

ANALYZING SPELLING PERFORMANCE AMONG NATIVE SPANISH-
SPEAKING ENGLISH LANGUAGE LEARNERS UTILIZING LATENT CLASS
ANALYSIS AND CONTEXTUAL FACTORS

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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August 2018

Major Subject: Curriculum and Instruction

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ABSTRACT

English language learners (ELLs) make up an increasingly large portion of the population in American schools. Improving the literacy skills of these students is critical to their life-long success as these students have lower performance and higher dropout rates than their native English-speaking peers. The orthographic differences between Spanish and English present a unique challenge for native Spanish-speaking ELLs, and understanding the effects of the Spanish orthography on the acquisition of literacy skills in English is a critical step to improving these students' literacy. Spelling is a crucial literacy skill as it affects one's ability to read, write, and complete daily tasks.

This study examined the English and Spanish spelling performance of 209 native-Spanish speaking ELLs in Grades 4 and 5. Students completed an English spelling inventory and a Spanish spelling inventory, each of which contained 25 spelling words. The words were examined for errors, and analyzed using latent class analysis, a 7-point spelling rubric, and feature analysis, which was included with each spelling inventory. The teachers of the participants were interviewed to determine ways in which the spelling instruction and assessment students receive in the classroom impact their spelling performance.

The spelling errors made by the native Spanish-speaking ELLs were indicative of the orthographies. Additionally, ELLs appeared have an advantage when learning to spell in English where consistencies exist between the two orthographies. However, these students do still struggle when inconsistencies arise. These students made English-

influenced errors when spelling in their native language, Spanish, indicating that they do not have a firm grasp on the differences between the two orthographies.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Wijekumar, and my committee members, Dr. Cantrell, Dr. Viruru, and Dr. Luo, for guiding and supporting me through the duration of this dissertation.

Thank you, Dr. Wijekumar, for taking me on as your student and providing me with incredible mentorship and guidance. The knowledge and experience you have helped me obtain has made me grow as a researcher and as a person. I am extremely grateful for the opportunity to work with you.

I would also like to thank the faculty and staff in the department of Teaching, Learning, and Culture, and the department of Educational Psychology for their support during my many years of education at Texas A&M University. I would also like to thank Texas A&M University for allowing me to stay and continue my education for so long.

Thank you to my parents for supporting said long stay at the university. Also, thank you for always setting high expectations for me and providing immense support in order for me to meet those expectations.

Beyond effort and commitment, completing this research required a lot of time – much of which was borrowed from my social life. Thanks to my brother and sister for being the kind of best friends who still love me through extended periods of time without being able to get together. Knowing that both of you are in my corner has provided me with a great deal of comfort.

Thanks to my best teammate for always believing in me, and in my dreams, even when it was next to impossible for me to do so. Thank you for never letting me give up or forget why I started. Thanks for your unwavering support and encouragement, and for always celebrating the victories, big and small.

Thanks to my friends and BGP buddies for commiserating with me during the tough times, and for the laughs and memories during the great times. Thanks to BGP for showing me how awesome it is to work on something close to my heart with truly amazing people.

Finally, thanks to my most fuzzy, loyal, and precious friend, Porter, who has provided me with comfort, unconditional love, and perfectly timed breaks for runs and games of fetch.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supported by a dissertation committee consisting of Dr. Kausalai Wijekumar (advisor), Dr. Emily Cantrell, and Dr. Radhika Viruru of the Department of Teaching, Learning, and Culture, and Dr. Wen Luo of the Department of Educational Psychology.

Dr. Wijekumar made the data collection for this research possible and enjoyable. The interrater reliability was calculated using the independent codes of Samantha Meister of the Department of Teaching, Learning, and Culture.

All other work conducted for the dissertation was completed independently by the student.

Funding Sources

No outside funding contributions were made to this research.

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CHAPTER 1

INTRODUCTION

National Representation

The fastest growing sub population in American schools today is Spanish-speaking English language learners (ELLs). According to the National Center for Educational Statistics (NCES; NCES, 2016), ELLs represented 9.3 percent (4.5 million students) of all students in K–12 public schools in America for the 2013–2014 school year. Of those 4.5 million ELLs, 3.8 million, or 76.5 percent, reported Spanish as their home language (NCES, 2016).

These native Spanish-speaking ELLs score lower in reading than their native English-speaking peers on the National Assessment of Educational Progress (NAEP; NCES, 2010). Unsurprisingly, these students also have the highest dropout rate in the nation (NCES, 2007). Improving these students' English literacy skills may alleviate a large portion of the difficulties these students face in school and in everyday life. However, ELLs are typically excluded from large-scale research studies examining literacy development (Rickard Liow & Lau, 2006). Investigating the literacy development, including spelling, among these students will lead to an increased understanding of how to best educate and support them, which is crucial to increasing their English literacy skills and chances for academic success.

Orthographic Differences

For Spanish-speaking ELLs, learning English may be more difficult than Spanish due to the differences in orthographic depth. Spanish is a transparent orthography in

which grapheme-phoneme correspondences are highly regular and consistent, making reading a relatively easy task. Whereas phoneme-grapheme correspondences in Spanish may be more complex than grapheme-phoneme correspondences (Defior, Gutierrez-Palma, & Cano-Marin, 2011; Serrano & Defior, 2010), making spelling more difficult than reading, these correspondences are still much more consistent than phoneme-grapheme correspondences in the deeper, more opaque English orthography.

The orthographic depth of English makes reading and spelling difficult to learn; this may be particularly true for native Spanish speakers who are accustomed to a more consistent orthography. For example, in Spanish, each of the five vowels (*a*, *e*, *i*, *o*, and *u*) makes only one sound (Defior, Jimenez-Fernandez, & Serrano, 2009). However, in English, these same letters may make different sounds depending on the letter position and the word. For example, in a closed syllable, the letter *o* makes the short sound (e.g., *got*), whereas in an open syllable, the letter *o* may make the long sound (e.g., *go*).

While the grapheme-phoneme relationships in Spanish are very consistent (Gaintza & Goikoetxea, 2016), the language does have some inconsistent phoneme-grapheme relationships (e.g., *y* and *ll* represent the same sound; *b* and *v* represent the same sound). However, most of these inconsistencies are consonant-based, with vowels remaining more consistent.

In addition to containing more grapheme-phoneme inconsistencies than Spanish, English is also more inconsistent in phoneme-grapheme relationships. For example, the long *o* sound (/ō/) may be represented by several different graphemes (e.g., *o*, *oa*, *oe*,

ow). Many of the inconsistencies that add to the orthographic depth in English are vowel-based inconsistencies.

For Spanish-speaking ELLs, the unfamiliar inconsistencies of the English orthography may make spelling in English particularly difficult. In addition to learning new letter sounds, these individuals must also learn the complex history of the English language, which contributes to the frequent inconsistencies in the relationships between graphemes and phonemes (Henry, 1988; Moats, 2005).

Relation of Spelling to Reading

As a strong relationship exists between spelling and reading (Berninger, Abbott, Abbott, Graham, & Richards, 2002; Ehri, 2000; Graham & Hebert, 2011; Graham & Satangelo, 2014; Pittman, Joshi, & Carreker, 2014; Shanahan, 2006; Shankwiler, Lundquist, Dreyer, & Dickinson, 1996), understanding the English spelling errors made by native Spanish-speaking ELLs is an important factor of improving literacy among these students.

An individual's spelling abilities are indicative of their knowledge of the alphabetic principle, which allows them to master the relationships between letters or graphemes and sounds (Joshi, Treiman, Carreker, & Moats, 2008). Spelling also impacts an individual's decoding abilities during reading, allowing them to sound out new and unfamiliar words. As spelling impacts reading abilities, it is reasonable that appropriate, formal spelling instruction improves reading (Berninger et al., 2002; Graham & Hebert, 2011).

Purpose of Study

The purpose of this study is to examine spelling errors in English and Spanish made by English language learners (ELLs) in elementary school whose native language is Spanish. The specific error types made and the influence of the Spanish orthography on the English spelling of ELLs will be examined. Specific spelling instruction may be recommended to improve English literacy among Spanish-speaking ELLs by studying the nature of the spelling errors made by these individuals.

CHAPTER II

LITERATURE REVIEW

Orthographic Impact

According to the Orthographic Depth Hypothesis (ODH), the features of an orthography can have an effect upon reading processes (Katz & Frost, 1992). In a deep orthography, it is expected to be more difficult to master reading and writing skills compared to a more shallow, transparent orthography, as shallow orthographies are characterized by consistent relationships between graphemes and phonemes. Because the orthographical characteristics, including grapheme-phoneme correspondences, vary, the orthographic depth and features of an individual's first language (L1) impacts their literacy skills and acquisition in a second language (L2; Dixon, Zhao, & Joshi, 2010; Figueredo, 2006; Wang & Geva, 2003; Zhao, Quiroz, Dixon, & Joshi, 2016).

Spanish orthography. Spanish is a transparent orthography made up of 27 letters and two digraphs (*ch* and *ll*), which represent 29 graphemes and 24–25 phonemes with highly consistent grapheme-phoneme correspondences (Gaintza & Goikoetxea, 2016). That is, letters or graphemes consistently make the same sound when reading in Spanish. For example, each of the five vowels – *a*, *e*, *i*, *o*, and *u* – only make one sound (Defior et al., 2009). However, consonants are not as strictly consistent as vowels. For example, *c* may make the /k/ or /s/ sound depending on the context.

While still relatively transparent, phoneme-grapheme relationships are more inconsistent than grapheme-phoneme relationships. For example, some sounds may be represented by more than one letter or grapheme (e.g., /b/ can be represented by *b*, *v*, and

w; /y/ can be represented by both *ll* and *y*; Defior, Gutierrez-Palma, & Cano-Marin, 2012; Gaintza & Goikoetxea, 2016; Serrano & Defior, 2012). Therefore, when a sound that may be represented by more than one letter or grapheme is heard, it may be difficult for spellers to determine which letter or grapheme to use. These inconsistencies are more prevalent among consonants than vowels (Gaintza & Goikoetxea, 2016), which may result in Spanish speakers experiencing more difficulties with spelling consonant sounds.

Whereas Spanish does have inconsistencies in both grapheme-phoneme relationships and phoneme-grapheme relationships, these inconsistencies are limited. This limited amount of irregularities contributes to the well-known relative ease with which one may learn to read and spell in Spanish compared to a more opaque orthography such as English (Ardila, Garcia, Garcia, Mejia, & Vado, 2017).

English orthography. The English orthography is considered to be a deep orthography, as there are many grapheme-phoneme and phoneme-grapheme inconsistencies (Perfetti & Dunlap, 2008). With 26 letters and about 41 phonemes (National Institute of Child Health and Human Development, 2000), it is easy to see how complex and inconsistent the relationships between phonemes and graphemes may be.

Unlike the Spanish orthography, these inconsistencies are present in reading and spelling, and include vowels and consonants. Because of the frequent inconsistencies among vowel sounds in English, which are not common in Spanish, it is reasonable that native Spanish-speaking ELLs have more difficulty reading and spelling vowel sounds in English than in Spanish.

In addition to an increased amount of inconsistencies between phonemes and graphemes, English words are often spelled in a way that relates to and is explained by the origin language of the word (Moats, 2005). Many of the spelling inconsistencies are due to the influence of different languages including Anglo-Saxon, Latin, Norman-French, and Greek (Henry, 1988; Moats, 2005). Because of the varying historical origins of words in the English language, an understanding of the history of the language and word origins is necessary to be an efficient speller (Henry, 1988). This poses a particular challenge for native Spanish-speaking ELLs as they likely have not been exposed to the history of the English language.

Importance of Spelling

Spelling plays an important role in tasks including reading, finding words in a dictionary, completing filing tasks, and writing academic papers, letters, emails, and text messages, to name a few. The spelling of words, together with meanings and derivations, create a solid foundation for both reading and writing (Treiman, 1998).

Impact of spelling on reading. The impact of spelling on reading arguably begins with the alphabetic principle – the relationship between letters and sounds – as an individual’s spelling abilities are indicative of their knowledge of the alphabetic principle (Pittman, Joshi, & Carreker, 2014). With knowledge of the relationships between letters and sounds, Treiman (1998) highlights that spelling improves children’s reading by increasing their ability to focus on the sounds present in spoken words. This allows readers are able to decode and read new and unfamiliar words.

In a study examining whether spelling-sound rules affect phonological recoding in fluent reading, Treiman, Freyd, and Baron (1983) found that individuals struggled with sentences that contained multiple words with similar spellings but different pronunciations (e.g., *nasty*, *hasty*). The individuals in this study applied the same spelling-sound correspondences to both words in the sentence, even though they were not both pronounced the same way. These results highlight the need for explicit spelling instruction to increase students' abilities to accurately decode words.

According to the Theory of Automaticity (Lagerge & Samuels, 1974), as decoding becomes more automatic, and thus not requiring attention for processing, individuals are able to increase their reading fluency and devote attentional and cognitive resources to text comprehension, which is the well-known ultimate goal of reading.

Following this logic, it is reasonable that spelling has been shown to be predictive of reading development and reading abilities in higher grades among monolingual and bilingual individuals (e.g., Abbott, Berninger, & Fayol, 2010; Bahr, Silliman, Danzak, & Wilkinson, 2015; Caravolas, Hulme, & Snowling, 2001; Chua, Rickard, Liow, & Yeong, 2016; Desimoni, Scalisi, & Orsolini, 2012; Ehri, 2000). Additionally, formal spelling instruction has been shown to significantly increase students' reading skills across Grades K–12 (Graham & Satangelo, 2014).

Evaluating the spelling performance among native Spanish-speaking ELLs will shed light on instructional practices that may best help these students improve their spelling skills and, in turn, their reading skills.

Impact of spelling on writing. In addition to the impact spelling has on reading, spelling also impacts the writing abilities of individuals. According to the Simple View of Writing (SVW), transcription skills, including spelling, serve as the building blocks for children's writing development (Berninger et al., 2002; Satangelo & Graham, 2015). Similar to the Theory of Automaticity in reading (LaBerge & Samuels, 1974), when children struggle with spelling, their text transcription lacks fluency, thus requiring more cognitive resources be devoted to spelling (Moats, 2005). These cognitive demands inhibit other writing processes and impede writing fluency and quality (Graham, Harris, & Hebert, 2011; Satangelo & Graham, 2015). Additionally, writers tend to include only words they know how to spell in their writing, thus limiting their written vocabulary (Moats, 2005).

The use of keyboarding for text transcription has increased as computers have become increasingly prevalent in classrooms. With the increased use of technology in the classroom, a common argument for the use of spellcheck software has arisen. However, spellcheck is not able to detect every spelling mistake; for instance, if a word is not spelled closely enough to the target word, the spell check software is unable to provide an appropriate correction. Furthermore, if the spell check software does provide a list of corrections, the user must be able to recognize the appropriate spelling of the target word (Moats, 2005). Assuming a spell-checking software was able to perfectly correct spelling errors, it would not correct grammatical errors. For example, if the writer misspells the target word *where* as *wear* or *were*, the spell check software would not catch the error, as the misspelling is actually an accurately spelled word.

Additionally, writers would still experience difficulties trying to determine how to appropriately spell the word the best they can, which would still impede writing fluency. Furthermore, the concern of using a limited vocabulary while writing due to spelling difficulties would still be present.

While text transcription difficulties negatively impact writing quality, they also negatively impact others' perceptions of the writer's abilities (Satangelo & Graham, 2015). Graham et al. (2011) refer to this as the Presentation Effect. Under the Presentation Effect, non-content factors, including spelling errors, negatively influence the reader's perception of written quality (Satangelo & Graham, 2015). The negative perceptions of the writer's abilities caused by spelling leads the rater to assign a paper with poor spelling a lower grade than a paper with accurate spelling, even though the two papers contain the same content (Satangelo & Graham, 2015). An additional concern highlighted by Satangelo and Graham (2015) is the tendency for raters to not fully read all of the text if it is poorly spelled and difficult to decipher; thus, the rater assigns a grade after having read only part of the written work.

Whether through the act of writing, or through others' perception of the writer's competency based on one's spelling abilities, spelling impacts the writing success of an individual.

Impact of spelling on life success. In addition to reading and writing, spelling also impacts long-term life success. Similar to the Presentation Effect (Graham et al., 2011), individuals who hire employees may have negative perceptions of an applicant's abilities and intellect if the applicant's resume contains spelling errors. Once an

individual is part of the work force, their spelling difficulties may negatively impact their business by ways of losing clients due to poorly spelled written communications or presentations.

Outside of the business world, poor spelling may impact daily tasks, such as writing checks or addressing envelopes, causing mail to be sent to the wrong address. As spelling is part of everyday life, poor spelling will continue to negatively impact an individual's life success.

Spelling Analysis

Spanish spelling. The shallow orthography of Spanish allows for spelling to be learned relatively easily. As previously mentioned, most of the irregularities in Spanish are consonant-based phoneme-grapheme inconsistencies, rather than vowel based. Because of this, students tend to make more errors involving consonants than vowels when spelling in Spanish (Joshi et al., 2016; Manrique & Signorini, 1994; Sun-Alperin & Wang, 2008).

Joshi et al. (2016) examined the Spanish spelling performance of 166 Spanish-speaking children in Grades K–3. The results showed that between kindergarten and first grade, students' vowel-based spelling errors decreased by more than 50 percent. This finding indicates the relative ease with which the spelling of vowel sounds is learned in Spanish. Additionally, the authors found that the predominant error type across all grade levels was consonant substitution (e.g., *vufanda* instead of *bufanda*). The findings from this study illustrate the consistency of vowels in Spanish, as well as the difficulties children experience with consonant-based inconsistencies.

English spelling. Contrary to Spanish, English has a large amount of vowel-based inconsistencies, which contribute to the orthographic depth of English. These inconsistencies result in a larger amount of vowel-based spelling errors when spelling in English (Manrique & Signorini, 1994; Sun-Alperin & Wang, 2008).

Difficulty with vowels (specifically, medial vowels) was found by Lee and Al Otaiba (2016) in their study examining the English spelling performance of 430 native English-speaking children in kindergarten. In addition to these vowel errors, the authors also found that 90% of the students struggled to accurately spell consonant clusters due to omission errors. For instance, students omitted the first consonant in final consonant clusters (CVCC) and the second consonant in initial clusters (CCVC). These errors are indicative of the orthographic depth of English.

These findings highlight the inconsistencies among vowels and consonants in English. Whereas the individuals spelling in Spanish experience difficulty mainly due to consonant-based irregularities, English contains many consonant- and vowel-based irregularities.

English language learners' spelling. English language learners face a particular challenge when learning to spell in English. These individuals must learn the complex rules of English, which may contradict the rules they have previously learned in their native language. Thus, their L1 spelling skills may negatively affect their L2 spelling development.

Dixon et al. (2010) examined the influence of bilingual children's L1 orthography on their L2 spelling performance in English. The authors found that

children learning English with a shallow L1 (e.g., Spanish) are likely to apply phoneme-grapheme correspondences from their L1 until they are able to master the more complex English spelling. That is, with a shallow L1 background, these students may spell phonetically, or represent the sounds they hear with more simple graphemes.

These findings align with the findings of Figueredo's (2006) meta-analysis of 27 studies, which assessed the effects of students' L1 on their development of spelling in English. Figueredo found that students relied on phonological knowledge from their first language to guide their English spelling. Additionally, the author highlighted that, because ELLs' phonetic knowledge from Spanish provides them with an advantage where similarities exist (i.e., letters make the same sound), instruction in both English and Spanish is beneficial for these students until the complex rules of English are learned.

Rolla San Francisco, Mo, Carlo, August, and Snow (2006) also found that Spanish-English bilingual learners made Spanish-influenced errors when spelling in English. While Spanish literacy instruction was found to have the largest impact on Spanish-influenced English spelling, the authors also found that students with better Spanish vocabularies produced more spellings influenced by Spanish.

These findings indicate that the English spelling errors made by native Spanish-speaking ELLs will likely reflect the orthographic features of Spanish. With appropriate instruction and time, ELLs may reach spelling levels comparable to those of native English-speaking monolinguals (Lesaux, Koda, Siegel, & Shanahan, 2006; Zhao et al., 2016).

Spelling has not received as much research attention as reading (Gaintza & Goikoetxea, 2016; Zhao et al., 2016). However, examining the spelling performance among ELLs whose L1 orthography has different characteristics and depth from English (their L2) can help differentiate between errors that are made due to the influence of their L1 and errors that are possibly due to learning disabilities (Dixon et al., 2016). Additionally, considering the relationship between spelling and reading and writing (Berninger et al., 2002; Ehri, 2000; Graham & Hebert, 2011; Graham & Satangelo, 2014; Pittman et al., 2014; Shanahan, 2006; Shankwiler et al., 1996), further research on spelling, including specific types of spelling errors made by individuals, will be beneficial in better understanding the instructional needs of students and determining effective instruction to increase literacy skills (Gaintza & Goikoetxea, 2016; Joshi et al., 2008).

CHAPTER III

METHODS

Description of Study

English and Spanish spelling errors committed by native Spanish-speaking ELLs in Grades 4 and 5 were evaluated and analyzed using feature and latent class analysis (LCA). LCA is used to discover hidden categories or classes within the data and estimate the likelihood of membership for each category (Muthén & Muthén, 2009; Nylund, Asparouhov, & Muthén, 2007). Feature analysis, which is included in the spelling inventories, examines the orthographical features present in each word in the spelling inventory; this information was utilized to determine the influence of the Spanish orthography on the English spelling among the ELL participants. A spelling rubric was used to assess the phonemes represented in the participants' spelling of the target words.

In addition to analyzing the spelling errors made by the participants, the demographic information for the participants was collected, and the teachers of the participants were interviewed. The teacher interviews investigated the spelling instruction and assessment the participants receive in the classroom. The interviews were used to determine the ways in which these factors impact the participants' spelling performance.

Research questions. This study is designed to explore the ways in which the Spanish orthography and contextual factors such as classroom instruction impact the English spelling of ELLs. The research questions that guided the current study are: 1) Do differences exist among consonant-based errors in English and in Spanish? 2) Do

differences exist among vowel-based errors in English and in Spanish? 3) How do the features of the Spanish orthography impact the English spelling of ELLs? 4) Do classroom factors impact students' spelling performance? Participants' spelling performance in English and Spanish was examined, and the teachers of the participants were interviewed for insight to the spelling instruction the students receive in order to answer the research questions.

Participants

This study included 209 participants in Grades 4 and 5 from an elementary school in Las Cruces, NM. The school is in an area of the state that has a large population of native-Spanish speakers. Seventy-two percent of the students who attend the school are Hispanic, and 57% of the students receive free or reduced priced lunch. The school is made up of 49% females and 51% males, and the student-teacher ratio is 16:1.

The teachers of the participants were interviewed in order to examine the ways in which the instruction and assessment the students receive in the classroom impacts their spelling performance. All of the teachers have more than five years of teaching experience. Two of the 11 teachers have master's degrees, and 9 teachers have bachelor's degrees.

Measures

Spelling inventories. Each student completed the Elementary Spelling Inventory in *Words Their Way: Word Study for Phonics, Vocabulary, and Spelling Instruction* (Bear, Invernizzi, Templeton, & Johnston, 2016) and the Spanish Spelling Inventory in

Palabras a Su Paso: El Estudio de Palabras en Acción (Words Their Way: Word Study in Action; Helman, Bear, Templeton, Invernezzi, & Johnston, 2012). Only one word in the inventories, *civilize*, contains a cognate (*civil*). That is, the word *civil* is present in both English and Spanish. The words from the spelling inventories are displayed in the Appendix.

Teacher interviews. Interview questions were based on gathering information regarding teachers' practices regarding spelling. The interviews were initially to be administered by the author one-on-one with each teacher in person, the teachers' schedules did not allow for such interviews to take place. Therefore, the interview questions were given to each teacher in the form of a survey. The survey consisted of nine questions regarding the nature, duration, and frequency of spelling instruction in the classroom as well as the teachers' perceptions about spelling instruction. For the teacher interviews, the author provided each teacher with the nine interview questions typed and printed on a sheet of paper. Each teacher wrote their answers to the open-ended interview questions on their own time and gave the completed survey to the author. The surveys were completed at the beginning of February 2018. The interview questions can be found in the Appendix.

Scoring

Latent class analysis. For the latent class analysis, the spelling errors were coded dichotomously. Because the dichotomous coding of spelling words (i.e., each word is marked as correct or incorrect) limits the knowledge that can be gained from students' spelling errors (Figueredo, 2006), specific and distinct spelling error categories

were utilized in this study. Based upon past research (e.g., Joshi et al., 2016; Lindner, Joshi, & Wijekumar, 2017), the eight categories of misspellings that were included in the examination of spelling are: 1) Vowel Omission; 2) Vowel Addition; 3) Vowel Substitution; 4) Vowel Sequence; 5) Consonant Omission; 6) Consonant Addition; 7) Consonant Substitution; 8) Consonant Sequence. Using the same eight error categories to examine the spelling errors in both English and Spanish allowed for a direct comparison between the types of errors made in each language.

Error examples. Examples of each error type are displayed in Table A-1.

Vowel omission. A vowel omission error is committed when the student leaves out a vowel in the spelling of a word. For example, if the student spelled *train* as *tran*, omitting the *i*, the student has committed a vowel omission error.

Vowel addition. Contrary to vowel omission, vowel addition errors occur when the student includes a vowel that is not in the accurate spelling of the word. For example, if the student spelled *ripen* as *riepen*, adding an extra *e*, the student committed a vowel addition error.

Vowel substitution. A vowel substitution error occurs when the student includes the incorrect vowel in the spelling of a word. For example, if the student spelled *shower* as *shawer*, including an *a* instead of an *o*, the student has made a vowel substitution error.

Vowel sequence. A vowel sequence error is committed when the student includes the appropriate vowels in the word, but in the incorrect sequence. For example, if the

student spelled *pleasure* as *plaesure*, reversing the order of the *e* and the *a*, the student has made a vowel sequence error.

Consonant omission. A consonant omission error occurs when the student omits a consonant in the spelling of a word. For example, if the student spelled *shopping* as *shoping*, leaving out a *p*, the student committed a consonant omission error.

Consonant addition. A consonant addition error is committed when the student includes a consonant in the word that is not in the accurate spelling of the word. For example, if the student spelled *ripen* as *rippen*, adding a *p* to the word, the student has made a consonant addition error.

Consonant substitution. A consonant substitution error occurs when the student includes the incorrect consonant in the spelling of a word. For example, if the student spelled *place* as *plase*, substituting an *s* for the *c*, the student has committed a consonant substitution error.

Consonant sequence. A consonant sequence error is committed when the student includes the appropriate consonants in the word, but in the incorrect order. For example, if the student spelled *bright* as *brihgt*, reversing the order of the *g* and the *h*, the student has made a consonant sequence error.

Data preparation. The words spelled by each student were examined using the aforementioned spelling error categories. If the student committed an error in a given category, the student was given a score of 1 for that error category; if the student did not commit an error in a given category, the student was given a score of 0 for that error category. For example, using the Vowel Omission example from above, if the student

spelled *different* as *diffrent*, omitting the first *e*, a score of 1 was provided for the Vowel Omission error category.

All of the spelling words were independently examined and coded by two coders. The interrater reliability was 0.93. After coding the words separately, the two coders then met and discussed each word on which we disagreed, and adjustments were made for the final coding of the words.

Feature analysis. For the *Words Their Way* Elementary Spelling Inventory, 12 specific orthographical features are included: 1) Initial Consonants; 2) Final Consonants; 3) Short Vowels; 4) Digraphs; 5) Blends; 6) Long Vowels; 7) Other Vowels; 8) Inflected Endings; 9) Syllable Junctures; 10) Unaccented Final Syllables; 11) Harder Suffixes; 12) Bases or Roots.

For the *Palabras a su Paso* Spanish Spelling Inventory, nine orthographical features are included: 1) Vocal Prominente (Prominent Vowel); 2) Consonante Prominente (Prominent Consonant); 3) Vocales/Consonantes (Vowels/Consonants); 4) Representación de Sonidos (Sound Representation); 5) Dígrafos, Sílabas Cerradas (Digraphs, Closed Syllables); 6) Contrastes, Letras Mudas (Contrasts, Silent Letters); 7) Diptongos Homófonos (Diphthongs Homophones); 8) Tildes, Plurales, Afijos (Tildes, Plurals, Affixes); 9) Raíces (Roots).

In each of the spelling inventories, the student received a point for each of the correctly represented features present in the target word. The student received a score of 0 for any of the features in the target word that were absent or misrepresented in the spelling. For example, if the student spelled *when* as *wen*, the student received a point

for the correct short vowel, *e*, and a point for the correct final consonant, *n*. However, the student received a score of zero for the incorrectly represented digraph, *wh*, as the *h* was not included in the spelling (Bear et al., 2016).

After scoring each of the words in the spelling inventories, the earned points for each feature were totaled at the bottom of the respective column on the feature guide. The feature points were used to determine the approximate spelling stage of the student. The spelling stages included in the feature guide for both the English and Spanish spelling inventories are: 1) Emergent; 2) Letter-Name Alphabetic; 3) Within Word Pattern; 4) Syllables and Affixes; 5) Derivational Relations. The spelling stages are broken down further into Early, Middle, and Late, indicating where in a given spelling stage the student may be. For example, if the student received 7 out of 7 possible points for Initial and Final Consonants, the student has mastered the emergent spelling stage. However, if the student received all of the possible points for Short Vowels, most of the possible points for Long Vowels, and received some points for Other Vowels, the student was scored in the middle of the Within Word Pattern spelling stage (Bear et al., 2016).

For *Words Their Way: Word Study for Phonics, Vocabulary, and Spelling Instruction*, the reliability was found to range from .931–.974, the predictive validity was found to range from .135–.706 for Grades 2–5, and the concurrent validity was found to range from .384–.692 for Grades 2–5 (Sterbinsky, 2007).

Spelling rubric. The rating scale created by Tangel and Blachman (1992) was used to analyze the participants' spelling. Rather than simply counting each spelling

word as correct or incorrect, the spelling rubric examines the phonemes represented in the participants' spelling of the target words. The participants are able to earn a score ranging from 0–6 for each spelling word. A score of 0 indicates the participant included a random string of letters while a score of 6 indicates the correct conventional spelling of the word. The point values assigned to each word increase with the amount of phonemes represented in the spelling. As there are 25 spelling words in English and 25 in Spanish, the total possible score on the spelling rubric is 150 points in each language. The spelling rubric, including the rationale for each point value, can be found in the Appendix.

The scores on the 7-point spelling rubric were summed and recoded in order to allow for better comparisons across orthographies and measurements. Scores ranging from 0–15 were recoded as 1, scores ranging from 15–30 were recoded as 2, scores ranging from 31–45 were recoded as 3, scores ranging from 46–60 were recoded as 4, scores ranging from 61–75 were recoded as 5, scores ranging from 76–90 were recoded as 6, scores ranging from 91–105 were recoded as 7, scores ranging from 106–120 were recoded as 8, scores ranging from 121–135 were recoded as 9, and scores ranging from 136–150 were recoded as 10. Including 10 new scores in the recoding instead of only three (e.g., *low*, *medium*, *high*) allowed for more information about the scores to be kept and for the new scores to be more accurately compared.

This 7-point rating scale was found to be highly reliable ($r = .98$; Tangel & Blachman, 1992).

Procedures

The author administered the English spelling inventory and the participants' teachers administered the Spanish spelling inventory in February 2018 during the school day in the participants' classrooms. The spelling inventory administrator stood at the front of the students' regular classroom and called out the words to the students. The students were supplied with a sheet of lined paper, numbered 1–25 on the both front and back in order to separate the English and Spanish spelling words. Students wrote down the spelling of each word called out in pencil; this method was used instead of keyboarding to ensure that any misspellings were due to spelling errors rather than possible typing mistakes. The spelling inventories completed by participants were examined and evaluated for errors.

The teacher was handed the interview questions while the students were completing the spelling inventory. The survey was completed by the teacher and returned to the author at the end of the school day.

Data Analysis

Analytic process for latent classes. After all of the data were coded, and the binary indicators were created, latent class analysis (LCA) was run in order to discover distinct, hidden categories within the data sample. In addition to discovering the categories, LCA also estimates the likelihood of membership for each category (i.e., the probability of each student belonging to each discovered class; Muthén & Muthén, 2009; Nylund et al., 2007).

Mplus version 7.4 (Muthén & Muthén, 2012–2015) was used to run LCA. In order to determine the number of classes with the best model fit, information criteria-based fit statistics, entropy, and model comparisons likelihood ratio tests were used. Error type frequencies, descriptive statistics, and correlations were determined using SPSS.

Information criteria-based fit statistics. Latent class analysis was run multiple times, each with a different number of classes. Each time LCA was run, fit statistics were examined to determine the best model. The goodness of fit indices that were used are: Aikake information criterion (AIC), Bayesian information criterion (BIC), and Sample-size adjusted BIC (SSA-BIC). Smaller values for these statistics indicate a better model fit (Singer & Willett, 2003). That is, the LCA model with the smallest values for these indices was considered to best fit the data.

Entropy. The entropy statistic, which ranges from 0 to 1, indicates the accuracy of the classification of individuals. The higher the entropy value is for a model, the better the individuals are classified (Muthén & Muthén, 2009) or placed in a discovered class.

Model comparisons likelihood ratio tests. The Lo-Mendell-Rubin likelihood-ratio test (LMR; Lo, Mendell, & Rubin, 2001) and the Bootstrapped likelihood ratio test (BLRT) were used to compare neighboring models (e.g., a model with two classes vs. a model with three classes). A result of a nonsignificant value on these model comparisons likelihood ratio tests indicates that the model with one fewer classes best fits the data (Muthén & Muthén, 2009). That is, if the p -value of the model with four classes is nonsignificant, the model with three classes is a better fit for the data.

Analytic process for features. The feature analysis included in each of the spelling inventories was used to analyze the accurate representation of specific orthographical features in each spelling word completed by each participant. After each individual word was analyzed for orthographical features, the students' performance on orthographical features throughout the entire 25-word spelling inventory was used to determine the current spelling stage of each student. Feature analysis was completed for both the English and Spanish spelling inventories.

After the orthographical features and spelling stages for each student were determined for the Spanish and English spelling inventories, the results from the Spanish spelling inventory were compared to the results from the English spelling inventory. The comparison between the Spanish and English spelling inventories assisted in determining the influence of the Spanish orthography on the students' spelling in English.

Analytic process for spelling rubric. The spelling rubric was used to analyze the phonemes present in the students' spelling of the target words. The students' performance on the spelling rubric in English and Spanish was compared in order to determine the impact of Spanish phonemes, or sounds present in the words, on the students' English spelling.

Analytic process for teacher interviews. After the surveys from each teacher were completed, the author entered the responses into an excel spreadsheet. The teachers' responses were read and analyzed for recurring themes as well as specific details from each teacher regarding how spelling was taught in their classroom. Themes

that were looked for in the responses include the frequency and duration of spelling instruction as well as the nature of the instruction and spelling activities to which the students are exposed. The type and purpose of spelling assessment was also examined in the responses. Additionally, the teachers' perceptions about spelling were analyzed.

CHAPTER IV

RESULTS

Seventy-two percent of the students who attend the elementary school in Las Cruces, NM are Hispanic, providing a large amount of native Spanish-speaking ELLs. In the elementary school, 57% of the students qualify for free or reduced price lunch. The student-teacher ratio is 16:1, and 49% of the students are females and 51% are males. The English and Spanish spelling performance of 209 students in Grades 4 and 5 were analyzed using latent class analysis, feature analysis, and a spelling rubric; the teachers of the participants were interviewed regarding the spelling instruction and assessment the students receive in the classroom.

Latent Class Analysis

Spelling words were analyzed using eight error categories: 1) Vowel Omission, 2) Vowel Addition, 3) Vowel Substitution, 4) Vowel Sequence, 5) Consonant Omission, 6) Consonant Addition, 7) Consonant Substitution, 8) Consonant Sequence. After the words were coded dichotomously, MPlus (version 7.4) was used to run latent class analysis in order to discover hidden classes among the data, and the class to which each subject belongs. Latent class analysis was used to determine classes based on students and words. In addition to running latent class analysis using these error types, descriptive statistics of each error type in each language were also determined and examined using SPSS.

The most frequently occurring error in English was vowel substitution with 1,148 total errors being made across all words. Ninety-one percent of students made vowel

substitution errors. Omission and substitution were by far the most frequently occurring error types made on both consonants and vowels (vowel omission $n = 718$; vowel substitution $n = 1,125$; consonant omission $n = 782$; consonant substitution $n = 751$). Eighty percent of students made vowel omission errors, 85% made consonant omission errors, and 83% made consonant substitution errors. Sequencing errors on both vowel and consonants were the least occurring errors (vowel sequence $n = 91$; consonant sequence $n = 57$). Thirty-four percent of students made vowel sequence errors while 25% made consonant sequence errors. Overall, English words contained 2,184 vowel-based errors (56.3%) and 1,812 consonant-based errors (43.7%). English error type descriptive statistics are displayed in Table A-2, and the correlations for each error type are displayed in Figure A-1.

Similar to English, omission and substitution errors, made on vowels and consonants, were the most frequently occurring errors in Spanish (vowel omission $n = 1,176$; vowel substitution $n = 1,689$; consonant omission $n = 1,332$; consonant substitution $n = 2,282$). Ninety-two percent of students committed vowel omission errors, 78% made vowel substitution errors, 98% made consonant omission errors, and 98% made consonant substitution errors. Whereas vowel substitution was the single most frequently occurring error category in English, consonant substitution errors were dominant in Spanish. As with the English results, sequencing errors in Spanish, both vowels based and consonant based, were the least occurring errors (vowel sequence $n = 36$; consonant sequence $n = 20$). Sixteen percent of students made vowel sequence errors and 9% made consonant sequence errors. Spanish words contained a total of 3,245

vowel-based errors (42.6%) and 4,371 consonant-based errors (57.4%). The larger amount of consonant-based errors is consistent with the Spanish orthography, as it contains mostly consonant-based inconsistencies. However, the difference in consonant- and vowel-based errors is not as large as what may be expected by native Spanish speakers. Spanish error type frequencies are displayed in Table A-3, and the correlations for each error type are displayed in Figure A-2.

English by student. The student-based classes were determined using the spelling errors made by each student in English. A three-class model was found to be the best fit for the data using information criteria-based fit statistics, entropy, and model comparisons likelihood ratio tests. The comparison of one-, two-, three-, and four-class models can be found in Table A-4. The likelihood of an individual in each class making each error type is displayed in Table A-5. Consistent with the vowel inconsistencies in the English orthography, the most likely error type in all three classes was vowel based. Additionally, two of the three classes also had a 90% chance of making consonant omission and substitution errors. Sequencing errors among both vowels and consonants were the least frequently occurring errors. The number of students in each class is displayed in Table A-6.

Class 1. Class 1 is characterized by a high probability of making omission and substitution errors on both consonants and vowels. That is, the 72 students in this class are highly likely to make those errors. Students in this class were found to have a 0% chance of making a consonant sequence error.

Class 2. Class 2 contains 84 students and is characterized by a high probability of making omission and substitution errors on both vowels and consonants as well as vowel addition errors. While each of these five error types are highly likely to be made by students placed in this class, vowel omission and consonant substitution had the highest probability, with students being 100% likely to make those errors.

Class 3. Class 3 is characterized by a low probability of making any of the eight error types. The 53 students in this class are most likely to make vowel substitution errors, with a probability of .461. As in Class 1, students in Class 3 have a 0% chance of making consonant sequence errors.

Spanish by student. As with the English student-based classes, the Spanish student-based classes were determined using the spelling errors committed by each student in Spanish. Similar to the spelling errors in English, a three-class model was found to be the best fit for the Spanish spelling data. The comparison of one-, two-, three-, and four-class models can be found in Table A-7. The likelihood of an individual in each class making each error type can be found in Table A-8. Consistent with the Spanish orthography, the most likely error type in all three of the classes was consonant based. Similar to the English student-based latent classes, sequence errors were the least frequently occurring errors in Spanish among both vowels and consonants. The number of students in each Spanish class is displayed in Table A-9.

Class 1. Similar to Class 3 in English, Class 1 in Spanish has the smallest amount of students out of the Spanish spelling classes ($n = 5$) and is characterized by a low probability of making any type of error. While the students in this class are not likely to

make any of the eight error types, these students were found to have a 0% chance of making any vowel-based errors as well as consonant sequence errors. The error type with the highest probability in this class is consonant substitution (0.462). While consonant substitution errors are the most likely errors to be made by the students in this class, the probability is still classified as low (> 0.50).

Class 2. Class 2 is the most populated class in the Spanish spelling with 143 students. This class is characterized by a high probability of making omission and substitution errors on both vowels and consonants as well as consonant addition errors.

Class 3. Class 3 is characterized by a high probability of making vowel omission, consonant omission, and consonant substitution errors. While all three of these error types are highly likely to be made by the 61 students in this class, these students were found to have a 100% chance of making consonant omission and consonant substitution errors.

English and Spanish student classes compared. Most of the students were placed in Class 1 in English and Class 2 in Spanish ($n = 56$) and Class 2 in English and Class 2 in Spanish ($n = 52$). These results show that most students had difficulty with omission and substitution errors on both consonants and vowels. Additionally, the 52 students placed in Class 2 in English and Class 2 in Spanish had a high probability of including additional consonants in Spanish and additional vowels in English. This result is consistent with the orthographical differences between Spanish and English as inconsistencies in Spanish are mostly consonant-based and English has a large amount of vowel-based inconsistencies.

No students were placed in Class 2 in English and Class 1 in Spanish. That is, zero students were in both the Spanish class that performed the best, or had a low probability of making any type of error, and the English class that performed the worst, or had a high probability of making the most types of errors. Alternatively, 35 students were placed in Class 3 in English, which had a low probability making any errors, and Class 2 in Spanish, which had a high probability of making the most types of errors among the Spanish classes.

Only one student was placed in Class 3 in English and Class 1 in Spanish. These classes are both characterized by a low probability of making any type of error. The students' membership in English and Spanish latent classes is displayed in Table A-10.

Sequencing errors, among both vowels and consonants, were the least frequently occurring errors in both English and Spanish. This result is not surprising, as sequence errors may be the most difficult error to make of the eight error types. Whereas the other error types (omission, addition, substitution) require only the incorrect representation of a letter, sequence errors require knowledge of the multiple correct vowels or consonants in the spelling of the word, which are then placed in the incorrect order, causing this error type to be more difficult to make. This result is indicative the overall spelling proficiency of the participants. That is, as the most difficult error type was the lowest error type made, the participants' knowledge of the correct letters in a word is low.

Feature Analysis

Cross tabulation tables were run in SPSS to compare students' overall spelling stages in English and Spanish as well as specific features that were present in the feature

analysis for both English and Spanish such as consonants, vowels, digraphs, affixes, and roots.

Ninety-eight of the total 209 students had a discrepancy of 2 or more spelling stages between their spelling stage in English and in Spanish. For example, if a student was in the Emergent spelling stage (Stage 1) in English and in the Patrones spelling stage (Patterns; Stage 3) in Spanish, the student had a difference of two spelling stages between their English and Spanish spelling. Eighteen students were in a higher spelling stage in Spanish compared to 155 students who were in a higher spelling stage in English. Only 1 student was in the highest spelling stage in both English and Spanish (Derivational Relations), and none of the students were in the lowest spelling stage in both English and Spanish (Emergent). The number of students in each spelling stage in English is displayed in Table A-11, and the number of students in each spelling stage in Spanish is displayed in Table A-12. A comparison of students' spelling stage in English and Spanish is displayed in Table A-13.

Consonants. One hundred fifty two of the total 209 students earned all possible points on consonants in the feature analysis for both English and Spanish. Thirty-two students received all possible points on English consonants and missed only 1 point on Spanish consonants while 7 students received all possible points on Spanish consonants and missed only 1 point on English consonants. Four students performed perfectly on English consonants, but received no points on Spanish consonants, while seven students received the maximum amount of points on Spanish consonants and no points on English consonants. These results show that students performed well on consonants in

both languages, suggesting that the students' knowledge of consonants in their native language, Spanish, may be an asset in spelling in English. A comparison of students' performance on consonants in English and Spanish is displayed in Table A-14.

Vowels. Ninety-three students earned all possible points on vowels (long and short vowels combined) in English and prominent vowels in Spanish. Twenty-nine students received all possible points on Spanish vowels while missing only one point on English vowels, and 25 students received all possible points on long and short English vowels while earning 2 out of 3 points on vowels in Spanish. Seven students earned all possible points on Spanish vowels while earning 0 points on English vowels, and 6 students received all possible points on English vowels and no points on Spanish vowels. In total, 124 students received all possible points on long and short vowels combined in English, and 157 students received all possible points on vowels in Spanish.

When the vowel categories in English were broken down into long vowels and short vowels, and then each compared to vowels in Spanish, each of which consistently make one sound, students' performance varied. One hundred twenty nine students received all possible points on both short vowels in English and vowels in Spanish. Fifty-one students performed better on short vowels in English than on vowels in Spanish while 29 students performed better on Spanish vowels than on short vowels in English.

In comparing long vowels in English to Spanish vowels, 97 students received perfect scores in both English and Spanish. Sixty-six students performed better on Spanish vowels than on long vowels in English, and 45 students performed better on

long vowels in English than on Spanish vowels. Overall, 177 students performed perfectly on English short vowels, and 129 students performed perfectly on English long vowels.

These results show that more students struggled with long vowels than short vowels, suggesting that while vowel knowledge in Spanish is helpful to learning vowels overall in English, it may be more helpful when learning short vowels than long vowels. This may be due to the similarities between Spanish vowels and short vowels in English. A comparison of students' performance on short vowels in English and vowels in Spanish is displayed in Table A-15, and a comparison of students' performance on long vowels in English and vowels in Spanish is displayed in Table A-16.

Digraphs. Overall, 109 students earned a higher percentage of points for digraphs in English while only 32 students earned a higher percentage of points for digraphs in Spanish. One hundred sixty-six students received all possible points for English digraphs compared to 92 students for Spanish digraphs. Sixty-eight students received 100% of the points for digraphs in both English and Spanish. Sixty-five students received all points in English while missing one point in Spanish, compared to 13 students who received all points in Spanish while missing one point in English. None of the students received 0 points on digraphs in both English and Spanish.

Students' spelling performance on digraphs in English was better than their spelling of digraphs in Spanish. As this may seem surprising, further examination of the digraphs included on the feature analysis may provide insight to this result. The English feature analysis includes six digraphs; however, there are only three unique digraphs.

That is, some of the digraphs were included in the scoring multiple times. The digraph *sh* was included three times, *ch* was included two times, and *wh* was included once.

Therefore, if students have a strong grasp on the digraphs *sh* and *ch*, they would likely receive a high score on digraphs in English. Conversely, the Spanish digraphs feature included five unique digraphs; in order to receive a high score on Spanish digraphs, the students must have a grasp on all five of these unique digraphs. A comparison of students' performance on digraphs in English and Spanish can be found in Table A-17.

Affixes. As the orthographical features became more complex (e.g., consonants, followed by vowels, followed by digraphs), fewer students earned all possible points in both English and Spanish. This trend continued with the affixes in the feature analyses: only 5 of the total 209 students received all possible points on affixes in English and Spanish. The points earned by the students for this orthographical feature were much more evenly dispersed than in the previously discussed features. Twenty-six students received all possible points in Spanish compared to the 23 students who received all possible points in English. The students who earned 5 out of 5 points in English also earned at least 3 out of 9 points in Spanish. Conversely, the students who earned 9 out of 9 points in Spanish were spread out across all possible point values (0–5) in English, with most students (15 out of 26) earning either 2 or 3 points in English.

Overall, 125 students performed better on affixes in Spanish than in English compared to 78 students who performed better in English than in Spanish. This result shows that knowledge of and performance on affixes in Spanish does not necessarily

transfer to affixes in English. A comparison of students' performance on affixes in English and Spanish is displayed in Table A-18.

Roots. One hundred nine students performed better on spelling roots in English than in Spanish, whereas only 50 students performed better in Spanish. Fifty students received the same score for spelling roots in both English and Spanish. Only one student earned all possible points for roots in both Spanish and English, while 38 students received a score of 0 for both Spanish and English. Only two students performed perfectly on roots in Spanish compared to 29 students who performed perfectly on roots in English. A comparison of students' performance on roots in English and Spanish is displayed in Table A-19.

These results exhibit two salient themes: 1) students performed better overall on spelling roots in English than in Spanish, and 2) roots were more difficult for these students than other orthographical features, which is to be expected as they are the final and most complex feature on the feature analyses. The students' higher performance on roots in English could be attributed to the duration and nature of formal English education and spelling instruction the students have received compared to the formal Spanish instruction the students previously received. As roots are the final orthographical feature on the feature analysis, and represent the highest spelling stage, it is reasonable that these students' formal Spanish education may have been discontinued before they reached the final spelling stage.

Spelling Rubric

Each of the spelling words recorded by each student was scored using a 7-point spelling rubric (Tangel & Blachman, 1992), which assesses the phonemes represented in the spelling of the target word. As each word is assigned a score of 0–6, and there are 25 English words and 25 Spanish words, the total maximum score each student was able to receive is 150 points for their English spelling and 150 points for their Spanish spelling.

The differences in the performance between English and Spanish were examined and compared. Seventy-three of the total 209 students had a difference of 3 or more points between their score on the phonetic spelling rubric in English and in Spanish, which was considered to be a large discrepancy. For example, if a student received a total of 140 points on the Spanish rubric, which was recoded as a 5, and the student received a total of 80 points on the English rubric, which was recoded as a 3, that student was considered to have a large discrepancy between their performance on the English and Spanish spelling, as scored using the spelling rubric. A difference of 3 or more recoded points was considered to be a large discrepancy because it is a difference of at least 60 points, or 40% of the 150 total possible original points on the spelling rubric. The number of students in each group of scores in English can be found in Table A-20, and the number of students in each group of scores in Spanish is displayed in Table A-21. A comparison of students' performance on the spelling rubric in English and Spanish can be found in Table A-22.

Alternatively, 34 students scored in the same category (i.e., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10) on their English and Spanish spelling. Only 36 of the 209 students scored

higher on the Spanish spelling than on the English spelling (e.g., Spanish = 5; English = 4), while 139 students scored higher on the English spelling (e.g., Spanish = 3; English = 4). Whereas this result may appear to be unexpected, as the participants were native Spanish-speaking ELLs, it is not surprising when the orthographical differences between Spanish and English are considered.

The Spanish orthography is highly consistent, thus allowing phonemes to be represented using few variations. Conversely, English is more inconsistent, which allows phonemes to be represented in multiple ways. For example, /ā/ may be represented by *a*, *e*, *igh*, *ay*, or *ai*. Thus, spelling the target word *train* as *trayn* would still represent all of the phonemes in the target word. As all of the phonemes are represented in this misspelling by a mixture of conventional and phonetically related letters, the speller would receive a score of 4 points for that word.

These orthographical differences result in fewer opportunities for spellers to earn points for misspellings in Spanish when the misspellings are scored using a rubric to assess the represented phonemes. That is, the spelling of a word in Spanish that contains highly consistent phoneme-grapheme relationships is more likely to either represent all of the phonemes using the accurate (or conventional) letters, earning a score of either 5 or 6 points, or to not represent all of the phonemes, earning a score of 3 or fewer points.

In addition to examining the performance of each student, the scores on the rubric for each word were also examined. The word that most frequently received a score of 5 points was *shopping*. In order to receive a score of 5 points, the spelling of the target word was required to contain all phonemes with conventional letters, and the

correct short vowel or attempt to mark a long vowel. As *shopping* was one of the words containing the highest amount of consonant omission errors (students frequently omitted one *p*), it is reasonable that this word also frequently received a score of 5 points. While the /p/ phoneme is represented by a double letter (*pp*) in the accurate spelling, the phoneme is still represented in the misspelling *shoping*, using one *p* instead of two. Additionally, as the representation of the /ð/ is regular, and students' knowledge of Spanish vowels appears to be an advantage for ELLs when spelling short vowels in English, as was evidenced by the feature analysis results, it is likely that the students would accurately represent the short vowel phoneme.

Similarly, the rubric scores for *fortunate*, *cellar*, and *civilize* were also reflective of the error types used for latent class analysis that were present in these words. For each of these three words, more than half of the total scores assigned to misspellings were a score of 4. In order for a misspelling to receive a score of 4 on the rubric, the misspelling must represent every phoneme with a mixture of conventional (correct) and phonetically related letters. These requirements are similar to the substitution errors used in the latent class analysis. While vowel substitution was the most common error among *fortunate*, vowel and consonant substitution errors were both highly prevalent in *cellar* (vowel substitution $n = 135$; consonant substitution $n = 135$) and *civilize* (vowel substitution $n = 125$; consonant substitution $n = 230$). These results further support the previous findings that individuals with a shallow L1 spell phonetically and use simpler graphemes when spelling in a deeper L2 (Dixon et al., 2010 & Figuerdo, 2006).

Whereas a score of 5 on the rubric may correlate with words misspelled due to omission errors, and a score of 4 may correlate with words that were misspelled due to substitution errors, the requirements for a score of 3, which includes some but not all of the phonemes are represented with conventional or phonetically related letters, are similar to the requirements for both omission and substitution errors. That is, if a misspelling does not contain all of the phonemes present in the target word, thus omitting one or more letters, or if the phonemes were represented with letters that make a similar sound, the word would be assigned a score of 3. The three words with the highest percentage of misspellings earning a score of 3 were *chewed*, *fortunate*, and *opposition*. Omission and substitution errors were the most frequently occurring errors in each of these three words.

A score of 3 points and 4 points both allow for the inclusion of intrusions, or added letters, making it possible for words with addition errors to earn either 3 or 4 points. Therefore, a score of either 3 or 4 is not necessarily correlated with addition errors.

Teacher Interviews

Eleven fourth and fifth grade classes were included in the study; 10 of the 11 teachers agreed to participate in the teacher interviews. The teacher interviews focused on two main themes: instruction and assessment.

An additional goal of in the interviews was to gain insight to the teachers' knowledge and beliefs in regards to the relationship between reading and spelling. Understanding where the teachers stand on this relationship may provide valuable

insight to the nature of spelling instruction and assessment in their classrooms. For their privacy, the teachers will be referred to using identification numbers rather than their names (e.g., Teacher 2).

Instruction. The nature of and time allotted for spelling instruction varied across classrooms. Several teachers discussed including some spelling instruction imbedded in writing and small group activities, and some teachers do not include any spelling instruction in their classrooms. Only one teacher discussed including separate spelling instruction or activities in their classroom.

Teacher 1 teaches spelling in context and highlights spelling patterns during vocabulary instruction. The nature of the spelling instruction included is differentiated for different groups of students, depending on the students' language proficiency. This teacher utilizes the students' scores on ACCESS, which is a test that determines the English proficiency of ELLs on an annual basis, in order to group students and provide differentiated instruction. In addition to this instruction, students also complete activities in *Words Their Way* and write in their composition notebooks for 10-15 minutes each day. Teacher 1 includes between 60–90 minutes of spelling instruction and activities per week in their classroom.

Similar to Teacher 1, Teachers 5, 6, 7, 8, and 9 also utilize activities in *Words Their Way* in the classroom. Teachers 5 and 6 both highlighted that these students work on these activities when time allows, but that the time constraints are too great to focus and work on spelling consistently. Both of these teachers also discussed including some spelling instruction during writing instruction, but that spelling was not the main focus.

These teachers also included chunking, word sorts, and spelling rules or patterns in their discussion of spelling instruction.

Similarly, Teachers 7 and 9 also discussed using word sorting activities in their classrooms in addition to other activities focusing on specific strategies and aspects of spelling such as categorizing, word families, digraphs, and blends. These teachers both include activities from *Words Their Way* during small group times.

Teacher 8 also mentioned using *Words Their Way*, but noted that they focus on vocabulary, not spelling. Similar to Teacher 8, Teachers 2, 4, and 10 do not include spelling instruction in their classrooms.

Teacher 4 mentioned that they are required to focus more on comprehension, vocabulary, and critical thinking, so time does not permit them to include spelling instruction. Instead, this teacher instructs students to use the dictionary when they do not know how to spell a word. If there is a word with which the class has difficulty, the teacher adds the word to a word wall in the classroom. However, the teacher did not mention any further use of the word wall after a word has been added.

In lieu of spelling instruction or activities focusing on spelling, Teacher 2 instructs students to utilize a spell checker on the computer when they are editing their writing.

Teachers 1, 7, and 9 mentioned that they differentiate instruction for the ELLs in their classrooms. Teacher 1 uses the ACCESS scores as a way to group students and provide differentiated instruction based on their English proficiency. Teacher 9 also discussed differentiating instruction based on student level, but did not discuss how each

student's "level" was determined. Finally, Teacher 7 mentioned using *Palabras a su Paso* for their students who are not proficient in English while the students in the class who are proficient in English only complete activities from *Words Their Way*.

Assessment. Within the topic of assessment, some teachers discussed assessing students formally at the beginning of the year, some discussed assessing students informally on a regular basis throughout the year, and some did not include any form of spelling assessment in their classroom.

Teacher 7 discussed using *Words Their Way* at the beginning of the school year in order to assess each student's spelling stage. The teacher then uses this assessment to determine instruction for the students. However, after the initial assessment using *Words Their Way*, this teacher does not include any additional spelling assessment in the classroom throughout the year. The teacher mentioned that spelling is not assessed throughout the school year because it is not a "report card category."

Teachers 1, 3, 5, 6, and 10 all assess spelling through writing activities and assignments that their students complete in the classroom. Three of the teachers in this group (Teachers 1, 3, and 6) use the information about their students' spelling that they gain from the students' writing to guide instruction in some way, and to some extent. Teacher 3, who includes "mini-lessons" on specific skills as needed, uses the students' writing activities to determine what "mini-lesson" will be taught next, and which students in the class need the instruction. Teacher 6, who utilizes small groups for spelling instruction, uses the students' writing samples to determine how to group students for the spelling instruction. Teacher 1, who teaches spelling in context, such as

during vocabulary instruction, mentioned that the students' writing grades drive instruction, but did not elaborate further. Finally, Teacher 10 does not use the information regarding spelling from the students' writing samples for future instruction, as this teacher does not include spelling instruction of any sort in their classroom.

Teachers 2, 4, 8, and 9 do not include any form of spelling assessment either at the beginning of the school year or throughout the school year.

Relationship between reading and spelling. As spelling abilities enable students to decode novel words during reading, a relationship between reading and spelling does exist. Teachers' knowledge of this relationship may play a role the inclusion or exclusion of spelling instruction and assessment in the classroom.

Six of the teachers (Teachers 3, 5, 6, 8, 9, 10) believe that a relationship between reading and spelling does exist. However, knowledge of the nature of this relationship varied among the teachers. Teachers 6 and 9 specifically mentioned the term "decoding" when discussing the link between spelling and reading. Teacher 6 went beyond simply mentioning decoding and made a point that if students have difficulty with decoding, their comprehension suffers. Similarly, Teacher 3 discussed the importance of spelling as it impacts fluency and comprehension. These three teachers were the only ones to include reading-specific "buzzwords" (i.e., decoding, fluency, comprehension) while discussing the relationship between reading and spelling.

Teachers 5 and 8 both mentioned that they believe that a relationship does exist, and that spelling can improve reading. However, both of these teachers also mentioned that there is not enough time to explicitly teach spelling. Teacher 10 also believes there

is a relationship between reading and spelling but, different from the other teachers who discussed the relationship from spelling to reading, Teacher 10 believes that the more a person reads, the better they are at spelling.

Teacher 7 believes that unless students are particularly bad at spelling, it does not impact their reading. Teacher 10 mentioned that students who are good spellers are not necessarily good decoders, and students who are good decoders are not necessarily good spellers. Finally, Teacher 2 does not see any relationship at all between reading and spelling. This teacher pointed out that the spelling in their students' writing samples has not improved by reading. This teacher also highlighted that their students "don't even capitalize their names."

Teachers and Students

Cross tabulation tables were run in SPSS in order to compare the teachers to the English student-based latent classes, English spelling stages, and English rubric performance.

Teachers and latent classes. The comparison of English student-based latent classes and teachers was spread out fairly evenly with few exceptions. Twelve of the 20 students in Teacher 10's class, who does not include any spelling instruction or assessment of any kind in their classroom, were in Class 2, which had the highest probability of making the highest amount of errors. Similarly, Teacher 4, who does not include spelling instruction or assessment in their classroom and directs students to use a dictionary for unknown words, had 12 of their 18 students in Class 2. Almost half (11/23) of the students in Teacher 9's class were also in Class 2.

Teacher 7, who differentiates spelling instruction based on students' English proficiency, allowing students with low English proficiency to complete activities in *Palabras a su Paso* in addition to *Words Their Way*, had the most students in Class 3 ($n = 7$), which had a low probability of making any type of error. Eleven of the 23 students in Teacher 11's class were in Class 1; however, Teacher 11 declined to participate in the teacher interviews. The number of students in each teacher's class and each English latent class is displayed in Table A-23, and the number of students in each teacher's class and each Spanish latent class can be found in Table A-24.

Teachers and spelling stages. Teachers 7 and 10 are the only teachers with students in the Emergent spelling stage (Teacher 7: $n = 2$; Teacher 10: $n = 8$). Almost half of the students in Teacher 10's class (8/20) were in this spelling stage. Teachers 3, 7 and 8 had 0 students in the highest and most complex spelling stage, Derivational Relations. As most of the total 209 students were in the Within Word Pattern and Syllables and Affixes spelling stages ($n = 88$, $n = 72$, respectively), most of the students in each of the classes were in these spelling stages with the exception of Teacher 10 (50%). The number of students in each teacher's class and each spelling stage in English is displayed in Table A-25, and the number of students in each teacher's class and each spelling stage in Spanish can be found in Table A-26.

Teachers and the spelling rubric. The total points (150 possible) earned by each student were recoded into 10 groups to allow for comparison of groups. Teacher 10 is the only teacher with any students ($n = 8$) in Group 1, which received 0–15 total points on the rubric. No teachers had students in Groups 2–4, which received 16–60 total

points. Only one teacher (Teacher 7) had any students in Group 5 ($n = 1$), which received 61–70 points, and only two teachers (Teachers 2 & 7) had any students in Group 6 ($n = 1$, $n = 2$, respectively), which received 76–90 points. Teacher 9 had the most students ($n = 11$) in Group 9, which earned 121–135 points.

Teacher 4 had the highest number of students ($n = 13$) and the highest percentage of the students in their class (72%) in Group 10, which received the most total points on the rubric. Additionally, Teacher 4 is the only teacher without any students in Groups 1–8; all of their students were in Groups 9 and 10, earning the most points on the rubric. As this teacher directs their students to use the dictionary to find unknown words, it would appear as though these students have practice spelling phonetically, or sounding out words. The number of students in each teacher’s class and each rubric points group in English is displayed in Table A-27, and the number of students in each teacher’s class and each rubric points group in Spanish can be found in Table A-28.

CHAPTER V

CONCLUSION

The aim of the current study was to investigate spelling errors made by native Spanish-speaking ELLs in English and Spanish in order to examine the impact of the Spanish orthography on the students' English spelling.

Orthographical Evidence

The characteristics of the English and Spanish orthographies were evidenced across both languages and multiple measures. The students' spelling performance on vowels in English supports the previous findings of Sun-Alperin and Wang (2008) who found that ELLs made vowel errors that were consistent with the Spanish orthography. The nature of the students' vowel errors across multiple measures in the current study is reflective of the Spanish orthography. For instance, when the errors were coded for the latent class analysis, the two most frequently occurring error types in English spelling were vowel omission and vowel substitution. These errors indicate the students relied on phonetic spelling and represented vowels with simple graphemes. For example, more than half of the errors made on the word *pleasure* were vowel omission errors due to inaccurate one-to-many vowel mappings. When spelling this word, students frequently represented the /ě/ with only an *e* rather than the vowel pair *ea*. This error pattern has been previously demonstrated in the literature (Bahr et al., 2015; Rubin & Carlan, 2005; Sun-Alperin & Wang, 2008). Similarly, the students performed better on short vowels than on long vowels in the feature analysis. These findings are representative of the Spanish orthography and are indicative of the students' reliance upon phonological

knowledge from their L1 when learning to spell in English, supporting additional previous findings (Dixon et al., 2010; Figueredo, 2006).

Students' performance spelling vowels in Spanish was not as strong as expected, considering previous findings that reported the vowel errors made by native Spanish-speaking children spelling in Spanish decreased 50% between Kindergarten and Grade 1 (Joshi et al., 2016). Joshi et al. also reported a tremendous gap between consonant and vowel errors, whereas the current study found the number of consonant and vowel errors in Spanish to be more equal. However, that study included only monolingual Spanish-speaking students, and therefore did not examine the English spelling of the students in addition to their Spanish spelling. These differences indicate that the English orthography may be affecting the students' spelling in Spanish in addition to the Spanish orthography affecting the English spelling. That is, the students learning English may be applying their knowledge of vowel-based inconsistencies in English to their spelling in Spanish indicating that these students do not have a firm grasp on the vowel differences between English and Spanish.

Whereas the difference between vowel and consonant errors in Spanish was not as large as was expected, the consonant-based errors were more frequent, consistent with the Spanish orthography. Among the error types, consonant substitution was the single most frequently occurring error type in Spanish. This finding is consistent with previous findings by Joshi et al. (2016) and Justicia et al. (1999) who also found consonant substitution errors to be the dominant error type in Spanish spelling among native Spanish-speaking children. As the participants in these previous studies were

monolingual Spanish speakers, the dominance of consonant substitution errors appears to be a result of the Spanish orthography. Paired with the results from the current study, this suggests that the application of the students' knowledge of English to their Spanish spelling is vowel based rather than consonant based. That is, students appear to confuse the rules for spelling vowels between Spanish and English more than consonants.

Conversely, the most frequently occurring consonant-based error in English was consonant omission. The accurate representation of consonant clusters and doubles has been found to be a challenge for ELLs when spelling in English (Bahr et al., 2015; Sun-Alperin & Wang, 2008, Treiman, Zukowski, & Richmond-Welty, 1995). The results of the current study confirm these difficulties, as the three English words with the highest amount of consonant omission errors were *shopping*, *carries*, and *opposition*. These words were most frequently misspelled due to an inaccurate representation of the double consonants (e.g., *shoping* for *shopping*). In addition to these consonant omission errors, consonants that should not be doubled often were (e.g., *rippen* for *ripen*; *civillize* for *civilize*). This suggests that these students are aware of consonant doubling in English, but do not yet have a firm grasp on when doubling occurs. Additionally, these results highlight an orthographic difference between Spanish and English, as consonant doubling is dependent on the preceding vowel. This challenge is unique to English as the vowels in Spanish have a one-to-one correspondence, and ELLs have not had prior practice doubling consonants.

Other Orthographical Features

Whereas other studies have highlighted that students' knowledge of Spanish may be advantageous to spelling in English where similarities exist such as phonological awareness and consonant sounds (e.g., Bahr et al., 2015; Dixon et al., 2010; Figueredo, 2006; Rickard Liow & Poon, 1998), the current study also included feature analysis in *Words Their Way* and *Palabras a su Paso* to examine additional orthographic features in English and Spanish, and how they may impact the spelling of ELLs. Students' knowledge of vowels and consonants in Spanish did appear to be beneficial when spelling in English. However, the results of the current study suggest that this is not the case for affixes or roots. Students performed better on affixes in Spanish than in English, and the students who performed perfectly on affixes in Spanish scored anywhere from 0 to 5 (maximum) points on affixes in English. This finding suggests that students have grasped the concept of affixes in Spanish, but have not yet mastered the spelling of English affixes. Direct instruction on English affixes would be beneficial for these students.

The students' higher performance on roots in English could be attributed to the duration and nature of formal English education and spelling instruction the students have received compared to the formal Spanish instruction the students previously received. As roots are the final orthographical feature on the feature analysis and represent the highest spelling stage, it is reasonable that these students' formal Spanish education may have been discontinued before they reached the final spelling stage. The high performance on English roots comes as somewhat of a surprise as none of the

teachers interviewed include any instruction on the history of the English language or word origins.

Phonological Awareness

Whereas the students in the current study demonstrated difficulty accurately representing doubled consonants, their misspellings of words with double consonants did accurately represent the phonemes present in the words. This finding strengthens previous suggestions that individuals with a shallow L1 are able to develop strong phonological awareness skills in their native language, which can then be transferred to English, providing an advantage in learning the phonetic base of English spelling (Bahr et al., 2015; Dixon et al., 2010; Figueredo, 2006; Rickard Liow & Poon, 1998).

This phonological advantage was present in the results of the spelling rubric. Overall, students performed better on the spelling rubric when spelling in English than in Spanish. However, this may be due to the orthographic differences; more phonemes in English can be represented in multiple ways whereas phonemes in Spanish can be represented in fewer ways due to the phoneme-grapheme consistencies of the Spanish orthography. Similar to previously discussed measures, the results from the spelling rubric again indicated that the students applied their English phonological awareness to their Spanish spelling (e.g., *autoboos* for *autobus*), indicating the need for increased understanding of the differences between the two orthographies.

Bahr et al. (2015) found that students strongly relied on phonology from their L1 when learning to spell in English. The current study supports these findings, and adds to them using evidence from the teacher interviews. Whereas these students may naturally

apply phonological knowledge when spelling unfamiliar words, at least one class full of students included in this study appear to be instructed to use the “sound it out” strategy when spelling. One of the teachers who participated in the interviews discussed instructing their students to look up words they do not know how to spell in the dictionary in lieu of including spelling instruction in the classroom. These students’ practice sounding out words when trying to find a word in the dictionary to spell may have been beneficial for their scores on the spelling rubric included in this study, but detrimental to their accurate conventional spelling, as was evidenced by the high percentage of students in this teacher’s class in the English student-based latent class that had the highest probability of making the most types of errors. Future research investigating how teachers’ viewpoints of sounding out unknown spelling words and the inclusion of this strategy in teachers’ classroom instruction may provide more insight to the phonological spelling of ELLs. This may shed light on how much of the phonological spelling of ELLs is attributed to the transfer of skills from Spanish, and how much is attributed to these students being coached or taught to sound out unfamiliar words as a spelling strategy.

Educational Implications

The first and perhaps most apparent educational implication is the need for explicit instruction regarding vowels in English. As the strict one-to-one correspondences among vowels in Spanish are in stark contrast to the vowels in English, native Spanish-speaking ELLs need adequate direct, explicit instruction targeting the vowel spelling rules and patterns in English, particularly those that are not present in

Spanish. As these students have prior knowledge of vowels consistently representing one sound, the differences between vowels in Spanish and English should be highlighted and made clear.

Students' difficulty accurately representing double consonants indicates the need for explicit instruction including the patterns and rules for doubling consonants.

Preceding instruction regarding vowels will be beneficial for students when learning the patterns of doubling consonants, as consonant doubling is dependent on the preceding vowel. That is, until ELLs have a grasp on the different vowel sounds in English, which may not be present in Spanish, they will not be able to fully understand the guidelines for doubling consonants.

The apparent impact of the students' knowledge of English on their Spanish spelling, as is evidenced by the vowel errors in the students' Spanish spelling, indicates that the students do not yet have a firm grasp on spelling vowels in English. This finding also signifies the need for ELLs to be explicitly instructed on the differences between the English and Spanish orthographies and spelling patterns. This may alleviate confusion and prevent the students from applying orthographical knowledge and spelling strategies from one language to the other.

One teacher interviewed in the current study provides instruction in the form of activities from *Words Their Way* in their classroom. However, this teacher allows the students who are not yet proficient in English to complete activities from *Palabras a su Paso* in addition to the activities in *Words Their Way*. As this teacher had the highest amount of students in the English student-based latent class that performed the best, or

had a low probability of making any type of error, this finding supports previous findings that suggest instruction in both English and Spanish may be beneficial for these students until the complex rules and patterns of English are learned (Figueredo, 2006). Further instruction in Spanish in addition to English would also be beneficial in ensuring students understand the differences in the orthographies, as previously mentioned, which could limit the impact of the features of one orthography on the students' performance in the other language.

While the phonological awareness skills students have developed in their native language may be beneficial when learning to spell in English where similarities exist, the “sound it out” strategy is not completely effective and should not be included as the sole spelling strategy as many differences do exist between the two languages. If spelling instruction for ELLs consists only of teaching them to sound out words they do not know how to spell, their conventional spelling will suffer when inconsistencies and irregularities arise. Direct, explicit instruction including these phoneme-grapheme inconsistencies will be beneficial for ELLs, particularly pertaining to vowel-based inconsistencies, as these students have previously learned that vowels each consistently make one sound.

Limitations and Future Research

Knowledge of each students' academic English and Spanish proficiency would be beneficial to providing further insight to their spelling performance on the measures included in this study. Specific knowledge and understanding of the students' proficiency in each language may provide insight as to why the English spelling

performance was better than the Spanish spelling performance on some parts of the measurements.

This result may also be better understood with knowledge regarding the amount of time each student has been learning English, as well as the duration of the students' formal education in Spanish. If students' formal Spanish education ceased before mastery of spelling in Spanish, and they began receiving instruction on the English language, it would help explain why the students' English spelling outperformed their Spanish spelling. It is possible that the participants began learning academic English at a young age, as they are now in fourth and fifth grades.

Future research may include gathering information regarding the students' reading abilities in order to examine how spelling performance correlates with their reading in English. Additionally, as spelling has been found to impact both reading and writing (Berninger et al., 2002; Ehri, 2000; Graham et al., 2011; Graham & Hebert, 2011), examining the students' writing abilities to determine how their spelling performance affects their writing in English may be beneficial for future research.

As the students in this study appear to have applied phonological awareness from English to their Spanish spelling, it may be interesting to compare the Spanish spelling of native Spanish-speaking ELLs to that of native English-speaking students learning Spanish. This comparison may provide insight to the confusions being made between the Spanish and English orthographies. In addition to being beneficial for the education of native Spanish-speaking ELLs, this knowledge may be useful for native English speakers as well; as the amount of native Spanish speakers in the United States continues

to increase, it is reasonable that more native English-speaking children will need to learn Spanish in order to be successful in an increasingly diverse country.

An additional result of the increasing number of native Spanish speakers is a more diverse population of teachers. As this study was completed in an area largely composed of native Spanish speakers, it is possible that English is the second language for multiple teachers included in the study. Future research investigating native Spanish-speaking teachers' knowledge of the English orthography and spelling system may be beneficial to examining the type of spelling instruction included in their classroom, as well as how this knowledge may impact their students' learning of the English language.

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APPENDIX

***Words Their Way* Elementary Spelling Inventory Words**

1. bed
2. ship
3. when
4. lump
5. float
6. train
7. place
8. drive
9. bright
10. shopping
11. spoil
12. serving
13. chewed
14. carries
15. marched
16. shower
17. bottle
18. favor
19. ripen
20. cellar

21. pleasure
22. fortunate
23. confident
24. civilize
25. opposition

***Palabras a su Paso* Spanish Spelling Inventory Words**

1. el
2. suma
3. pan
4. red
5. campos
6. plancha
7. brincar
8. fresa
9. aprieto
10. guisante
11. quisiera
12. gigante
13. actrices
14. voy
15. hierro
16. bilingüe
17. lápices
18. extraño
19. autobús
20. haya
21. geometría

22. caimán

23. intangible

24. herbívoro

25. psicólogo

Teacher Interview Questions

1. How do you approach teaching spelling?
2. What kind of spelling instruction do students receive in your classroom?
3. Does the spelling instruction for ELLs differ from the spelling instruction for native English-speaking students?
4. How much time is devoted to spelling instruction?
5. What does the spelling instruction look like in the classroom?
6. What kind of independent practice for spelling do the students complete?
7. How is spelling assessed?
8. How is the spelling assessment used for future instruction?
9. What are your thoughts on the relationship between spelling and reading?

Spelling Rubric

0 points: A random string of letters

1 point: Initial phoneme represented by a phonetically related letter, *or* a single letter response that represents a salient part of the word other than the initial phoneme

2 points: Correct initial phoneme

3 points: More than one phoneme (but not all) represented by phonetically related or conventional letters, including intrusions (added letters), *or* every phoneme represented, but not all with phonetically related letters

4 points: Every phoneme (including blends) represented with a mix of phonetically related and conventional letters, including intrusions

5 points: All phonemes with conventional letters; correct short vowel or attempt to mark a long vowel

6 points: Correct spelling

Table A-1

Error Type Examples

Error Type	Example
Vowel Omission	<i>train vs. tran</i>
Vowel Addition	<i>ripen vs. riepen</i>
Vowel Substitution	<i>shower vs. shawer</i>
Vowel Sequence	<i>pleasure vs. plaesure</i>
Consonant Omission	<i>shopping vs. shoping</i>
Consonant Addition	<i>ripen vs. rippen</i>
Consonant Substitution	<i>place vs. plase</i>
Consonant Sequence	<i>bright vs. brihgt</i>

Note. The first word in the example sequence is the correct spelling; the second word is an example of the error.

Table A-2

English by Student Descriptive Statistics

Error Type	Frequency	Mean	Standard Deviation
Vowel Omission	718	3.44	3.506
Vowel Addition	250	1.20	1.711
Vowel Substitution	1125	5.38	3.982
Vowel Sequence	91	0.44	0.670
Consonant Omission	782	3.74	3.563
Consonant Addition	222	1.06	1.201
Consonant Substitution	751	3.59	3.032
Consonant Sequence	57	0.27	0.497

Table A-3

Spanish by Student Descriptive Statistics

Error Type	Frequency	Mean	Standard Deviation
Vowel Omission	1176	5.63	4.104
Vowel Addition	337	1.61	2.023
Vowel Substitution	1689	8.08	7.420
Vowel Sequence	36	0.17	0.415
Consonant Omission	1332	6.37	3.516
Consonant Addition	737	3.53	3.619
Consonant Substitution	2282	10.92	5.682
Consonant Sequence	20	0.10	0.295

Table A-4

English by Student Model Comparison

Classes	Log Likelihood	AIC	BIC	SSA-BIC	Entropy	LMR	LMR <i>p</i> -value	BLRT	BLRT <i>p</i> -value
1	-879.993	1775.986	1802.725	1777.377	N/A	N/A	N/A	N/A	N/A
2	-750.051	1534.03	1590.85	1536.985	0.82	254.660	0.0002	-879.993	0.000
3	-714.659	1481.318	1568.218	1485.837	0.795	69.272	0.0253	-750.015	0.000
4	-708.938	1487.876	1604.858	1493.959	0.83	11.209	0.3437	-714.659	0.6667

Table A-5

English by Student Class Error Probability

Error	Class 1	Class 2	Class 3
Vowel Omission	0.830	1.000	0.163
Vowel Addition	0.436	0.816	0.101
Vowel Substitution	1.000	0.987	0.461
Vowel Sequence	0.108	0.732	0.092
Consonant Omission	0.913	0.999	0.253
Consonant Addition	0.580	0.790	0.218
Consonant Substitution	0.916	1.000	0.141
Consonant Sequence	0.000	0.663	0.000

Table A-6

English Student-Based Class

Class	Students
1	72
2	84
3	53

Table A-7

Spanish by Student Model Comparison

Classes	Log Likelihood	AIC	BIC	SSA-BIC	Entropy	LMR	LMR p -value	BLRT	BLRT p -value
1	-642.192	1264.385	1291.123	1265.775	N/A	N/A	N/A	N/A	N/A
2	-519.907	1073.814	1130.633	1076.768	0.87	204.322	0.000	-629.192	0.000
3	-503.548	1059.096	1145.997	1063.615	0.937	32.051	0.0002	-519.907	0.000
4	-498.307	1066.613	1183.595	1072.696	0.818	10.269	0.635	-503.548	0.4286

Table A-8

Spanish by Student Class Error Probability

Error	Class 1	Class 2	Class 3
Vowel Omission	0.000	1.000	0.851
Vowel Addition	0.000	0.781	0.261
Vowel Substitution	0.000	0.967	0.432
Vowel Sequence	0.000	0.235	0.000
Consonant Omission	0.283	1.000	1.000
Consonant Addition	0.179	1.000	0.091
Consonant Substitution	0.462	1.000	1.000
Consonant Sequence	0.000	0.135	0.016

Table A-9

Spanish Student-Based Class

Class	Students
1	5
2	143
3	61

Table A-10

Student Latent Class Membership by Language

Spanish Class	English Class		
	1	2	3
1	4	0	1
2	52	56	35
3	16	28	17

Note. Pearson Chi-Square value = 7.154 ($p = 0.128$)

Table A-11

English Spelling Stage

Spelling Stage	Students
Emergent	10
Letter Name-Alphabetic	12
Within Word Pattern	88
Syllables and Affixes	72
Derivational Roots	27

Table A-12

Spanish Spelling Stage

Spelling Stage	Students
Emergent	40
Letter Name-Alphabetic	97
Within Word Pattern	64
Syllables and Affixes	3
Derivational Roots	5

Table A-13

Spelling Stage Crosstab

Spanish Spelling Stage	English Spelling Stage				
	Emergent	Letter-Name Alphabetic	Within Word Pattern	Syllables and Affixes	Derivational Roots
Emergent	0	4	18	14	4
Letter Name-Alphabetic	6	4	40	35	12
Within Word Pattern	4	4	28	18	10
Syllables and Affixes	0	0	0	3	0
Derivational Roots	0	0	2	2	1

Table A-14

Consonants Crosstab

Spanish Consonants	English Consonants							
	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	4
1	0	0	0	0	0	0	0	6
2	1	0	0	0	0	0	0	32
3	7	0	0	0	0	0	7	152

Table A-15

English Short Vowels X Spanish Vowels

Spanish Vowels	English Short Vowels					
	0	1	2	3	4	5
0	0	0	0	0	0	6
1	0	0	0	0	0	8
2	1	0	0	0	3	34
3	7	0	1	6	14	129

Table A-16

English Long Vowels X Spanish Vowels

Spanish Vowels	English Long Vowels					
	0	1	2	3	4	5
0	1	1	0	0	2	2
1	0	1	0	1	2	4
2	1	1	1	2	7	26
3	12	1	10	10	27	97

Table A-17

Digraphs Crosstab

Spanish Digraphs	English Digraphs						
	0	1	2	3	4	5	6
0	0	0	1	0	0	0	5
1	0	0	0	0	1	0	3
2	0	0	0	0	1	0	6
3	0	0	1	0	1	2	19
4	4	0	0	1	2	5	65
5	4	1	0	1	5	13	68

Table A-18

Affixes Crosstab

Spanish Affixes	English Affixes					
	0	1	2	3	4	5
0	1	0	1	1	0	0
1	3	1	1	0	0	0
2	2	5	3	1	1	0
3	4	5	9	5	9	1
4	2	5	4	7	5	6
5	1	2	3	4	6	1
6	1	1	3	5	5	0
7	5	9	3	3	1	3
8	4	6	7	16	5	7
9	3	1	7	8	2	5

Table A-19

Roots Crosstab

Spanish Roots	English Roots					
	0	1	2	3	4	5
0	38	23	17	8	9	9
1	9	4	5	2	2	3
2	9	8	1	7	3	5
3	6	5	5	5	5	8
4	2	3	0	2	1	3
5	0	0	1	0	0	1

Table A-20

Students in English Rubric Groups

Group	Students
1	8
2	0
3	0
4	0
5	0
6	3
7	13
8	29
9	70
10	85

Table A-21

Students in Spanish Rubric Groups

Group	Students
1	3
2	1
3	1
4	0
5	6
6	33
7	66
8	20
9	44
10	35

Table A-22

English X Spanish Rubric Groups

Spanish Points Group	English Points Group									
	1	2	3	4	5	6	7	8	9	10
1	0	0	0	0	0	1	0	0	2	0
2	0	0	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	0	0	0	1
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	4	1	0	1
6	0	0	0	0	0	0	1	13	12	7
7	0	0	0	0	1	0	1	5	24	35
8	2	0	0	0	0	0	1	2	7	8
9	3	0	0	0	0	1	4	6	14	16
10	3	0	0	0	0	1	2	2	10	17

Table A-23

English Student Class by Teacher

Teacher	Class 1	Class 2	Class 3
1	4	6	6
2	7	8	4
3	8	5	5
4	4	12	2
5	9	8	5
6	5	6	6
7	6	3	7
8	7	4	6
9	7	11	5
10	4	12	4
11	11	9	3

Table A-24

Spanish Student Class by Teacher

Teacher	Class 1	Class 2	Class 3
1	0	7	9
2	3	15	1
3	2	2	14
4	0	18	0
5	0	21	1
6	0	17	0
7	0	4	12
8	0	17	0
9	0	23	0
10	0	8	12
11	0	11	12

Table A-25

English Spelling Stage by Teacher

Teacher	Emergent	Letter-Name Alphabetic	Within Word Pattern	Syllables & Affixes	Derivational Relations
1	0	2	6	4	4
2	0	1	3	12	3
3	0	2	8	8	0
4	0	0	2	10	6
5	0	0	12	7	3
6	0	1	9	4	3
7	2	3	9	2	0
8	0	1	11	5	0
9	0	1	10	11	1
10	8	0	8	2	2
11	0	1	10	7	5

Table A-26

Spanish Spelling Stage by Teacher

Teacher	Emergent	Letter-Name Alphabetic	Within Word Pattern	Syllables & Affixes	Derivational Relations
1	1	7	8	0	0
2	4	14	0	0	1
3	0	0	12	3	3
4	8	10	0	0	0
5	4	18	0	0	0
6	6	11	0	0	0
7	0	5	11	0	0
8	8	9	0	0	0
9	9	14	0	0	0
10	0	7	13	0	0
11	0	2	20	0	1

Table A-27

English Spelling Rubric by Teacher

Group	Teacher										
	1	2	3	4	5	6	7	8	9	10	11
1	0	0	0	0	0	0	0	0	0	8	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1	0	0	0	0
6	0	1	0	0	0	0	2	0	0	0	0
7	3	0	2	0	0	1	2	2	2	1	0
8	3	2	2	0	4	5	3	5	1	1	3
9	3	6	5	5	7	6	5	6	11	7	9
10	7	10	9	13	11	5	3	4	9	3	11

Table A-28

Spanish Spelling Rubric by Teacher

Group	Teacher										
	1	2	3	4	5	6	7	8	9	10	11
1	0	3	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0
3	0	0	0	1	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	2	0	2	2	0	0
6	0	4	0	3	5	4	0	7	9	0	1
7	2	9	0	13	13	8	2	7	10	2	0
8	2	1	0	1	4	3	0	1	2	3	3
9	9	2	5	0	0	0	6	0	0	10	12
10	2	0	13	0	0	0	8	0	0	5	7

Figure A-1. English Error Type Correlations

		Vowel Omission	Vowel Addition	Vowel Substitution	Vowel Sequence	Consonant Omission	Consonant Addition	Consonant Substitution	Consonant Sequence
Vowel Omission	Pearson Correlation	1	.526**	.658**	.304**	.798**	.351**	.747**	.420**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000
Vowel Addition	Pearson Correlation	.526**	1	.482**	.214**	.665**	.347**	.533**	.327**
	Sig. (2-tailed)	.000		.000	.002	.000	.000	.000	.000
Vowel Substitution	Pearson Correlation	.658**	.482**	1	.330**	.685**	.361**	.763**	.391**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000
Vowel Sequence	Pearson Correlation	.304**	.214**	.330**	1	.370**	.253**	.360**	.536**
	Sig. (2-tailed)	.000	.002	.000		.000	.000	.000	.000
Consonant Omission	Pearson Correlation	.798**	.665**	.685**	.370**	1	.364**	.740**	.431**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
Consonant Addition	Pearson Correlation	.351**	.347**	.361**	.253**	.364**	1	.380**	.237**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.001
Consonant Substitution	Pearson Correlation	.747**	.533**	.763**	.360**	.740**	.380**	1	.396**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000
Consonant Sequence	Pearson Correlation	.420**	.327**	.391**	.536**	.431**	.237**	.396**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.001	.000	

Figure A-1. *N* = 209 for all correlations

** . Correlation is significant at the 0.01 level (2-tailed).

Figure A-2. Spanish Error Type Correlations

		Vowel Omission	Vowel Addition	Vowel Substitution	Vowel Sequence	Consonant Omission	Consonant Addition	Consonant Substitution	Consonant Sequence
Vowel Omission	Pearson Correlation	1	.412**	.737**	.179**	.804**	.646**	.700**	.212**
	Sig. (2-tailed)		.000	.000	.009	.000	.000	.000	.002
Vowel Addition	Pearson Correlation	.412**	1	.489**	.326**	.402**	.476**	.525**	.224**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.001
Vowel Substitution	Pearson Correlation	.737**	.489**	1	.278**	.697**	.751**	.770**	.183**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.008
Vowel Sequence	Pearson Correlation	.179**	.326**	.278**	1	.233**	.324**	.283**	.218**
	Sig. (2-tailed)	.009	.000	.000		.001	.000	.000	.001
Consonant Omission	Pearson Correlation	.804**	.402**	.697**	.233**	1	.553**	.679**	.183**
	Sig. (2-tailed)	.000	.000	.000	.001		.000	.000	.008
Consonant Addition	Pearson Correlation	.646**	.476**	.751**	.324**	.553**	1	.666**	.268**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000
Consonant Substitution	Pearson Correlation	.700**	.525**	.770**	.283**	.679**	.666**	1	.145*
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.036
Consonant Sequence	Pearson Correlation	.212**	.224**	.183**	.218**	.183**	.268**	.145*	1
	Sig. (2-tailed)	.002	.001	.008	.001	.008	.000	.036	

Figure A-2. N = 209 for all correlations

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).