and control. The majority of the participants were Sylheti speakers. Since the classroom teachers chose one condition based on their interests, the grouping was not random and the two groups contained uneven number of participants. The experimental group received phoneme awareness and phonics instruction and the control group took a holistic approach of reading books and learning letter names and sounds. The intervention had the duration of 12 weeks. One hour was dedicated each day to reading and writing, centered around either condition. The immediate posttest results showed that the experimental group made significantly greater gains in reading and writing than the control group. When both groups were administered the same tests again one year later, the intervention groups still significantly outperformed the control group

on phoneme awareness, phonics knowledge, and standardized reading and spelling tests. The implication that can be drawn from the study is that teaching phoneme segmentation and blending skills and letter-sound/sound-letter correspondences accelerates ESL learners' reading and spelling skills and can have a long-term positive effect.

Training of bilingual adults developing spelling skills in L2. Spelling training studies with bilingual adults are scarce. Jones (1996) conducted a qualitative study on phonics and spelling instruction in an intermediate-level adult ESL literacy class where the Mexican immigrant workers had limited L1 and L2 literacy. During the intervention, sound-letter correspondences of vowels and doubling final consonants were taught. Three steps were taken in the instructional process. Sound-letter relationships and basic rules for English spelling were taught in the first step. Irregular verb tenses were emphasized in the second step. Guided compositions were practiced in the third step. Portfolio analysis was conducted to examine participants' progress in the ability to spell and compose. The findings suggested that incorporating phonics instruction helps adult ESL learners develop spelling skills.

Summary. The empirical studies reviewed in this section confirmed that explicitly and systematically teaching phonological awareness, alphabetic principles, and sound-letter correspondences are critical for a successful spelling instructional program for ESL learners. It is also pertinent to help ESL learners understand the importance of spelling. There are several limitations found in the intervention studies reviewed above. Most studies used phonemic awareness tasks and very few looked at syllable and rhyme awareness. Since English is an inconsistent orthography, both large and small sized language units play important roles in spelling development (see Ziegler & Goswami,

2005). A comprehensive spelling instructional program might better take language units of all sizes into consideration. None of the studies had used experimental design with random assignments, which will provide more generalizable interpretations, and none of the studies had examined the transfer of spelling skills to reading and writing after intervention.

The intervention studies reviewed so far had different range of training periods. Participants worked independently, in pairs, in small groups, or as a whole class. Teaching materials also varied among the studies, using either commercial or teacher-created curriculum. Thus, there is no agreement on which curriculum, teaching methods, program duration, and assessments are more effective.

Ehri et al. (2001) and Schuele and Boudreau (2008) conducted comprehensive reviews of spelling intervention studies and suggested that phonological awareness intervention can be more effective when focusing on just a few phonological awareness skills rather than many and when having small groups of learners instead of individual lessons. The studies reviewed had program duration of seven to twelve weeks with three to five sessions per week, and 15 to 30 minutes per session. But at-risk learners may need longer and more intensive training than regular readers. There are two important factors which could influence training outcomes: (1) tasks implemented (e.g., rhyme, phoneme blending, phoneme segmentation), and (2) stimuli created (e.g., number of syllables, number of phonemes). It is noteworthy that spelling intervention research with bilinguals, especially bilingual adults, is very limited. More intervention research is needed to provide insights how to effectively help adult ESL learners develop English literacy skills.

In the following section I briefly review literature on bilingualism and bilingual education in the United States. Bilingual education is contrary to English only education in that instruction incorporates bilingual learners' L1 and L2. The spelling intervention studies reviewed in the previous section did not consider learners' L1, which is a missing point. Literature on cross-linguistic transfer makes clear that bilingual learners' L1 plays an important role in L2 literacy acquisition. Reviewing bilingual education studies helped me gain a better understanding of how to incorporate L1 into L2 literacy instruction and how to balance the two languages to maximize the benefits to bilingual learners.

Bilingualism and Bilingual Education

Bilingualism. Romaine (1995) reviewed literature on the definition of bilingualism and found different views toward bilingualism. One view considered bilingualism as “native-like control of two languages” (p. 11). Another specified that bilingualism began when L1 learners can produce meaningful utterances in L2. A third view considered bilingualism as the entire process of second language acquisition.

Baker (2006) listed eight dimensions of bilingualism: (a) Bilinguals have different strengths in L1 and L2: some are more productive in speaking and writing, and some are more receptive in reading; (b) bilinguals use L1 and L2 in different circumstances, for example, home and school, and for different purposes; (c) bilinguals often have unequal linguistic and literacy skills in L1 and L2 and one language is dominant; (d) bilinguals start to learn L2 at different ages; (e) bilinguals experience different phases of development in L2 acquisition; (f) bilinguals, especially those in ESL environments, are likely to be bicultural; (g) bilinguals in ESL environments can experience different contexts of L2 acquisition: the mainstream policies may require them to focus on L2 only

or may encourage them to keep using their mother tongue; and (h) some people choose to be bilinguals out of their own motivation and there is no pressure for them to learn L2. But some people, especially immigrants, have to learn L2 in order to function properly in the mainstream society. Romaine (1995) stated, “Bilingualism has often been defined and described in terms of categories, scales and dichotomies” (p. 11). One important category of dichotomies is discussed below.

Simultaneous vs. sequential bilingualism. Baker (2006) referred to the phenomenon of two languages being learned simultaneously from birth as simultaneous bilingualism, and referred to a second language being learned after about three years of age as sequential bilingualism. Romaine (1995) framed a simultaneous bilingualism phenomenon as “one-person-one-language method” (p. 193). In such a situation, a child’s parents have different native languages, but each has certain level of literacy in the other’s language. The parents speak their own native languages to the child from birth. But since one parent’s native language is the socially dominant language, the child is likely to understand both languages but speak fluently only the dominant language.

Ledesma and Morris (2005) further investigated how five- to seven-year-old Filipino-English simultaneous bilingual boys used two languages in different contexts. Two questionnaires were sent to the children’s parents at a one-year interval. Analysis of the responses revealed that at the beginning of kindergarten, the simultaneous bilinguals preferred to use Filipino in social settings such as during informal conversations, but preferred English in media (while watching television or listening to radio). In formal settings such as school, both languages were fairly evenly used. By first grade, the boys started to prefer to use English in all contexts. When comparing the children’s social

economic status (SES), data showed that children with higher SES tended to use more English in social and media contexts. Ledesma and Morris attributed this finding to Filipino social stratification, wherein English was considered an elite language. The study findings indicate that sociocultural and social economic factors can affect simultaneous bilinguals' language preference. But since this study did not include girls, it is not clear if there will be gender differences in language preference in different contexts.

According to the definition of sequential bilingualism, most ESL and EFL (English as a Foreign Language) learners are sequential bilinguals. Langdon (1989) discussed factors that can influence sequential bilinguals' second language acquisition, namely exposure to the second language, years of schooling, type of instruction received, first language usage, peer comparisons, and developmental factors. Jia, Kohnert, Collado, and Aquino-Garcia (2006) stated two essential features of sequential bilingualism. The first is that the individual experiences of sequential bilinguals interact with general cognitive processes. The second is that the dynamic interaction of learners' L1 and L2 can have either positive or negative results. The two languages also compete for processing resources.

Brenneman, Morris, and Israelian (2007) recruited 96 sequential bilingual Latino students in second, third, or fourth grade. Responses from the questionnaire given to the parents showed that the students preferred to use English for media and communication outside the family. Such preference correlated with better reading skills in English. It is indicative that in ESL environments, English may eventually become the dominant language for sequential bilinguals. However, in EFL environments, the dominant

language can always be the mother tongue. Thus, sequential bilingualism may show different patterns in different cultural circumstances.

Krashen (2002) stated the importance of L1 in L2 literacy acquisition:

There is very good reason to believe that learning to read in the primary language is a shortcut to reading in the second language. The argument in favor of this consists of three stages:

1. we learn to read by reading, by understanding what is on the page;
2. it is easier to understand text in a language you already know;
3. once you can read, you can read; reading ability transfers across languages. (p. 143)

Brief review of bilingual education in the United States. Petrovic (2010)

provided the definition of bilingual education as “the use of both students’ native language and English as languages of instruction for content area instruction” (p. 7).

Zimmerman (2010) discussed that bilingual education has become the center of the debate between those who support English Only and those who do not. The English Only Movement emerged in the early 1980s. Proponents of the movement argued that English Only protects the nation from losing the English language, and consequently promotes immigrants’ assimilation into American culture so as to maintain the national identity. Opponents of English Only argued that the idea of keeping a national identity is against the demographic principle, “the spirit of tolerance and diversity” (p. 14) and immigrants’ civil rights. English Only imposes political and economic power privileges over minority groups. In the field of education, opponents of English Only generally support bilingual education, which they believe will not only enhance a child’s ability to learn English, but

more importantly help children to “develop a strong, individual identity upon which to build their collective identity” (p. 17).

Wright (2006) introduced five bilingual models, which are *transitional bilingual education (TBE) programs*, *developmental bilingual education (DBE) programs*, *dual language programs*, *bilingual immersion programs*, and *heritage language programs*.

TBE typically spans from grades K to three. The goal of TBE programs is to quickly transit ELLs to all-English instruction in mainstream classrooms within two to three years. But since only a small number of students can learn English as the second language that fast, as a result many end up being pushed into mainstream classrooms before they are ready. In a typical TBE program, ELLs receive ESL instruction 30 to 60 minutes daily and content-area instruction initially about 90% in L1 and 10% through sheltered English instruction, but L1 instruction decreases very fast.

DBE typically spans from grades K to six. The goal of DBE programs is to help ELLs meet grade-level standards as their English-speaking peers and at the same time promote biculturalism and biliteracy. In a typical DBE program, ELLs receive ESL instruction 30 to 60 minutes a day and content-area instruction initially about 90% in L1 and 10% through sheltered English instruction. What makes DBE different from TBE is that in DBE instructions in both languages continue till the end of the program even after the students have attained English proficiency (both language and literacy).

Dual language programs typically span from grades K to six. The goal of dual language programs is to help students meet grade-level standards and at the same time promote cultural pluralism, biliteracy, and effective cross-cultural communication. The target population is ELLs who speak the same L1 and English-speaking children who

want to learn that L1. In a typical dual language program, ELLs receive content-area instruction either 50% in L1 and 50% in English or 90% in L1 and 10% in English, but as students move up in grade level, instruction will even out to 50/50.

Bilingual immersion programs can span from grades K to eight. The goal of bilingual immersion programs is to help English speakers become bilingual and biliterate. The target population is English-speaking children. In a typical bilingual immersion program, instruction begins in the non-English language that the students want to learn. All students receive content-area instruction initially 90% to 100% in the non-English language, but after one or two years, instruction gradually evens out to 50/50.

Heritage language programs can span from pre-K to grade 12. The goal of heritage language programs is to help students meet grade-level standards and at the same time strengthen linguistic knowledge in heritage language and advance cross-cultural communication skills. The target population is heritage language speakers (ELLs or non-ELLs). In a typical heritage language program, the heritage language is taught as a separate subject between one and five or more hours per week. Sometimes out-of-school classes and foreign language courses designed at the college/university level are also provided.

A number of empirical studies have reported the advantages of bilingual education over English Only in ELL children's literacy development. Durán, Roseth and Hoffman (2009) conducted a longitudinal (spanning three years) and experimental study with 31 Spanish-speaking preschoolers who were randomly assigned to English-only instruction or transitional bilingual instruction. At the end of the first year of intervention during which Spanish was the main language of instruction for the bilingual education

group, children in the bilingual group made significantly more progress on both Spanish oral vocabulary and word identification skills. They also performed as well as their peers in the English-only group on the same measures in English, a result which indicates that bilingual education does not hinder children's ability to acquire literacy in English.

Tong, Irby, Lara-Alecio, and Mathes (2008) compared the effectiveness of a DBE program (using 70/30 Spanish/English model) to a late-exit TBE program (using 80/20 Spanish/English model) through a longitudinal English intervention study. 70/30 means 70% of the instruction is in Spanish and 30% in English. 80/20 means 80% of the instruction is in Spanish and 20% in English. The study duration spanned three years from kindergarten to second grade. The results indicated that the DBE program is superior to the TBE program in helping Spanish-speaking ELLs advance both English literacy skills (e.g. oral language, reading fluency and comprehension) and Spanish literacy skills (e.g. letter sound, reading comprehension).

Tazi (2011) randomly selected 83 Spanish-speaking ELLs who enrolled in a dual language program (50/50 model) to participate in a causal comparative study for two years (pre-kindergarten and kindergarten). Twenty-five children received bilingual instruction and 58 children received monolingual instruction. The study results indicated that bilingual education mitigated the negative impact of poverty and mother's low educational attainment on bilingual children's academic achievement. Bilingual children attained comparable achievement in English literacy skills to children who received English-only instruction. To be more detailed, bilingual education helped the ELL children gain greater metalinguistic skills, greater expressive language skills, greater rates of phonemic awareness, and greater rates of English language acquisition.

Sanders (2010) also conducted a causal comparative study to examine the effectiveness of dual language programs (90/10 model) on Spanish-speaking ELL third, fourth, and fifth graders. 90/10 means 90% of the instruction is in Spanish and 10% in English. A total number of 846 students who enrolled at nine elementary schools were recruited. One major finding of this study is that by fifth grade, students enrolled in dual language programs outperformed their peers enrolled in English only programs on TAKS (Texas Assessment of Knowledge and Skills) reading Test.

Rolstad, Mahoney, and Glass (2005) conducted a meta-analysis of 17 experimental studies (published between 1985 and 1995) that used comparative research methods to investigate bilingual education programs' effectiveness on ELLs. The meta-analysis revealed that bilingual education was consistently better than English only instruction in helping ELLs make academic achievement in both English and the native language. In addition, DBE programs were found to be more effective than TBE programs. Wright (2006) also reported that TBE programs are less effective than the other models of bilingual education on decreasing the academic achievement gap between ELLs and their English-speaking peers.

The above brief review of bilingual education in the United States provides evidence that bilingual education can facilitate young ELLs' biliteracy development, both in languages and school contents. However, little is known about the benefits of bilingual education to adult ELLs. More research on adult ELLs' literacy education is needed to fill in this gap. The following section describes the Facilitation Theory that was used as the theoretical framework to guide this study.

The Facilitation Theory

Rossell and Baker (1996) referred to Cummins' (1979) Developmental Interdependence Hypothesis and Threshold Hypothesis as two components of the "facilitation theory" (p. 26), which basically tells us that L1 competence facilitates the development of L2 competence, but bilingual learners may need to reach certain threshold levels of linguistic competence in both languages in order for bilingualism to positively influence cognitive growth. MacSwan and Rolstad's (2005) reconceptualized the Linguistic Interdependence Hypothesis as the Facilitation Theory, differentiating between the acquisition of linguistic knowledge and learning of school content.

Linguistic Interdependence Hypothesis. Cummins (1979) proposed that when L2 learning begins, bilingual learners' level of L1 competence interacts with intensive instruction in L2. High level of L1 competence facilitates the development of skills in L2 at no cost to L1 development. However, when bilingual learners' level of L1 competence is low, having L2 as the dominant language of instruction could impede the continued development of L1, which in turn could hinder the development of L2. The Linguistic Interdependence Hypothesis is based on the CUP model of bilingualism that is discussed below.

The SUP and the CUP models. Cummins (1980) discussed two models of bilingualism: the "Separate Underlying Proficiency" model (SUP) and the "Common Underlying Proficiency" model (CUP). The SUP model considers L1 proficiency and L2 proficiency as separate units (see Figure 4) and suggests that instruction in L1 will result in lower levels of L2 proficiency. Those who argue for English-only programs assume the validity of the SUP model.

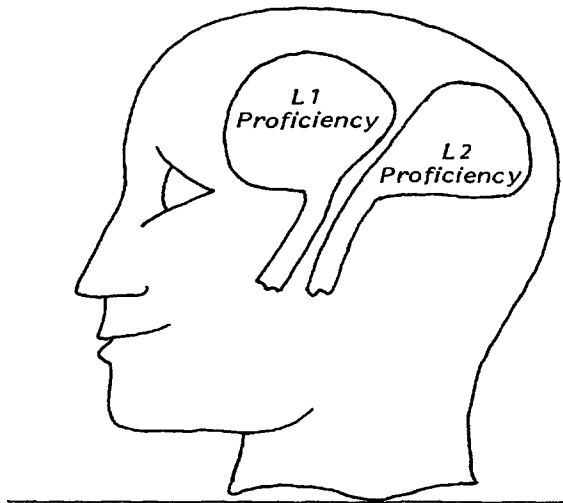


Figure 4. The Separate Underlying Proficiency (SUP) model of bilingualism from Cummins (1980, p. 91)

Cummins (1980) argued that the SUP model is problematic because it emphasizes the linguistic differences (e.g. phonology, syntax, lexicon) between L1 and L2 but ignores the common cognitive/academic proficiency that underlies successful literacy development in any language. Cummins rejected the SUP model in favor of the CUP model (see Figure 5).

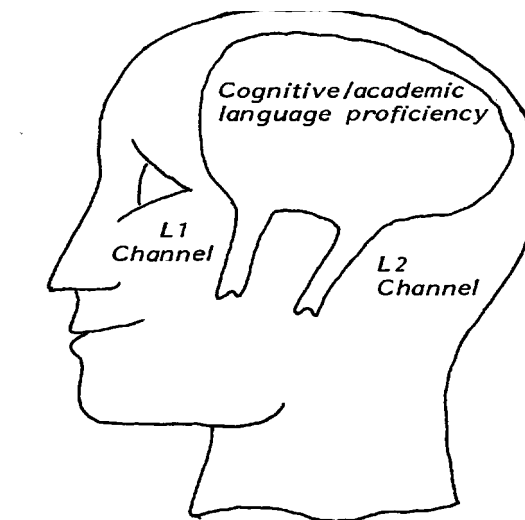


Figure 5. The Common Underlying Proficiency (CUP) model of bilingualism from Cummins (1980, p. 95)

The CUP model suggests that theoretically speaking, experience with either L1 or L2 can promote the underlying cognitive/academic literacy in both languages. As such, in the first years of ELLs' schooling in an English-speaking country, since the L2 channel is restricted, instruction should be through the L1 channel. Cummins (1980) reviewed studies on bilingual education and pointed out that the full benefit of bilingual education may not become prevalent until the later grades of elementary school.

Cummins also divided language proficiency into basic interpersonal communicative skills (BICS) and cognitive/academic language proficiency (CALP). BICS is acquired by normally developing people universally regardless of IQ or academic aptitude. CALP is strongly related to literacy skills. Figure 6 diagrams the distinction between BICS and CALP.

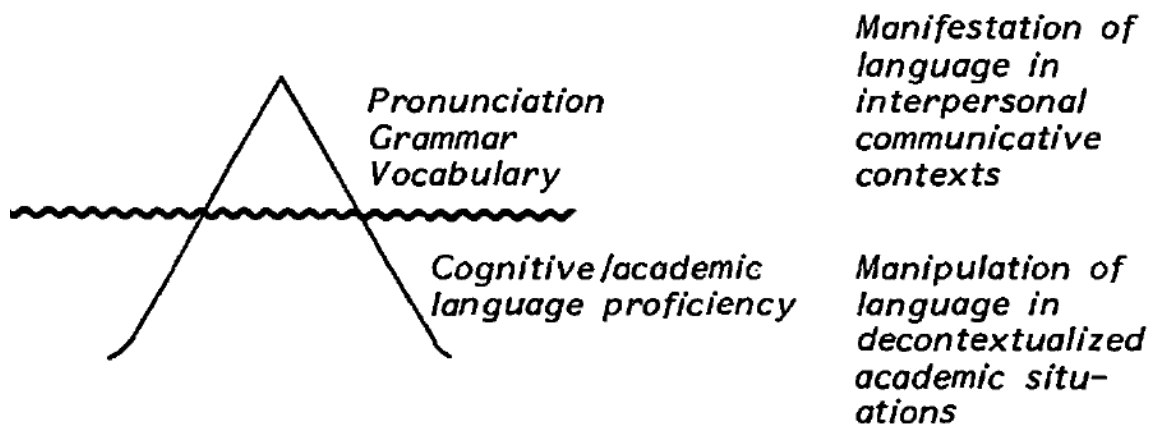


Figure 6. The 'iceberg' representation of language proficiency from Cummins (1980, p. 84)

Cummins (1980) speculated that a bilingual learner's L1 spelling and L2 spelling might be highly correlated if the learner has underlying spelling skills in each language. Cummins presented the interdependence of CALP across languages in Figure 7 and

hypothesized that CALP of L1 and L2 are interdependent and that previously developed CALP in L1 will predict future development of CALP in L2. In other words, despite the differences between L1 and L2 in terms of BICS, there is common underlying CALP that determines a bilingual learner's performance on cognitive/academic tasks (e.g. spelling) in both L1 and L2.

MacSwan and Rolstad (2005) distinguished school literacy and other aspects of academic knowledge from what Cummins (1980) called underlying proficiency in the CUP model. By doing so, higher levels of language proficiency will not be defined in terms of language use of the educated classes.

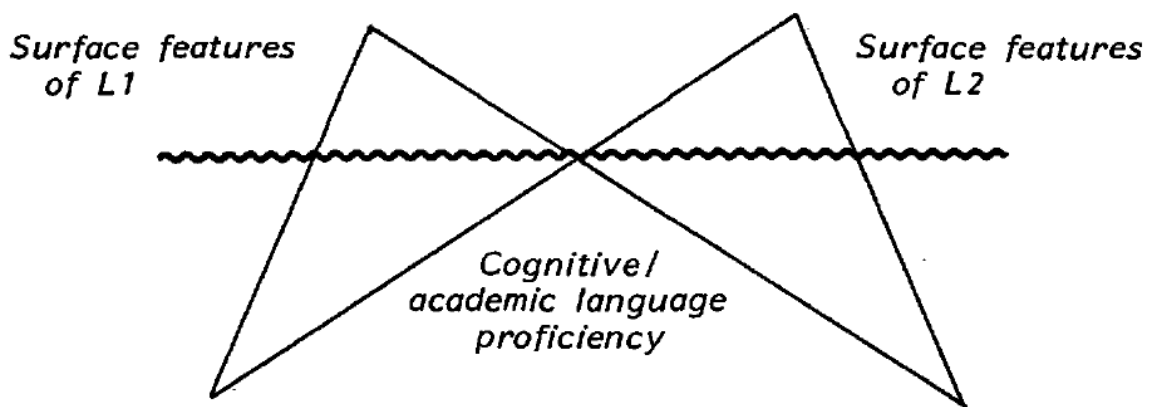


Figure 7. The ‘dual-iceberg’ representation of bilingual proficiency from Cummins (1980, p. 87).

Psychological Modularity and the Facilitation Effect. MacSwan and Rolstad (2005) used psychological modularity as a theoretical lens (see Figure 8 below) to explain the facilitation effect of bilingual education, focusing on transfer of subject matter knowledge (literacy and content knowledge) across languages. Modularity was characterized as “the standard assumption of researchers in cognitive neuroscience with research focused on the specific properties of discrete mental modules, their development, and their interactions with each other” (p. 229). The discrete mental

modules (also known as *modular cognitive systems*) such as *language*, *visual*, *numerical*, and *spatial-temporal* shown in Figure 8 are “domain specific, innately specified, hardwired, autonomous, and not assembled” (p. 230). Each mental module is common to all human societies and related to the central processes, which are largely responsible for general knowledge (especially school subject knowledge). Bilingual learners have access to general knowledge via their language system.

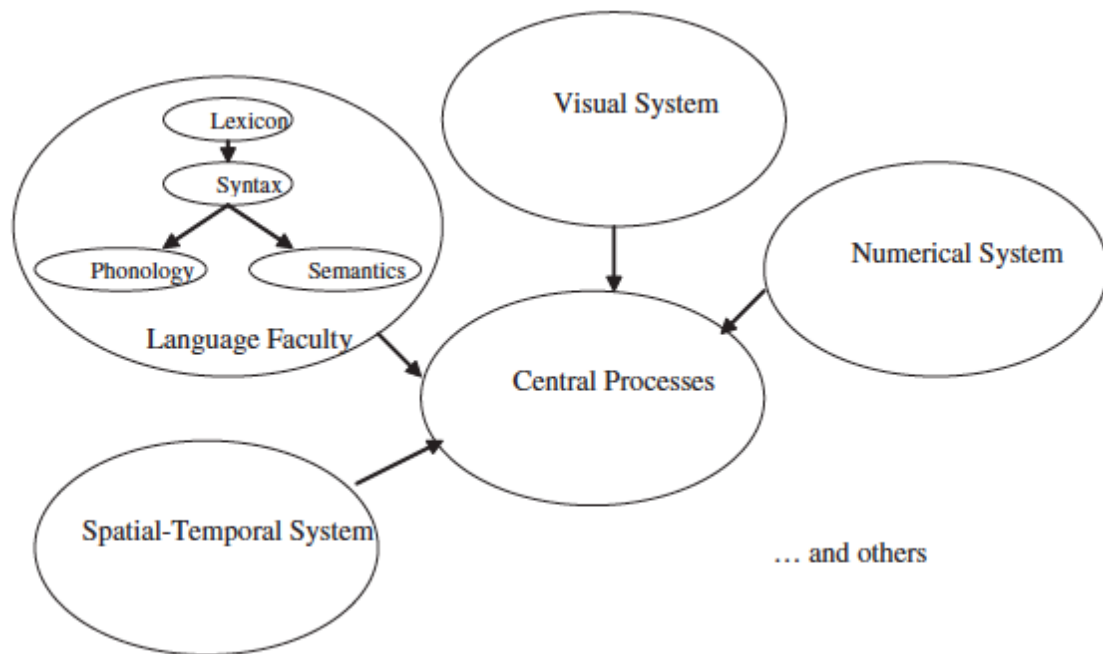


Figure 8. Psychological Modularity from MacSwan and Rolstad (2005, p. 232)

MacSwan and Rolstad (2005) reviewed four case studies, the findings of which revealed that people who have severely impaired language ability might possess normal cognitive abilities in other mental modules, and people who have normal language ability may be severely retarded in other mental modules. The study results indicate that discrete mental modules develop independently of one another, especially that linguistic ability is separate from other cognitive abilities. Based on psychological modularity and the

research review, MacSwan and Rolstad suggested that both languages of bilinguals have access to the same store of academic knowledge and transfer occurs as a “natural consequence of mental architecture” (p. 237), hence there is facilitation effect that learning in an L1 facilitate learning outcomes in an L2.

Cummins (1979) and MacSwan and Rolstad (2005) both argued that L1 skills are beneficial to academic development of L2. What MacSwan and Rolstad disagreed with Cummins is that they believe content knowledge and literacy should be treated as academic knowledge. By treating them as linguistic knowledge, Cummins implied that school language is developmentally superior to language used in other contexts.

The theoretical framework, namely the Facilitation Theory, provides a theoretical lens for cross-linguistic transfer. What can be learned from the framework is that in a bilingual setting, learning in one language facilitates learning outcomes in the other language. During the early stages of L2 acquisition/learning, instruction in L1 facilitates L2 acquisition/learning more effectively than instruction in L2 only. When thinking about the research questions in this study, what can be hypothesized based on this theoretical framework is that Spanish-speaking adult ESL learners’ Spanish (L1) spelling skills should be positively correlated with English (L2) spelling skills. When the spelling patterns of a vowel sound are the same in Spanish and English, applying a Spanish spelling rule will facilitate accuracy in English spelling, which results in positive transfer. This study will also further examine contexts when the spelling patterns are different and to what extent L1-influenced transfer may occur in these contexts. The theoretical framework does not affirm the role of English (L2) proficiency in the outcomes of English spelling or address if/how L1-influenced transfer happens from L1 to L2. This

study seeks to investigate whether L1-influenced transfer from Spanish to English could possibly happen and if it does, whether reaching a certain level of English proficiency may overcome the negative influence from Spanish (L1). By answering the research questions, the study aims to expand upon the understanding of the interaction between two languages as explained in the theoretical framework.

Discussion

The literature review confirms that phonological awareness, letter-sound knowledge, and orthographic knowledge and orthographic consistency play critical roles in English spelling acquisition and development. Thus, it is important to help ESL learners build these skills in order for them to gain spelling fluency and accuracy in English. In addition, cross-linguistic transfer is important to consider for spelling instruction. The review shows that certain L1 skills (e.g., knowledge of phonological awareness, letter-sound/sound-letter mappings, alphabetic principles, spelling) predict the corresponding skills in the L2 (Cárdenas-Hagan et al., 2007; Fashola et al., 1996; Lesaux, Koda et al., 2006; Lindsey et al., 2003; Riccio et al., 2001; Sun-Alperin & Wang, 2008). When considering Spanish as L1 and English as L2, due to the differences between Spanish and English orthographic and phonological systems, some sounds and letter-sound/sound-letter mapping rules transferred from Spanish may not conform to those in English. Hence, when looking at the phenomenon of transfer, both the positive and negative influences should be considered.

Based on the findings of empirical intervention studies and bilingual education studies, it appears that spelling deficits can be remediated with explicit and systematic training. For young bilingual children, teaching literacy skills in both languages would be

more effective than in English only. But it is not conclusive from the literature if the same applies to adult ESL learners.

There are three factors that could be taken into account while designing a spelling intervention program. First, it would be important to teach common spelling patterns that learners can use to make reasonable generalizations (Jones, 1996; Lesaux & Siegel, 2003; Stuart, 1999). Although English orthography is inconsistent, it still follows rules and patterns in sound-letter correspondences. If learners are scaffolded to investigate patterns on their own, they might gain a deeper understanding of English sound and orthography system. Second, Ziegler and Goswami (2005) reported that learners of English need to use encoding and decoding strategies at multiple grain sizes. Thus, it would be helpful to teach spelling at various grain sizes rather than only at phonemic level. For example, irregular words can be hard to teach at phonemic level, so teaching them at whole word or syllable/onset-rime level is more helpful.

Third, it would be important to let learners practice spelling in meaningful contexts such as in compositions (Jones, 1996; Lesaux & Siegel, 2003). Learning to spell individual words is only a small part of spelling instruction. The larger goal would be to help learners gain more reading and writing skills as a benefit of effective spelling instruction.

The limitations found from the literature are discussed below. They set directions for future research. One limitation is that research on cross-linguistic transfer in spelling skills is scarce. Among the few studies that focused on spelling, there was no comprehensive investigation on the manifestation of L1-influenced transfer in all English vowel sounds. Moreover, the phenomenon of cross-linguistic transfer has not been

sufficiently considered in intervention research. When working with bilingual learners, it is almost unavoidable to look at both learners' L1 and L2 and see how they interact with one another. Letting ESL learners be aware of transfer will help them gain insights into both languages.

Another limitation is that spelling intervention studies with adults, especially adult ESL learners are rare compared to those with children. Research findings from children cannot be fully applied to adults without careful examination because the two populations have unique differences such as age of acquisition, educational and professional background, maturity, life styles, learning styles, and so on. More research on adults will make contributions to the current theoretical framework, research, and instructional practices.

The next chapter discusses about this study's method which aims to fill in the gap in the literature by investigating the L1-influenced transfer of Spanish-speaking adult ESL learners' spelling skills in all English vowel sounds. The goal is to make insightful implications for designing spelling intervention programs. Before starting the methods chapter, it would be helpful to elaborate on the study's conceptual framework which explains the key concepts and how they are going to be examined. Using the Linguistic Interdependence Hypothesis (Cummins, 1980) and the Facilitation Theory (MacSwan & Rolstad, 2005) as a theoretical lens, and following the empirical findings on cross-linguistic transfer, the study aims to find out more empirical evidence in adult ESL learners' cross-linguistic transfer in spelling skills from their native language to English. Following the program design for the adult ESL participants of the study, English proficiency is conceptualized as English language/literacy skills (e.g. speaking, listening,

reading, writing) that adult ESL learners need in order to function effectively at work and in life.

Cross-linguistic transfer in spelling is viewed as the phenomenon that can occur during L2 spelling process when the spelling outcomes are influenced by L1 spelling conventions. Transfer can have either positive or negative effect, which respectively produces correct L2 spellings or spelling errors. The study focuses on examining L1-influenced transfer from Spanish in spelling English vowel sounds. To examine L1-influenced transfer, a customized experimental spelling test was used that includes pseudowords only. Spelling pseudowords is considered a “standard way of assessing the psychological ‘strength’ of a particular sound–spelling relationship” (Houghton & Zorzi, 2003, p. 117) and using pseudowords can control for the possibility of “spelling words based on whole word knowledge” (Sun-Alperin & Wang, 2008, p. 938). More detailed explanations about the relationships among the key concepts are presented in the Method chapter below.

Chapter 3: Method

This chapter describes the research methods utilized in this study, including participant selection, testing instrument design, and procedures. All the methods elements were designed based on the purpose of the study and the research questions.

Role of the Researcher

As the researcher of this study, at the time when recruitment of participants started, I was not teaching at the community college where the participants were recruited and did not know any of the participants beforehand. My role was more of an objective viewer/outsider. All participants acted independently of me, the researcher. This study would not affect the participants' academic records in any way or make them lose any benefits, the participants knew that their participation was completely voluntary and they could withdraw from this study freely at any time without receiving any penalty, and participants' data were kept anonymous. Therefore, the participants felt no pressure in participation or performance during this study and the researcher's presence highly unlikely affected participants' performance on the spelling tests and answers to the questionnaires.

Participants

An a priori power analysis¹ indicated that 102 participants would be needed to attain 80% power for detecting a medium sized effect when employing the traditional .05

¹ An a priori power analysis was done using the G*Power computer program (Faul, Erdfelder, Buchner, & Lang, 2009) with power ($1 - \beta$) set at 0.8, α set at 0.05, and effect size set at medium 0.5 (Cohen, 1988). To answer research question 1 using a multiple regression procedure, a total sample size of 23 ESL participants is required. To answer research question 2a using an independent samples t test, a total sample size of 102 participants (including both native English speakers and ESL learners) is required. To answer research question 2c using a multiple regression procedure, a total sample size of 23 ESL participants is required.

criterion of statistical significance. The whole student body of ESL and GED (General Educational Development) classes was recruited in the spring semester of 2014 at a community college located in the South Atlantic region of the United States. During recruitment, all students who came to class agreed to participate in the study. Among them, 178 were adult ESL learners and 104 were GED students who were native English speakers in GED classes. The data for 49 ESL participants were excluded from analysis because these students were unavailable to take the posttest. The remaining 129 ESL participants who took both the pretest and posttest consisted of 54 beginning proficiency students, 39 intermediate proficiency students, and 36 advanced proficiency students.

The adult ESL participants were recruited from the community college's adult ESL program, which placed the students into varying levels of English classes (advanced, intermediate, beginning) based on their performance on the Comprehensive Adult Student Assessment Systems (CASAS)², which consists of standardized assessments that measure basic life skills for adults. The ESL subtest specifically measures English language and literacy skills adult ELLs need in order to function effectively at work and in daily life (CASAS, 2008). The reading portion of the ESL subtests has internal

² CASAS describes beginning proficiency as "Listening/Speaking: Functions with some difficulty in situations related to immediate needs; may have some simple oral communication abilities using basic learned phrases and sentences. Reading/Writing: Reads and writes letters and numbers and a limited number of basic sight words and simple phrases related to immediate needs. Can write basic personal information on simplified forms," intermediate proficiency as "Listening/Speaking: Can satisfy basic survival needs and limited social demands; can follow oral directions in familiar contexts. Has limited ability to understand on the telephone. Understands learned phrases easily and new phrases containing familiar vocabulary. Reading/Writing: Can read and interpret simplified and some authentic material on familiar subjects. Can write messages or notes related to basic needs. Can fill out basic medical forms and job applications," and advanced proficiency as "Listening/Speaking: Can satisfy most survival needs and social demands. Has some ability to understand and communicate on the telephone on familiar topics. Can participate in conversations on a variety of topics. Reading/Writing: Can read and interpret simplified and some non-simplified materials on familiar topics. Can interpret simple charts, graphs, and labels; interpret a payroll stub; and complete a simple order form; fill out medical information forms and job applications. Can write short personal notes and letters and make simple log entries."

consistency reliability ranging between .83 and .92. The listening part has parallel forms reliability ranging between .96 and .98. All adult ESL participants across the three proficiency levels were given the same standardized and experimental spelling tests to assess both of their Spanish and English spelling skills.

The native English-speaking participants were recruited from GED classes in the same community college as the adult ESL participants. I sought to match the ESL and native English-speaking participants as closely as possible in terms of educational background. Information from the background questionnaires indicated that both the ESL group ($M = 1.84$, $SD = 1.098$) and the native English-speaking group ($M = 1.51$, $SD = .715$) had an average highest education level of less than a high school diploma³. The purpose of recruiting native English speakers was to compare the vowel sound spelling errors on the experimental spelling test (pseudowords) to those made by the adult ESL participants. If the adult ESL participants made statistically significantly more errors reflecting Spanish spelling patterns as compared to the native English speakers, it may be inferred that L1-influenced transfer from Spanish to English occurred.

Measures

The Spanish-speaking adult ESL participants were given both English and Spanish spelling tests. The native English-speaking participants were given only the English experimental spelling test. I asked an English-Spanish bilingual assistant to audio record all the English and Spanish spelling tests. The bilingual assistant was born to a native English-speaking father and native Spanish-speaking mother and has been living in Maryland since birth. She was raised speaking both languages and she self-rated her

³ Choices for highest level of education include: (1) Less than High School, (2) High School/GED, (3) Some College, (4) 2-Year College Degree (Associates), (5) 4-Year College Degree (BA, BS), (6) Master's Degree, (7) Doctoral Degree, and (8) Professional Degree (MD, JD).

Spanish proficiency as native-like. Her undergraduate major was English linguistics and she completed Master's degree in TESOL. Audio recordings followed the exact instructions in test manuals. Before using the recordings to collect data, the assistant and I examined all recordings carefully to ensure that the voice was clear, the pronunciation was accurate, and the words and sentences were read correctly. I played the recorded Spanish spelling test items to three classes of adult ESL learners (beginning, intermediate, and advanced) before data collection and the ESL learners all confirmed that the recording was clear and the speaker's pronunciation sounded native to them.

English spelling. The Woodcock-Johnson III Normative Update (NU) Tests of Achievement (WJ III), Forms A spelling subtest was used as the standardized English spelling measure for the adult ESL participants. This test has a split-half reliability of .90. The spelling subtest contains 32 real word test items. During the test, each target word was read once, followed by a sentence containing the word, and then the word was repeated again (e.g., *time...It is time to go to school...time*). The participants were given ten seconds to write down each target word they heard. The participants took the test in their classrooms and the audio was played from a single recorder. I ensured that the audio sound was clear and the volume was comfortable to the participants.

Other than the standardized measure, an experimental spelling test in English was administered to all participants (both ESL and native English speakers). The first set of the test items comes from the WJ III Forms A "spelling of sounds" subtest which includes pseudowords only and has a reliability of .76 as calculated using Rasch analysis procedures. The second set comes from the English pseudoword spelling test used in

Sun-Alperin and Wang (2008)⁴ (see Appendix B). I created the third set of target words which consists of three pseudoword (*tould*, *zull*, and *fook*) containing the short /ʊ/ sound, which is not included in the first two sets. There are 54 pseudowords in total for the participants to spell. During the experimental spelling test recording, each target word was read aloud twice and the participants were given ten seconds to spell the word they heard in writing. The participants took the test in their classrooms and the audio was played from a single recorder. I ensured that the audio sound was clear and the volume was comfortable to the participants.

Spanish spelling. The Woodcock-Muñoz: Language Survey spelling subtest was used as the standardized Spanish spelling measure for the adult ESL participants. This test has a split-half reliability of .912. This Language survey contains individually administered tests to assess cognitive-academic language proficiency in oral language, reading, and writing. The tests' reliability ranges between .87 and .93. In the "dictation" subtest, there are 20 real words test items. The administration of the Spanish spelling test was the same as that of the standardized English spelling test as described in the previous section.

Scoring and coding. For the standardized spelling tests of English and Spanish, an incorrect response or no response received a score of 0. A correct response received a score of 1. The bilingual assistant and I scored all tests independently and compared scores afterwards. Since scoring was based on the answer key provided by the test manuals, as long as a spelling was written legibly, there was no disagreement between the scorers. When a spelling was illegible, a score of 0 was given to that item.

⁴ Reliability is not reported for this set of words.

For the experimental spelling test in English, the bilingual assistant and I first took a sample of the participants' spellings and scored them in a spreadsheet independently. In addition, spelling errors were documented for future analysis. After agreement was reached on the scoring of sample spellings, the bilingual assistant and I scored the remaining spellings independently. After scoring was complete, an inter-rater reliability analysis using the Kappa statistic and Cronbach's alpha was performed. The results revealed strong consistency between the bilingual assistant and I, as determined by Cohen's kappa coefficient ($\kappa = .855$, 95% CI [.847, .863], $p < .001$), and also a high level of inter-rater reliability, as determined by a Cronbach's alpha of 0.922. Differences in scoring and documentation of error patterns were resolved via extensive discussion until agreement was reached or the item was excluded from analysis.

After scoring and error documentations were complete, vowel sound spelling errors were coded to identify possible instances of L1-influenced transfer. For this stage of analysis, I recruited a second assistant who is a native Spanish speaker and highly proficient in English. The second assistant was a Ph.D. candidate in Latin American Literature attending a large-sized university located in the South Atlantic region of the United States. The first bilingual assistant and I met with the second assistant to introduce the research and to ensure that he understood clearly about the coding task. To avoid or minimize the intimidation that the two bilingual assistants might feel when working with me, I assured them that disagreement within the team was perfectly normal. They were also told that when there was unsolved disagreement after coding, an expert would be invited to provide consultation. The unsolvable disagreement after the expert's consultation would be excluded from data analysis.

Before coding started, the two assistants and I finalized two tables (see Appendix D) based on extensive literature review (see Table 1, Figure 9, and descriptions of empirical studies below) and knowledge from the second research assistant who is a native Spanish-speaker. During the coding process, additional spelling patterns were added according to the coding paradigm based on the participants' data. In Appendix D, the first table reflects possible occurrence of L1-influenced transfer in spelling from Spanish to English. For example, if the target word is *vime*, the response *vaym* might indicate that L1-influenced transfer possibly happens as the digraph *ay* is a typical spelling in Spanish for the sound /aɪ/ but very rare in English. The second table in Appendix D presents vowel sound spellings that can be the same in Spanish and English and thus would not necessarily be evidence of L1-influenced transfer. I also tested the second research assistant on the experimental English pseudowords spelling test and instructed the assistant to spell using his Spanish phonological/orthographic knowledge only.

Table 1

The vowels of Spanish and American English compared from Hualde (2005, p. 126)

		Spanish	English
High vowels	Front	/i/: short, nondiphthongal	Contrast between two phonemes /i/ (beat): long, slightly diphthongal and /ɪ/ (bit): short, lower, more centralized
	Back	/u/: short, nondiphthongal and more retracted than Eng. /u/	Contrast between two phonemes /u/ (food): long, slightly diphthongal and /ʊ/ (book): short, lower Both often more centralized than Sp. /u/

Mid vowels	Front	/e/: pure vowel, contrasts with diphthong /ei/- pena vs peina. Slightly higher or lower allophones depending on the context.	Contrast between two phonemes /e/ (bait, made): higher, realized as a diphthongizing vowel [ei], with a shorter offglide than the Sp. diphthong /ei/ [ei]. /ɛ/ (bet): lower, shorter, nondiphthongal
	Back	/o/: pure vowel, contrasts with diphthong /ou/ - Sosa vs Sousa. Slightly higher and lower allophones depending on the context.	Contrast between two/three phonemes /o/ (boat, go): higher, often realized as a diphthongizing vowel [oʊ], with a shorter offglide than Sp. diphthong /ou/ [ou]. /ɔ/ (dog, dawn): lower, shorter. In many North American varieties neutralized with /ɑ/.
Low vowels		/a/: central	/ʌ/ (cut): central, unrounded. Contrast between two phonemes /æ/ (mad): front /ɑ/ (pod): back

His spellings provided an insightful view of the patterns native Spanish-speakers are likely to use when trying to spell English vowel sounds that do not exist in Spanish.

Table 1 above shows a comparison of vowels of Spanish and American English and

Figure 9 below graphically depicts Spanish and English single vowel phonemes.

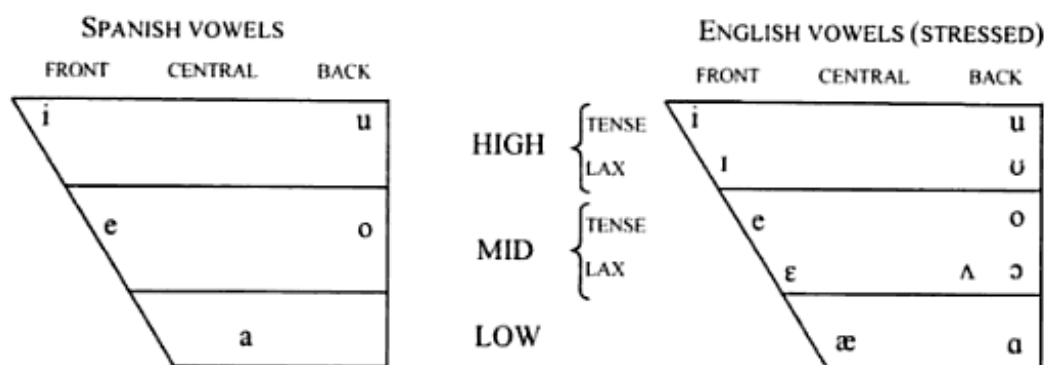


Figure 9. Spanish and English vowel phonemes from Whitley (2002, p. 28)

Coe (2001) specified that English /i/ and /ɪ/ correspond to Spanish /i/. English /a/, /æ/, and /ʌ/ correspond to Spanish /a/. English /ɑ/ and /ɔ/ correspond to Spanish /o/. English /u/ and /ʊ/ correspond to Spanish /u/. As for diphthongs, /aʊ/ and /ɔɪ/ are pronounced similarly in English and Spanish. Sun-Alperin and Wang (2008) examined four English vowel phonemes (/eɪ/, /i/, /u/, /aɪ/) that are pronounced similarly but spelled differently in Spanish. The four sounds could respectively be represented orthographically using *ei/ey*, *i*, *u*, and *ai/ay*. The findings showed that the native Spanish-speaking children spelled these English vowels according to Spanish orthographic rules that indicated the possible occurrence of L1-influenced transfer.

Whitley (2002) specifically stated that for Spanish-speaking ESL learners, the contrasts between English “beat” and “bit,” “pool” and “pull,” “boat” and “bought,” and “cat,” “cot,” and “cut” could be very difficult because Spanish does not have a tense/lax contrast and all Spanish vowels tend to be tense. Fashola et al. (1996) detected possible occurrence of L1-influenced transfer in Spanish-speaking children when spelling the English vowel sounds /ɔ/ as *o*, /eɪ/ as *ei/ey*, /ʊ/ as *u*, and /i/ as *i*. Cronnell (1985) examined the influence of Spanish spelling rules on Mexican-American children’s

English vowel spelling errors such that they spelled the English vowel sounds /i/ spelled as *i*, /a/ as *a*, and /eɪ/ as *e*. Rolla San Francisco, Mo, Carlo, August, and Snow (2006) found out that bilingual children receiving Spanish literacy instruction exhibited Spanish-influenced spelling such that they spelled the English vowel sounds /eɪ/ as *ei/ey*, and /aɪ/ as *ai/ay*.

Howard et al. (2006) introduced an English spelling assessment tool developed by the researchers, namely English Developmental Contrastive Spelling Test (EDCST). The test was a group-administered dictation assessment that was developed for a longitudinal study of Spanish-English bilingual students' spelling from Grade 2 to Grade 5, and measured both the students' spelling progress over time and possible cross-linguistic transfer in spelling from Spanish to English. The real-word subtest has 40 items, while the pseudoword subtest has 20 items. Howard, Green, and Arteagoitia (2012) conducted a longitudinal study of 220 Spanish-English bilingual students in four two-way immersion (TWI) programs over a three-year period, from Grade 2 to Grade 4. The real-word subtest of EDCST was administered to the participants and the results indicated that the occurrence of cross-linguistic spelling errors was highest in Grade 2, considerably lower in Grade 3, and vastly nonexistent in Grade 4. The conclusion drawn from the findings was that cross-linguistic transfer in spelling, manifested in L1-influenced spelling errors, typically resolves itself over a period of time without needing specific intervention.

Table 2 shows the coding scheme for the experimental spelling test in English that contains only pseudowords. The scheme is adapted from Sun-Alperin and Wang (2008) with modifications. Code 1 represents vowel sound spellings that are incorrect in both English and Spanish. Code 2 represents vowel sound spellings that are incorrect in

English but acceptable in Spanish, which might possibly indicate L1-influenced transfer from Spanish to English. Code 3 represents correct spelling responses.

Table 2

Coding Scheme

Codes	Description	Target Word	Response
1	Incorrect in both English and Spanish	koos	kos
2	Spanish-influenced spelling (acceptable in Spanish but not in English)	Zie	zay
3	Correct response to the target word (acceptable spelling in English)	Pab	pab

The two assistants and I coded spelling errors based on Appendix D. The second research assistant could not participate fully in the coding of spelling errors shortly after coding started due to a change in his availability. The first research assistant and I coded all errors and compared results until agreement was reached and unsolved disagreements were documented. Then I sent the coding results to the second research assistant and met with him to discuss. The second research assistant confirmed all coding that was agreed upon between the first research assistant and me, and made suggestions on the areas of disagreement. After talking with the second research assistant, I forwarded the suggestions to the first research assistant who agreed with some of the suggestions but not all.

I documented the disagreement and consulted with a linguist who is a professor at the linguistics department in a large-sized university located at the South Atlantic region of United States and who has expertise in English phonology. The linguistics professor

provided very valuable insight into English vowel sound spelling. Using his insight, it was discovered that many spelling patterns previously been identified as L1-influenced transfer or L1-influenced spelling errors were actually acceptable spelling patterns in English and should not be counted as errors. The first research assistant and I met several times to develop modified coding guidelines.

The first table in Appendix E displays spelling patterns considered correct for each target sound. All of these patterns except *ye* in the word *bye* occur within the 5000 highest-frequency Contemporary American English words (Davies, 2015). Since the goal of the study is to focus on how Spanish-speaking adult ESL learners spell English vowel sounds, spellings were coded “correct” regardless of post-vocalic context, which is defined as speech sound(s) occurring immediately after a vowel (e.g. *oo* for the sound /ʌ/ as in the word *flood* vs. *oo* for the sound /u/ as in the word *boot*). It was not assumed that non-native participants at this level of English proficiency would have knowledge of the salience of post-vocalic context for vowel spellings in English. Thus, as long as a given vowel spelling produced by a participant is an acceptable spelling for a high-frequency word with that vowel sound in English, the pattern was considered correct.

The second table in Appendix E displays spelling patterns considered exceptional or incorrect. Such patterns include the following: 1) /r/-colored vowel patterns such as *er*, *ir*, *ur*, *ar*, *wor* or digraphs occurring before /r/ such as *ear*, *eer*, *ier*, *eir*, and *oir* as the pronunciations are complicated and vary substantially by dialect; and 2) patterns that are found in loan words or are found in very few representations of certain sounds. Some of these spellings, such as the spelling of *au* for the sound /aʊ/, the spelling of *e* for the sound /eɪ/, and spellings of *ae*/*ai*/*ay* for the sound /aɪ/, were considered possible instances

of L1-influenced transfer. Although *au* in the word *umlaut* produces the sound /*au*/, *e* in the word *ballet* produces the sound /*e*/, *ai* in the word *aisle* produces the sound /*ai*/, and *ay* in the word *bayou* produces the sound /*ai*/, these words either have very low frequency in English according to Davies' (2015) word frequency list or are very rare for the patterns to produce the specific sounds. These patterns were counted as possible occurrences of L1-influenced transfer as they are prominent Spanish spellings of these vowel sounds.

Procedure

At the beginning of the study, consent forms were distributed to all potential participants, whose approval of participation was obtained. The participants were also asked to fill out a background questionnaire containing questions about their personal demographic and language learning information (see Appendix A and B). All participants took the English spelling tests first. The adult ESL participants took both standardized and experimental English spelling tests. The native English-speaking participants took the experimental English spelling test only. One week later the adult ESL participants took the standardized Spanish spelling test. In order to prevent collaboration among the participants during the tests (such as cheating), I was present during testing to help the classroom teacher monitor and ensure that appropriate testing procedures were implemented.

Chapter 4: Results

Cronbach's alpha was used to measure internal consistency of test items in the experimental English spelling test. The overall test had a high level of internal consistency, as determined by a Cronbach's alpha of 0.83. The items from the standardized test, from the Sun-Alperin and Wang's (2008) study, and from the items created for this study yielded Cronbach's alpha values of 0.71, 0.77, and 0.02 respectively. Because the internal consistency of the three items (*fook*, *tould*, *zull*) created for the study was very low, the items were excluded from data analysis.

Research Question 1

The first research question examines the nature of the relationship between Spanish-speaking adult ESL learners' English spelling skills and two variables as potential predictors: Spanish spelling skills and English proficiency. To answer this question, a multiple linear regression procedure was used to test how well English proficiency and Spanish spelling skills predicted Spanish-speaking ESL participants' English spelling skills. The assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were met, but there were unusual points (two outliers). Since the outliers were neither due to data entry error nor measurement error, they were most likely genuinely unusual data points. A robust regression procedure (MM estimation) was used to provide resistant (stable) results in the presence of outliers (see Table 3). The results of the robust regression indicated that the two predictors explained 45.8% of the variance ($R^2 = .458$). After controlling for Spanish spelling skills, there was a statistically significant difference in English spelling scores between the beginning and intermediate level participants, and between the beginning and advanced

level participants. ESL participants who were at the intermediate level were predicted to score slightly higher than the advanced level participants on English spelling, but the difference was not statistically significant (see Table 4). Nevertheless, after controlling for English proficiency, each one-point increase in the Spanish spelling score predicted 0.58-point increase in the English spelling score and the increase was statistically significant. For example, when the Spanish spelling score increases from 5 to 6, the English spelling score will be predicted to increase from 5 to 5.58.

Table 3

Summary of Robust Regression Analysis Using the Beginning Level as the Reference Group
($N = 129$)

Variable	<i>B</i>	<i>SE B</i>	X^2
Constant	-5.431	.923	34.62***
Intermediate	3.266	.407	64.41***
Advanced	2.651	.433	37.45***
Spanish Spelling	.582	.066	77.95***

Note. $R = .677$, $R^2 = .458$

*** $p < .001$

Table 4

Summary of Robust Regression Analysis Using the Advanced Level as the Reference Group
($N = 129$)

Variable	<i>B</i>	<i>SE B</i>	X^2
Constant	-2.780	1.000	7.72**
Beginning	-2.651	.433	37.45***
Intermediate	.615	.470	1.71
Spanish Spelling	.582	.066	77.95***

Note. $R = .677$, $R^2 = .458$

** $p < .01$

*** $p < .001$

English proficiency level alone explained 25.5% of the variance ($R^2 = .255$) (see Table 5). There was a statistically significant difference in English spelling scores between the beginning and intermediate level participants, and between the beginning and advanced level participants, after controlling for Spanish spelling skills. Again, the

difference between intermediate and advanced level participants was not statistically significant (see Table 6).

Table 5

Summary of Robust Regression Analysis with Dummy Coded English Proficiency Variable Only (Using the Beginning Level as the Reference Group)
($N = 129$)

Variable	<i>B</i>	<i>SE B</i>	X^2
Constant	2.442	.363	45.30***
Intermediate	3.791	.578	43.03***
Advanced	3.319	.610	29.62***

Note. $R = .505$, $R^2 = .255$

*** $p < .001$

Table 6

Summary of Robust Regression Analysis with Dummy Coded English Proficiency Variable Only (Using the Advanced Level as the Reference Group)
($N = 129$)

Variable	<i>B</i>	<i>SE B</i>	X^2
Constant	5.761	.490	138.15***
Beginning	-3.319	.610	29.62***
Intermediate	.472	.665	.50

Note. $R = .505$, $R^2 = .255$

*** $p < .001$

Spanish spelling alone explained 25.9% of the variance ($R^2 = .259$) (see Table 7).

Each one-point of increase in the Spanish spelling score predicted 0.69-point increase in the English spelling score, and the increase was statistically significant.

Table 7

Summary of Robust Regression Analysis with Spanish Spelling Variable Only
($N = 129$)

Variable	<i>B</i>	<i>SE B</i>	X^2
Constant	-5.318	1.316	16.33***
Spanish Spelling	.692	.094	54.60***

Note. $R = .509$, $R^2 = .259$

*** $p < .001$.

Answers to the first research question indicated that both English proficiency and Spanish spelling skills are important predictors of adult ESL participants' English

spelling skills. Higher English proficiency and better Spanish spelling skills will produce better English spelling outcomes. There was no statistically significant difference between intermediate and advanced level ESL participants in terms of English spelling performance. One plausible explanation could be that the standardized English spelling test was too challenging to differentiate these two groups. This could also be due to the instrument itself that only differentiates beginning level and higher level, but not intermediate level and advanced level ESL participants.

Research Question 2a

Do the spelling errors indicate the possible presence of L1-influenced transfer from Spanish to English? This question addresses the possible occurrence of L1-influenced transfer from Spanish to English. To answer this question, I first used descriptive statistics to detect outliers and check if the data was normally distributed. A boxplot showed one outlier in the ESL participants' data and one outlier in the native English-speaking participants' data. Since the outliers were neither due to data entry error nor measurement error, they were most likely genuinely unusual data points. In addition, code 2 errors for each group were not normally distributed, as assessed by Shapiro-Wilk's test ($p < .05$), and there was violation of homogeneity of variances, as assessed by Levene's test for equality of variances ($p < .05$).

Given the aforementioned unusual points and violations, a Mann-Whitney test (nonparametric) was used to determine if there were differences in code 2 errors, which are indicative of L1-influenced transfer, between the ESL and native English-speaking groups. Code 2 errors produced by the ESL group (mean rank = 143.45) were statistically significantly more than those produced by the native English-speaking group (mean rank

= 84.19), $U = 3296.000$, $z = -7.112$, $p < .001$ (see Table 8). The results suggest that possible L1-influenced transfer in spelling from Spanish to English did occur in three English vowel phonemes (/aɪ/ spelled in digraphs *ai*, *ay*, or *ae*, /aʊ/ spelled in digraph *au*, and /eɪ/ spelled in letter *e*) among Spanish-speaking adult ESL students.

Table 8

The Mann-Whitney Test Result Showing Differences between Groups

<i>Group</i>	<i>N</i>	<i>Mean Rank</i>	<i>Sum of Ranks</i>	<i>U</i>	<i>p</i>
ESL	129	143.45	18505.00	3296.000	.000
Native English-Speaking	104	84.19	8756.00		

Research Question 2b

Do the spelling errors indicate something other than L1-influenced transfer from Spanish to English? If so, what do such errors indicate? The answer to the first part of this question is affirmative. To answer the second part of this question, descriptive statistics were used to display frequency distributions of spelling errors for each vowel phoneme. All spelling errors are displayed in Appendix F. The most frequently produced spelling error patterns are displayed in Tables 9 to 21. Some sounds have multiple spelling error patterns, those of which only occurred once in the data were not included in the tables below. They are not included in the tables below. In Tables 9 to 21, the second column for each group shows the frequency of spelling errors for each spelling error pattern. The third column shows the percentage distribution for each spelling error pattern.

The overall impression on the data shown in Tables 9 to 21 is that all participants (both ESL and native English speakers) produced very similar high-frequency spelling error patterns of the 13 vowel phonemes. Table 22 summarizes the results by displaying the most frequently produced error patterns by the participants.

Table 9

Most Frequent /i/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
u	3	27%	a	3	100%	a	2	40%	a	6	86%
a	2	18%									
Total	11			3			5			7	

Table 10

Most Frequent /i/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ee	36	31%	ea	22	28%	ea	28	33%	ea	21	26%
ea	22	19%	a	17	21%	ee	19	22%	ie	20	24%
a	20	17%	ee	16	20%	a	14	16%	a	18	22%
Total	117			80			86			82	

Table 11

Most Frequent /u/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	3	43%	au	1	25%	a	2	50%	oa	3	100%
oa	3	43%	e	1	25%						
			oa	1	25%						
			oe	1	25%						
Total	7			4			4			3	

Table 12

Most Frequent /eɪ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
i	81	72%	i	49	84%	i	56	79%	i	88	70%
ee	11	10%	ae	4	7%	ee	8	11%	ee	18	14%
ae	5	4%	ee	3	5%	ae	3	4%	ae	8	6%
Total	112			58			71			125	

Table 13

Most Frequent /ε/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	148	56%	a	109	71%	a	99	60%	a	187	71%
ee	29	11%	ee	9	6%	ee	14	9%	i	36	14%
i	23	9%	ou	8	5%	i	11	7%	ee	10	4%
Total	265			153			164			264	

Table 14

Most Frequent /ʌ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
e	22	61%	e	6	30%	e	16	52%	e	32	44%
ai	3	8%	ee	5	25%	ee	8	26%	i	29	40%
i	3	8%	ai	3	15%	i	5	16%			
			ow	3	15%						
Total	36			20			31			72	

Table 15

Most Frequent /ɔɪ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ou	9	35%	o	3	23%	ou	4	57%	o	16	42%
o	6	23%	ou	2	15%	oui	2	29%	oe	4	11%
oo	3	12%				oa	1	14%	ou	3	8%
									ow	3	8%
Total	26			13			7			38	

Table 16

Most Frequent /o/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
oo	55	52%	oo	21	47%	oo	29	55%	oo	28	52%
u	27	26%	u	15	33%	u	10	19%	u	20	37%
a	13	12%	a	3	7%	a	6	11%	a	3	6%
Total	105			45			53			54	

Table 17

Most Frequent /ɔ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ao	2	18%	u	3	75%	u	6	46%	u	51	75%
e	2	18%	ao	1	25%	oa	5	38%	i	5	7%
oa	2	18%							oa	5	7%
u	2	18%									
Total	11			4			13			68	

Table 18

Most Frequent /æ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
e	49	29%	ai	29	20%	u	27	22%	e	48	38%
u	45	26%	u	28	19%	e	24	20%	ai	21	17%
ai	28	16%	o	21	15%	o	18	15%	i	21	17%
o	10	6%	e	18	13%	ai	15	12%	ea	12	10%
									u	12	10%
Total	171			144			121			126	

Table 19

Most Frequent /aɪ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	32	65%	a	15	60%	a	5	56%	a	15	58%
e	5	10%	ea	3	12%	au	2	22%	e	4	15%
ea	4	8%	au	2	8%				ea	3	12%
			e	2	8%						
Total	49			25			9			26	

Table 20

Most Frequent /aʊ/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	41	79%	a	32	84%	a	21	78%	a	24	45%
e	5	10%	o	3	8%	o	3	11%	u	14	26%
u	4	8%	e	2	5%	e	2	7%	o	12	23%
Total	52			38			27			53	

Table 21

Most Frequent /a/ Sound Spelling Errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
u	3	43%	u	9	60%	u	6	60%	u	19	56%
			oi	3	20%				oi	7	21%
Total	7			15			10			34	

Table 22

Summary of Most Frequently Produced Error Patterns by Participants

Sound	Error Pattern	Participants
/i/	a	All
/ɪ/	a, ea	All
	ee	All ESL
	ie	Native English-speaking
/u/	oa	Beginning ESL Intermediate ESL Native English-speaking
	a	Beginning ESL Advanced ESL
/eɪ/	ae, ee, i	All
/ɛ/	a, ee	All
	i	Beginning ESL Advanced ESL Native English-speaking
	au	Beginning ESL
	o	Native English-speaking
/ʌ/	e	All
	i	Beginning ESL Advanced ESL Native English-speaking
	ai	Beginning ESL Intermediate ESL
/ɔɪ/	ou	All
	o	Beginning ESL Intermediate ESL Native English-speaking
/o/	a, oo, u	All
/ɔ/	u	All
	ao	Beginning ESL Intermediate ESL
	oa	Beginning ESL Advanced ESL

		Native English-speaking
/æ/	ai, e, u	All
	o	All ESL
	ea, i	Native English-speaking
/ɑɪ/	a	All
	e, ea	Beginning ESL
		Intermediate ESL
		Native English-speaking
	au	Intermediate ESL
/ɑʊ/		Advanced ESL
	a	All
	e	All ESL
	o	Intermediate ESL
		Advanced ESL
		Native English-speaking
/ɑ/	u	Beginning ESL
		Native English-speaking
	oi	All
		Intermediate ESL
		Native English-speaking

Research Question 2c

If L1-influenced transfer possibly happens, do Spanish-speaking adult ESL learners' Spanish spelling skills and English proficiency influence the degree of L1-influenced transfer? This question examines how Spanish-speaking adult ESL learners' Spanish spelling skills and English proficiency influence the degree of L1-influenced transfer. The answer to this question was determined by the count of code 2 errors. Poisson regression can be a fit model of count data as long as overdispersion is not an issue. Negative binomial regression results showed a dispersion parameter alpha value of 0.199 which is not statistically significant. Thus, there is no overdispersion issue and Poisson regression is an appropriate model to test if English proficiency and Spanish spelling skills significantly predicted Spanish-speaking ESL participants' degree of L1-influenced transfer in spelling.

The results of the Poisson regression indicated the model was statistically significant and the two predictors together statistically significantly predicted the degree of L1-influenced transfer ($p = .006$). Table 23 shows that after controlling for English proficiency, for each one-point of increase in Spanish spelling, the count of code 2 errors decreased by .93 point and the change was statistically significant ($p = .009$). After controlling for Spanish spelling, ESL participants at the beginning level of English proficiency made 1.224 (95% CI, .864 to 1.733) times as many code 2 errors as those at the advanced level, and ESL participants at the intermediate level made 0.84 (95% CI, .562 to 1.258) times as many code 2 errors as those at the advanced level. None of the differences was statistically significant ($p = .255$ and $p = .399$ respectively).

Table 23

Summary of Poisson Regression Analysis Using the Advanced Level as the Reference
($N = 129$)

Variable	<i>B</i>	<i>Exp(B)</i>	<i>Std. Error</i>	<i>Chi-Square</i>	<i>Sig.</i>
Proficiency (beginning)	.202	1.224	.178	1.293	.255
Proficiency (Intermediate)	-.174	.841	.206	.712	.399
Spanish Spelling	-.073	.930	.028	6.742	.009**

** $p < .01$

Table 24 shows that after controlling for Spanish spelling, ESL participants at the intermediate level of English proficiency made 0.69 (95% CI, .485 to .973) times as many code 2 errors as those at the beginning level. The difference was statistically significant ($p = .035$) which means that the intermediate level ESL participants made statistically significantly less L1-influenced spelling errors than the beginning level ESL participants. Table 24 also shows that ESL participants at the advanced level made 0.82 (95% CI, .577 to 1.157) times as many code 2 errors as those at the beginning level. The difference between the advanced level and the beginning level was not statistically significant ($p = .255$).

Table 24

Summary of Poisson Regression Analysis Using the Beginning Level as the Reference
(N = 129)

Variable	<i>B</i>	<i>Exp(B)</i>	<i>Std. Error</i>	<i>Chi-Square</i>	<i>Sig.</i>
Proficiency (Intermediate)	-.376	.687	.178	4.463	.035*
Proficiency (Advanced)	-.202	.817	.178	1.293	.255
Spanish Spelling	-.073	.930	.028	6.742	.009

* $p < .05$

Chapter 5: Discussion

Findings

The data shows that adult Spanish-speaking ESL participants exhibited positive transfer effects of advanced Spanish spelling skills on their English spelling skills. Similarly, participants with lower Spanish spelling skills produced statistically significantly more errors, including L1-influenced spelling errors, in spelling English vowel sounds. After controlling for English proficiency, Spanish spelling skills remained a critical factor predicting both English spelling and level of L1-influenced transfer.

English proficiency also played an important role in ESL participants' English spelling performance. Participants with higher English proficiency, both in the intermediate and advanced levels, outperformed those low English proficiency participants ranked as beginning level learners. However, there was no statistically significant difference in English spelling between intermediate and advanced level ESL learners. One possible explanation could be that the standardized English spelling test was too challenging to differentiate these two groups, considering that performance was similarly low for both groups: average score on the spelling test of both groups was six out of total of 20 items. With regard to level of L1-influenced transfer, after controlling for Spanish spelling skills, ESL participants at the intermediate level of English proficiency produced statistically significantly less L1-influenced spelling errors than ESL participants at the beginning level. Beginning level ESL participants made more L1-influenced spelling errors than advanced level participants but the difference was not statistically significant. Advanced level ESL participants made more L1-influenced

spelling errors than intermediate level participants but the difference was not statistically significant.

Previous research had identified L1-influenced transfer in spellings of *i* for the /i/ sound and *u* for the /u/ sound. These were not considered to be evidence of L1-influenced transfer in this study because it was found that high-frequency words such as *police*, *material*, and *period* use *i* for the /i/ sound. Similarly, it was found that high-frequency words such as *truth* and *nuclear* use *u* for the /u/ sound. It is plausible that both ESL and native English-speaking participants could have encountered these words in daily life and at school and relied on this knowledge to make corresponding spelling choices on the test. Thus, it is plausible that they applied English knowledge rather than Spanish knowledge when they used *i* to spell the /i/ sound and *u* to spell the /u/ sound. However, There is evidence suggesting that possible L1-influenced transfer in spelling English vowel sounds from Spanish did occur in three English vowel phonemes (/aɪ/ spelled as *ae*, *ai*, or *ay*, /aʊ/ spelled as *au*, and /eɪ/ spelled as *e*) among the ESL participants.

There were highly consistent patterns used across all participants for certain vowel spelling errors that were not considered the result of L1-influenced transfer. The participants used digraphs like *ea* and *ee* to spell the short /ɪ/ sound, suggesting that they seemed to have difficulty differentiating between the /i/ sound and the /ɪ/ sound when hearing the target during the pseudoword spelling test. Additionally, lexical knowledge seems to have had an effect on spelling performance. For example, the letter *i* was most frequently used to spell the /eɪ/ sound as when the participants spelled the pseudoword *paig*, such that many participants wrote the real English word *pig* for this target. Similarly, the letter *a* was frequently used to spell the /ɛ/ sound as when the participants

spelled the pseudoword *ket*, such that many participants wrote the real English word *cat*. Both cases imply that during the pseudoword spelling test, the participants may have mapped a spelling pattern to a real word that closely matched the target word in sound.

Several other common erroneous spelling patterns seemingly not related to L1-influenced transfer arose from the data: *e* was most frequently used to spell the /ʌ/ sound; *ou* and *o* were most frequently used to spell the /ɔɪ/ sound; *a*, *oo*, and *u* were most frequently used to spell the /o/ sound; *u* was most frequently used to spell the /ɔ/ sound; and *ai*, *e*, and *u* were most frequently used to spell the /æ/ sound. This information is useful in providing insight into the particular phonemes that may pose the most difficulty for participants, and demonstrates the vocalic candidates being considered to represent these difficult sounds. For example, the frequent spelling of *e* for /æ/ may indicate that participants struggled to differentiate between /æ/ and /ɛ/ when listening to the test items. The participants also frequently used letter *a* to spell the /aɪ/ sound, suggesting they may have had difficulty differentiating between /æ/ and /aɪ/. Similarly, they may have had difficulty differentiating between /a/ and /aʊ/, as they most frequently spelled /aʊ/ using *a*, and differentiating between /ʌ/ and /ɑ/ as they most frequently spelled /ɑ/ using *u*.

Significance of the Study

The findings of the study expand upon the current body of literature on cross-linguistic transfer of spelling from Spanish to English in ESL learners. Few published studies have investigated spelling as it pertains to the adult ESL population. The findings support the evidence in the literature that bilingual learners' level of L1 competence has effects on the development of L2 competence and the effects can be positive or negative. This study shows that these effects are visible in learner's spelling behaviors. Positive

effects are reflected in the finding that better Spanish spelling skills predicted better English spelling skills and fewer L1-influenced spelling errors. Negative effects are reflected in the finding that L1-influenced transfer likely occurred. These findings seemingly support the facilitation theory (Cummins, 1979; MacSwan & Rolstad, 2005) in the sense that bilingual learners' strong L1 spelling skills can facilitate their development of L2 spelling skills. It also follows that when exposure to L2 is intensive (e.g. in an ESL program), a low level of L1 spelling skills could impede or have negative effect on the development of L2 spelling skills as was observed in the findings of this study.

The finding that less proficient Spanish spellers produced more L1-influenced spelling errors might raise a question: Shouldn't less proficient Spanish spellers produce fewer L1-influenced spelling errors because their Spanish spelling knowledge is incomplete? The answer to this question could be that less proficient Spanish spellers may not necessarily be less proficient in spelling Spanish vowel sounds. The Spanish vowel sound system is much simpler than that of English. Given that the Spanish vowel sound system is simple, even less proficient Spanish spellers may be proficient in the Spanish sound-letter mapping patterns and may apply these patterns to English vowel sound spelling more readily than a more proficient Spanish speller. Perhaps the greater sensitivity of a more proficient Spanish speller to sound-letter correspondences makes them more aware of the mapping differences between Spanish and English. This is consistent with the finding that more proficient Spanish spellers performed better on the experimental English spelling test.

In summary, this study presents a valuable contribution to the literature because it examined 13 English vowel sound spelling errors when most empirical studies on second

language spelling examined far fewer English vowel sounds. In addition, it contributes to the literature on adult ESL learners. As a result, this study provides a model of a methodology for future researchers to conduct more thorough spelling error analyses of adult ESL learners.

Limitations

The study has several limitations. From a statistical power standpoint, the exclusion of 49 ESL participants who were absent for the posttest from the analysis may weaken the interpretation of the results due to the reduction in sample size. Additionally, the three pseudoword test items (*tould*, *fook*, *zull*) that targeted the /ʊ/ sound were excluded from the analysis because they produced a very low internal consistency. If the internal consistency had been higher, the spellings of the /ʊ/ sound might have provided valuable contrast with how participants spelled the long /u/ sound. It was anticipated that the contrast between /u/ and /ʊ/ may have presented a difficulty for the participants, but with the exclusion of the /ʊ/ items that result is still unknown. This is one possible area of exploration for future studies. Another limitation of the study is that it is purely quantitative. A qualitative component could have provided insights from participants directly about what they heard on the test and how they intended their spellings to be pronounced. An example of this qualitative insight could be follow-up individual interviews with randomly selected participants from different groups, allowing them to reflect on why they spelled each vowel sound using the patterns they chose to use. Such type of qualitative design would have informed the interpretation of results and perhaps made the results more reliable or authentic.

Implications for Research and Practice

The study results showed that Spanish-speaking adult ESL learners' Spanish spelling skills statistically significantly predicted English spelling skills and level of L1-influenced transfer. The results imply that encouraging and providing opportunities for adult ESL learners, especially less proficient Spanish spellers and learners of low English proficiency, to develop their L1 literacy in and out of school could help them enhance spelling skills in both L1 and L2. Research on the benefits of using both L1 and L2 as language of instruction in adult ESL programs is scarce. Future research may examine if bilingual education models (e.g. dual language programs, bilingual immersion programs) could benefit adult ESL learners as much as they benefit younger bilingual children. In adult ESL programs when there are a large number of learners who speak the same L1, bilingual education could be feasible to implement.

The results suggest that L1-influenced transfer likely occurs. As such, it could be a useful area of focus for targeted spelling instruction. Future research is needed to explore how teachers might modify spelling instruction to address these error patterns, including an investigation of pedagogical methods. Additionally, ESL teachers may also look at the high-frequency spelling error patterns that do not indicate L1-influenced transfer and find ways to address these patterns in spelling instruction as well. By doing so both the teacher and the students could gain a deeper understanding of the connection between English vowels and their orthographic variations.

Given that the pseudoword spellings were scored without taking post-vocalic context into consideration, a future study could develop a different scoring paradigm that considers post-vocalic context. While the new paradigm would likely expand the number

of spelling patterns that count as errors, it would also provide insights into the extent to which students lack knowledge and awareness of morphemic and consonantal influences on English spelling. The vowel-only and post-vocalic scoring paradigms may help teachers and researchers to think more critically about instructional spelling interventions for ESL students.

English vowel sound spellings are complex and often seem chaotic with no regularity. As an example, Venezky (1999) pointed out that “The letter <o> corresponds to at least 17 different sounds, <a> to 10, <e> to 9, and the combined group to 48.” As if this is not complicated enough, there are numerous dialects of English all around the world (e.g. England, North America, India, Australia, South Africa) with highly variable vowel pronunciation. Within the United States, accents of English vary among and across regions such as New York City, New England, and the South (Wells, 1982). Accents affect pronunciation, which in turn could affect spelling. Learning the patterns may not be impossible, but it is certainly a challenge. Venezky noted that:

When the morphemic structure and consonant environments of the words in which these units appear are considered, however, a single major pattern emerges, with a bevy of subpatterns. Exceptions still remain (large numbers of them in some cases), but the underlying pattern still dominates, giving a sense of order and tranquility to what originally appeared chaotic and without reason.” (p. 173)

As a demonstration, Venezky (1999) detailed primary vowel spellings and secondary vowel spellings, and under each category he introduced major spelling patterns, minor spelling patterns, and exceptions. His categorizations could serve as the basis for future research, such that researchers and teachers who are interested in second-language

spelling development may conduct research on or practice designing and implementing spelling intervention for adult ESL students as they acquire the many vowel spelling patterns of English.

Chomsky (1971) advocated creating “open classroom” to foster children’s invented spellings which could not only help children develop their own linguistic perceptions and find interesting ways of expressing themselves, but could also promote later reading skills and acquisition of conventional spellings. An “open classroom” should allow children progress at their own developmental pace and test their own judgments. When children know the letters of the alphabet and the associated sounds, they are likely able to create innovative spellings. The role of the teacher in an “open classroom” is mainly providing a welcoming and encouraging environment that makes children feel that their invented spellings are meaningful and valued by the teacher. It is not necessary for the teacher to provide explicit spelling instructions but it would be better if he or she can interpret the spellings and be aware of various features that appear at different stages in children's spelling progress. Chomsky brought up an important notion that although invented spellings can be erroneous, they shall not be viewed negatively. Such spellings among monolingual and bilingual children or adults can provide insightful information for researchers and teachers to understand how spelling progresses. When looking at L1-influenced spelling errors, future researchers and teachers may consider such errors as invented spellings and document and analyze them over time to find out if conclusions can be reached regarding L2 spelling development trajectories.

Howard, Green, and Arteagoitia (2012) drew a conclusion from their longitudinal study that cross-linguistic transfer in spelling, manifested in L1-influenced spelling errors, typically resolves itself over a period of time without needing specific intervention. The participants were Spanish-English bilingual students enrolled in four two-way immersion programs that adopted either a 90-10 approach, in which the majority of instruction in the primary grades was in Spanish (L1), or a 50-50 approach, in which instruction was divided equally between Spanish (L1) and English (L2). In a typical ESL program, instruction is primarily provided in English (L2) and rarely incorporates L1. Thus, it is not certain if the incidence of L1-influenced spelling errors will also resolve itself in ESL programs as in two-way immersion programs. Hammill, Larsen, and McNutt (1977) drew a similar conclusion after studying the effectiveness of spelling instruction on students' spelling competence. The participants were 2956 English-speaking students from Grade 3 to Grade 8 attending schools in twenty-two states. The major finding was that children in Grades 3 and Grade 4 who received systematic spelling instruction scored higher on the spelling test than those who did not receive any instruction. However, after Grade 4 there was no difference in spelling performance between children who received spelling instruction and who received no spelling instruction. One plausible explanation of the result could be that after learners reach a certain threshold of spelling competence, spelling instruction makes little or no impact on further development of spelling skills. Since both study results apply to young learners and more evidence is needed to make the results more generalizable, it is important to conduct future research to duplicate the research studies and examine to what extent the findings can also apply to a larger and more diverse population.

Conclusion

The study found that both Spanish spelling competence and English proficiency are strong predictors of English spelling competence. Adult Spanish-speaking ESL learners who have better Spanish spelling skills and higher English proficiency tend to demonstrate better English spelling skills. Spanish spelling competence is also a strong predictor of level of L1-influenced transfer. Adult Spanish-speaking ESL learners who have better Spanish spelling skills likely produce less L1-influenced spelling errors. English proficiency overall is not a strong predictor of level of L1-influenced transfer; however, intermediate level ESL participants made statistically significantly less L1-influenced spelling errors than the beginning level ESL participants. L1-influenced transfer of spelling knowledge from Spanish to English likely occurred in certain vowel targets (/aɪ/ spelled as *ae*, *ai*, or *ay*, /aʊ/ spelled as *au*, and /eɪ/ spelled as *e*) and less proficient Spanish spellers produced statistically significantly more L1-influenced spelling errors than more proficient Spanish spellers.

The ESL participants (regardless of English proficiency level) and the native English-speaking participants produced highly similar error patterns of English vowel spellings when the errors did not indicate L1-influenced transfer. This implies that the development of English spelling competence might follow similar trajectories between ESL learners and native English speakers. During the process of developing English spelling accuracy, both native English-speaking learners and English language learners might experience similar difficulties in differentiating certain vowel sounds (e.g. between /i/ and /ɪ/, between /æ/ and /aɪ/, between /ʌ/ and /ɑ/) and in choosing the eligible spelling patterns to spell vowel sounds in pseudowords. This study recruited English-speaking

GED students. It would be interesting for future researchers to investigate if an English-speaking person's educational background has an impact on his or her English vowel sound spelling error patterns by recruiting undergraduate and graduate students.

This study contributes to the current literature by providing more insights into how L1 spelling skills and L2 proficiency predict L2 spelling development and level of L1-influenced transfer in adult ESL learners. This study also provides a more thorough analysis of how adult ESL learners spell 13 English vowel phonemes, which are /i/, /ɪ/, /eɪ/, /ɛ/, /æ/, /ʌ/, /ɑ/, /u/, /o/, /ɔ/, /aɪ/, /aʊ/, and /ɔɪ/, and what error patterns are most frequently produced. Based on this study's findings, future research on L2 spelling development can investigate in more depth why ESL learners make certain selections of patterns to spell English vowel sounds by incorporating qualitative design of interviews. Future research on instructional spelling interventions can examine the effectiveness of instruction in L1 on enhancing adult ESL learners' L2 literacy development. The current literature presents different views toward the necessity and importance of providing spelling interventions for ESL learners. It would be meaningful for researchers to design a longitudinal study to find out if L1-influenced transfer in spelling can be effectively remediated by interventions or just resolves itself over time. By conducting well-designed empirical studies, researchers will be able to better inform ESL teachers about adult ESL learners' English spelling development and in return, ESL teachers will better help ESL learners develop advanced English spelling competence which is an important English literacy skill.

Appendices

Appendix A: Background Questionnaire for Spanish-speaking Participants

1. Age: _____
2. Gender (please circle one): Male Female
3. What is the highest level of education you have completed? (please circle one below)

Less than High School
High School/GED
Some College
2-Year College Degree (Associates)
4-Year College Degree (BA, BS)
Master's Degree
Doctoral Degree
Professional Degree (MD, JD)

Please indicate where you completed your highest level of education: _____

4. For how many years have you studied English formally at school (including college)?
_____ year(s).
5. Where did you live age 3 – 18? (Specify country, state, city). Did you go to primary and secondary school mostly in Spanish? (yes/no). If no, what other languages were used for instruction?

6. How long have you been in an English-speaking country (the U.S. or other English-speaking countries)? _____ year(s) _____ month(s).

7. What is your home language? If you have more than one home language, please list them all below.

8. What languages do you speak other than your home language and English?

9. Please indicate your occupation below. If you are a student, please write down “student.” If you are not working, please write down “not working.”

10. What is the average yearly income of your household, including everyone in the home? (please circle one below)

Less than \$10,000
\$10,000-\$19,999
\$20,000-\$29,999
\$30,000-\$39,999
\$40,000-\$49,999
\$50,000-\$59,999
\$60,000-\$69,999
\$70,000-\$79,999
\$80,000-\$89,999
\$90,000-\$99,999
\$100,000-\$149,000
More than \$150,000

Appendix B: Background Questionnaire for English-speaking Participants

1. Age: _____

2. Gender (please circle one): Male Female

3. What is the highest level of education you have completed? (please circle one below)

- Less than High School
- High School/GED
- Some College
- 2-Year College Degree (Associates)
- 4-Year College Degree (BA, BS)
- Master's Degree
- Doctoral Degree
- Professional Degree (MD, JD)

4. Other than English, what other language(s) do you know? Please list all languages below and indicate your fluency for each one (e.g., Spanish: fluent in speaking and listening, but don't know how to write)

5. Where did you live during elementary, middle and high school? (Specify country, state, city). Did you go to school mostly in English? (yes/no). If no, what other languages were used as medium of instruction?

6. Do you use more than one dialect or variety of English? Do you speak a variety of English specific to your region or your heritage? If so what? (e.g. Southern English, African American Vernacular, Chicano English, Bostonian English, World English).

7. Please indicate your occupation below. If you are a student, please write down "student" and indicate what you are studying (e.g. mechanical engineering). If you are not working, please write down "not working."

8. What is the average yearly income of your household, including everyone in the home?
(please circle one below)

Less than \$10,000
\$10,000-\$19,999
\$20,000-\$29,999
\$30,000-\$39,999
\$40,000-\$49,999
\$50,000-\$59,999
\$60,000-\$69,999
\$70,000-\$79,999
\$80,000-\$89,999
\$90,000-\$99,999
\$100,000-\$149,000
More than \$150,000

Appendix C: Selected English Pseudoword Spelling Items

The spelling items below are used in Sun-Alperin and Wang (2008).

/i/	peef
	treeb
	bleen
/eɪ/	paim
	paig
	gake
	lape
/aɪ/	shile
	ribe
	wike
	fie
/u/	roop
	goom
	loof
/ɛ/	mell
	frep
	pech
	beld
	weck
/æ/	trad
	saft
	bast
	plash
/o/	pode
	crote
	wobe
	vone
	shobe

Appendix D: Spelling Coding (Old Paradigm)

Table D1

Vowel sound spellings that indicate possible occurrence of L1-influenced transfer from Spanish to English

Vowel Sound	English Spellings	Spanish Spellings
/i/	<i>ee,ea,e-e,ie,ie-e,ei,ei-e</i>	<i>i,y,ui</i>
/ʌ/	<i>u,o-e</i>	<i>o,ou,a,oa,ua,oo</i>
/ɑ/	<i>o</i>	<i>a</i>
/u/	<i>oo,u-e,ue</i>	<i>u</i>
/ʊ/	<i>oo</i>	<i>u</i>
/o/	<i>o,oa,o-e,ow</i>	<i>ou</i>
/ɔ/	<i>or,aw,au,our</i>	<i>o,a,ou,oa,ao,ua,oo</i>
/aɪ/	<i>ie,y,i-e,ye</i>	<i>ai,ay</i>
/aʊ/	<i>ou,ow</i>	<i>au</i>

Table D2

Vowel sound spellings that can be the same in Spanish and English

Vowel Sound	English Spellings	Spanish Spellings
/ɪ/	<i>i/y</i>	<i>i/y</i>
/ɛ/	<i>e</i>	<i>e</i>
/æ/	<i>a</i>	<i>a</i>
/ɑ/	<i>o</i>	<i>o</i>
/o/	<i>o</i>	<i>o</i>
/ɔɪ/	<i>oy,oi</i>	<i>oy,oi</i>
/eɪ/	<i>ai,a-e,ay,ey,ei,eigh</i>	<i>ei,ey</i>

Appendix E: Spelling Coding (New Paradigm)

Frequency ranking numbers come from Davies (2015).

Table E1

<i>Correct Spelling Patterns</i>			
Vowel Sound	Correct Spelling Pattern	Word Example	Frequency Ranking
/i/	e	he	290
	ea	real	306
	ee	see	67
	ei	receive	499
	ey	money	234
	i	police	469
		period	617
		material	642
		piano	3327
		medium	3269
	ie	believe	213
	y	many	99
/ɪ/	ai	<i>portrait</i>	2677
	e	pretty	799
	i	big	162
	u	business	247
	ui	build	409
	y	system	191
/u/	o	movement	708
	oo	food	367
	ou	group	163
	u	truth	853
	ue	blue	845
	ui	suit	1418
/ʊ/	oo	good	110
	ou	would	41
	u	pull	472
/eɪ/	a	baby	589
	ai	explain	481
	ay	say	19
	ea	great	160
	ei	eight	744
	ey	they	21
	ua	equation	4019
/ɛ/	ai	again	184
	e	get	39
	ea	head	252

/ɔɪ/	oy	boy	383
	oi	point	212
/ʌ/	a	what	34
	o	wonder	791
	oo	blood	693
	ou	enough	375
	u	but	23
/o/	o	home	407
	oa	road	490
	oe	toe	3389
	ou	though	246
	ow	show	177
	uo	quote	2276
/ɔ/ or /ɑ/	a	father	268
	au	daughter	635
	aw	law	288
	o	lot	239
	ou	thought	761
	ua	quality	765
/æ/	a	catch	587
	au	laugh	864
	ua	guarantee	2798
/aɪ/	i	child	115
	ia	trial	901
	ie	tie	1510
	ui	quite	562
	uy	buy	398
	y	try	127
	ye	bye	19391
/aʊ/	ou	house	258
	ow	how	76

Table E2

<i>Exceptional Spelling Patterns</i>		
Vowel Sound	Exceptions	Word Example
/ɪ/	ei	foreign
	o	women
/u/	oe	shoe
/ʊ/	o	woman
/eɪ/	ae	Israeli
	e	ballet
	ie	lingerie
/ɛ/	a	many
	ie	friend
	u	bury
/o/	ew	sew
	oo	Roosevelt
/ɔ/ or /ɑ/	ao	extraordinary
	e	entrée
	i	lingerie
	oa	broad
	ow	knowledge
/aɪ/	ai	aisle
	ei	height

Appendix F: Frequency Distributions of Non-L1-influenced Transfer Spelling Errors

Table F1

/i/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
u	3	27%	a	3	100%	a	2	40%	a	6	86%
a	2	18%				ai	1	20%	u	1	14%
ai	1	9%				ay	1	20%			
eu	1	9%				ew	1	20%			
o	1	9%									
oi	1	9%									
oui	1	9%									
ue	1	9%									
Total	11			3			5			7	

Table F2

/i/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ee	36	31%	ea	22	28%	ea	28	33%	ea	21	26%
ea	22	19%	a	17	21%	ee	19	22%	ie	20	24%
a	20	17%	ee	16	20%	a	14	16%	a	18	22%
ue	9	8%	ie	8	10%	ie	7	8%	ee	6	7%
o	7	6%	ew	4	5%	ue	7	8%	ue	6	7%
ae	2	2%	ue	3	4%	ei	3	3%	ei	4	5%
ay	2	2%	ey	2	3%	ew	2	2%	o	2	2%
eu	2	2%	iu	2	3%	uie	2	2%	uie	2	2%
ie	2	2%	aw	1	1%	ae	1	1%	ia	1	1%
oo	2	2%	ei	1	1%	o	1	1%	oi	1	1%
ou	2	2%	ou	1	1%	oo	1	1%	oo	1	1%
aw	1	1%	uew	1	1%	oy	1	1%			
eea	1	1%	uey	1	1%						
eew	1	1%	uia	1	1%						
ei	1	1%									
ew	1	1%									
oow	1	1%									
oui	1	1%									
ow	1	1%									
ua	1	1%									
uia	1	1%									
uie	1	1%									
Total	117			80			86			82	

Table F3

/u/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	3	43%	au	1	33%	a	2	50%	oa	3	1
oa	3	43%	e	1	33%	e	1	25%			
au	1	14%	oa	1	33%	ow	1	25%			
Total	7			3			4			3	

Table F4

/ei/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
i	81	72%	i	49	84%	i	56	79%	i	88	70%
ee	11	10%	ae	4	7%	ee	8	11%	ee	18	14%
ae	5	4%	ee	3	5%	ae	3	4%	ae	8	6%
ie	3	3%	ue	1	2%	ie	2	3%	ia	3	2%
o	2	2%	ui	1	2%	eo	1	1%	ie	3	2%
oe	2	2%				ia	1	1%	o	1	1%
ou	2	2%							ow	1	1%
awe	1	1%							owa	1	1%
ew	1	1%							u	1	1%
ia	1	1%							y	1	1%
ui	1	1%									
uie	1	1%									
uy	1	1%									
Total	112			58			71			125	

Table F5

/ε/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	148	56%	a	109	71%	a	99	60%	a	187	71%
ee	29	11%	ee	9	6%	ee	14	9%	i	36	14%
i	23	9%	ou	8	5%	i	11	7%	ee	10	4%
au	18	7%	i	6	4%	ou	11	7%	o	9	3%
o	11	4%	o	5	3%	u	7	4%	ei	5	2%
ou	11	4%	u	5	3%	o	6	4%	u	5	2%
u	5	2%	au	3	2%	au	4	2%	ou	4	2%
ae	4	2%	aw	2	1%	ow	3	2%	ae	3	1%
ao	3	1%	ay	2	1%	ae	2	1%	ow	2	1%
ei	3	1%	ei	2	1%	ao	1	1%	awu	1	0%
ua	2	1%	ae	1	1%	aw	1	1%	eu	1	0%
aei	1	0%	iu	1	1%	ei	1	1%	ie	1	0%
aiu	1	0%				eu	1	1%			
eau	1	0%				oa	1	1%			
eu	1	0%				ua	1	1%			
ey	1	0%				ui	1	1%			
ie	1	0%									
oi	1	0%									
ow	1	0%									
Total	265			153			164			264	

Table F6

/ʌ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
e	22	61%	e	6	30%	e	16	52%	e	32	44%
ai	3	8%	ee	5	25%	ee	8	26%	i	29	40%
i	3	8%	ai	3	15%	i	5	16%	ee	2	3%
ee	2	6%	ow	3	15%	ea	1	3%	ow	2	3%
oa	2	6%	au	2	10%	ow	1	3%	ae	1	1%
ea	1	3%	ei	1	5%				au	1	1%
eae	1	3%							ea	1	1%
ei	1	3%							ew	1	1%
oy	1	3%							ie	1	1%
									oa	1	1%
									uy	1	1%
Total	36			20			31			72	

Table F7

/ɔɪ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ou	9	35%	o	3	23%	ou	4	57%	o	16	42%
o	6	23%	ou	2	15%	oui	2	29%	oe	4	11%
oo	3	12%	ai	1	8%	oa	1	14%	ou	3	8%
oe	2	8%	ay	1	8%				ow	3	8%
ue	2	8%	i	1	8%				ay	2	5%
ay	1	4%	oa	1	8%				oui	2	5%
ey	1	4%	oe	1	8%				ouy	2	5%
oa	1	4%	oui	1	8%				a	1	3%
oei	1	4%	u	1	8%				e	1	3%
			ue	1	8%				oa	1	3%
									u	1	3%
									ue	1	3%
									uy	1	3%
Total	26			13			7			38	

Table F8

/o/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
oo	55	52%	oo	21	47%	oo	29	55%	oo	28	52%
u	27	26%	u	15	33%	u	10	19%	u	20	37%
a	13	12%	a	3	7%	a	6	11%	a	3	6%
au	3	3%	au	2	4%	au	3	6%	i	2	4%
oi	3	3%	e	2	4%	e	2	4%	e	1	2%
e	2	2%	ao	1	2%	aw	1	2%			
eo	1	1%	ea	1	2%	oi	1	2%			
ew	1	1%				oy	1	2%			
Total	105			45			53			54	

Table F9

/ɔ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
ao	2	18%	u	3	75%	u	6	46%	u	51	75%
e	2	18%	ao	1	25%	oa	5	38%	i	5	7%
oa	2	18%				ao	1	8%	oa	5	7%
u	2	18%				i	1	8%	ae	2	3%
ae	1	9%							oe	2	3%
ow	1	9%							ai	1	1%
uo	1	9%							ay	1	1%
									iau	1	1%
Total	11			4			13			68	

Table F10

/æ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
e	49	29%	ai	29	20%	u	27	22%	e	48	38%
u	45	26%	u	28	19%	e	24	20%	ai	21	17%
ai	28	16%	o	21	15%	o	18	15%	i	21	17%
i	11	6%	e	18	13%	ai	15	12%	ea	12	10%
o	10	6%	i	10	7%	i	11	9%	u	12	10%
ay	6	4%	y	7	5%	ae	7	6%	o	5	4%
ea	3	2%	ea	5	3%	ea	4	3%	ae	4	3%
oe	3	2%	ae	4	3%	ou	4	3%	ie	2	2%
ou	3	2%	ee	4	3%	ee	2	2%	y	1	1%
ae	2	1%	ao	3	2%	ei	2	2%			
ee	2	1%	ay	3	2%	ue	2	2%			
ei	2	1%	ei	3	2%	aw	1	1%			
y	2	1%	ou	3	2%	ay	1	1%			
eu	1	1%	aw	2	1%	ie	1	1%			
ia	1	1%	oa	2	1%	oo	1	1%			
oa	1	1%	ia	1	1%	y	1	1%			
ow	1	1%	ie	1	1%						
ui	1	1%									
Total	171			144			121			126	

Table F11

/aɪ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	32	65%	a	15	60%	a	5	56%	a	15	58%
e	5	10%	ea	3	12%	au	2	22%	e	4	15%
ea	4	8%	au	2	8%	ao	1	11%	ea	3	12%
ao	2	4%	e	2	8%	ea	1	11%	ey	1	4%
aw	2	4%	o	1	4%				o	1	4%
oy	2	4%	ou	1	4%				ow	1	4%
ew	1	2%	u	1	4%				u	1	4%
oo	1	2%									
Total	49			25			9			26	

Table F12

/aʊ/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
a	41	79%	a	32	84%	a	21	78%	a	24	45%
e	5	10%	o	3	8%	o	3	11%	u	14	26%
u	4	8%	e	2	5%	e	2	7%	o	12	23%
ee	1	2%	i	1	3%	i	1	4%	ai	1	2%
o	1	2%							e	1	2%
									ea	1	2%
Total	52			38			27			53	

Table F13

/a/ sound spelling errors

ESL Beginning			ESL Intermediate			ESL Advanced			Native English		
Error	N	%	Error	N	%	Error	N	%	Error	N	%
u	3	43%	u	9	60%	u	6	60%	u	19	56%
e	1	14%	oi	3	20%	oe	1	10%	oi	7	21%
oi	1	14%	e	1	7%	oi	1	10%	ow	2	6%
oo	1	14%	oo	1	7%	oo	1	10%	ao	1	3%
uy	1	14%	oy	1	7%	oa	1	10%	e	1	3%
									i	1	3%
									oo	1	3%
									oy	1	3%
									oa	1	3%
Total	7			15			10			34	

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