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Can yu rid quat ay rot? A developmental investigation of cross-linguistic spelling errors among Spanish-English bilingual students

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Abstract

This study contributes to the literature on cross-linguistic literacy relationships for English language learners, and in particular, the Spanish-influenced spelling patterns of Spanish-English bilinguals. English spelling, reading and vocabulary assessments were administered to 220 students in four TWI programs over a three-year period, from 2nd grade to 4th grade. Data analysis consisted of t-tests and multiple regression. The incidence of cross-linguistic spelling errors was found to be low at all grade levels and to virtually disappear by 4th grade, indicating that this is a developmental issue that is common among bilingual students and that resolves itself without remediation.

INTRODUCTION

Like English language learners (ELLs) from all native language backgrounds, native Spanish speakers frequently apply what they know from their native language as they develop written competency in English. This application of first language skills and knowledge to similar domains in the second language is known as cross-linguistic transfer (Odlin, 1989), and is frequently seen as evidence of Cummins' developmental interdependence hypothesis (1979), which asserts that well-developed language and literacy skills in the first language (L1) can be carried over to language and literacy development in the second language (L2). This phenomenon has been well studied in second language reading research, with the finding that cross-linguistic associations tend to be strongest in

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the domains of alphabetic knowledge and word knowledge and weaker in more complex domains such as comprehension (Proctor, August, Snow & Barr, 2010). Far less cross-linguistic research has been conducted within the domain of writing (August & Shanahan, 2006; Genesee, Lindholm-Leary, Saunders & Christian, 2006), but the research that has been done suggests a similar pattern to reading, with clearest evidence of cross-linguistic transfer at the level of alphabetic knowledge as evidenced through spelling. The purpose of this paper is to explore this issue further by investigating potential cross-linguistic spelling patterns among both native Spanish speakers and native English speakers enrolled in two-way immersion programs as they progress from grade 2 to grade 4.

Cross-linguistic spelling

Much of the work on the English spelling of Spanish speakers has concentrated on documenting and categorizing errors. These studies have independently confirmed that such errors are frequently cross-linguistic in nature, meaning that Spanish sound-symbol correspondences are brought to bear on the spelling of English words (Bear, Helman, Templeton, Invernizzi & Johnston, 2007; Bear, Templeton, Helman & Baren, 2003; Dressler, 2002; Fashola, Drum, Mayer & Kang, 1996; Ferroli, 1991; Raynolds & Uhry, 2010; Rolla San Francisco, Mo, Carlo, August, & Snow, 2006; Terrebone, 1973; Zutell & Allen, 1988). For example, some of these Spanish-influenced errors include substituting *j* for *h* (e.g. *jorse* for *horse*), using the grapheme *i* to indicate the phoneme /i/ (e.g. *rid* for *read*), and simplifying final nasal clusters (e.g. *ban* for *band*). Many of these studies also included monolingual native English speakers who did not evidence the same spelling patterns, lending further evidence to the notion that they are indeed cross-linguistic in nature (Bear, et al., 2007; Dressler, 2002; Fashola et al., 1996; Raynolds & Uhry, 2009; Rolla San Francisco et al., 2006).

It appears that age may be one determining factor in the presence of cross-linguistic errors in the English spelling of native Spanish speakers. One cross-sectional study of students in grades 2–3 and 5–6 (Fashola et al., 1996) found a lower frequency of errors among older students, but other studies found that cross-linguistic errors can still be found among upper elementary students such as the long vowel *e* and *s* blends in the beginning of a word (Dressler, 2002; Zutell & Allen, 1988) and university educated students (Terrebone, 1973), indicating that more than developmental factors may be at play.

Language of instruction appears to be one of those factors. The research on the English spelling of native Spanish speakers has been conducted in a variety of instructional settings, including transitional bilingual programs (Ferroli, 1991; Zutell & Allen, 1988) and programs where English was the sole medium of instruction (Raynold & Uhry, 2010; Sun-Alprin & Wang, 2011). The Rolla San Francisco, et al. (2006) study was one of the few that has investigated the issue across instructional settings by comparing the English spelling performance of Spanish-English bilinguals in a bilingual program with that of both Spanish-English bilinguals and English monolingual students in an English only setting. This study found that the language of instruction was critical. Monolingual English speakers and native Spanish-speaking 1st graders who received instruction solely in English did not produce Spanish-influenced errors; however, native Spanish speakers instructed in Spanish made

more spelling errors overall, including Spanish-influenced errors. The researchers of this study concluded that early exposure to explicit English instruction could prevent the Spanish-influenced errors in particular from occurring.

Overall English spelling ability appears to be another mitigating factor, as stronger spellers, when they do make mistakes, show less Spanish influence in their misspellings (Zutell & Allen, 1988). These researchers posit that strong spellers are able to differentiate between the two language systems whereas poor spellers use letter-name strategies. In a study of Afrikaans-English bilinguals (De Sousa et al., 2011), letter-name strategies were also found to be employed by students who did not notice the differences in the two orthographies. Ferroli (1991) suggests that Spanish influence in the English spelling of Spanish-English bilinguals is not related to spelling ability in Spanish, but rather to knowledge of English spelling in particular. In this study, good Spanish spellers and poor Spanish spellers made similar cross-linguistic errors, but when their English spelling ability was factored in, those who lacked English spelling knowledge made more Spanish-influenced errors regardless of their Spanish spelling ability.

Transfer

The cross-linguistic spelling research discussed in the previous section as well as the current study are all based on notions of contrastive analysis (Lado, 1957), which seeks to identify areas of similarity and difference across languages, with the idea that people learning a second language will have an easier time attaining components of the second language that are similar to the first, and a more difficult time attaining components that are dissimilar. Spanish shares many things in common with English – it is an alphabetic language with clear symbols for both consonants and vowels, it uses a Roman alphabet, and the majority of letters and many of their corresponding sounds are the same as or very similar to those in English. The alphabetic differences between the English and Spanish literacy systems focus primarily on the sounds associated with a few letters (primarily vowels) and with the orthographic depth of the two languages (Dressler, 2002; Helman, 2004). English has a deep orthography, such that many letters can make more than one sound and many sounds can be made by more than one letter, while Spanish has a shallow orthography, where there is typically a clear one to one correspondence between each letter and its associated sound. As a result, it is fairly straightforward to identify the English sounds and letters that are likely to present challenges for native Spanish speakers spelling in English (such as the long vowels *a*, *e*, and *i*) and to predict the misspellings that will result based on the closest approximate graphemic representations in Spanish (*e*, *i*, and *ai* or *ay*).

Studies such as these that investigate first and second language relationships are frequently viewed as having a transfer orientation (Gass & Selinker, 1992), meaning that they seek to understand the ways in which first language knowledge transfers to the corresponding construct or a related construct in the second language. *Positive* transfer is said to occur when ability in the first language (L1) corresponds to ability in the second language (L2), which from a contrastive analysis perspective is most likely to happen in situations where the first and second languages are highly similar. On the other hand, *negative* transfer, where L1 knowledge is misapplied to the L2 in ways that impede rather than enhance L2

performance, is likely to occur in situations where the first and second languages are very different. As a result, the cross-linguistic research cited earlier is generally categorized as evidence of negative transfer or interference (Riches & Genesee, 2006).

South African researchers (De Sousa, et al, 2011) who looked at the spelling patterns of English-Afrikaans bilinguals identified three possible explanations for negative transfer among students in their study: 1) students simply used the wrong strategy because they were unaware of the differences in the orthographies of the two languages; 2) sensitivity to sounds in the L2 caused confusion; and 3) different cognitive skills are required based on the orthographic transparency of a language. Cross-linguistic spelling/reading research has provided further evidence for the influence of relative orthographic depth of the L1 and L2, with findings that Spanish orthographic knowledge does not predict the English decoding ability of Spanish-English bilinguals (Deacon, Chen, Luo & Ramirez, 2011), whereas French orthographic knowledge does predict the English decoding ability of French-English bilinguals (Deacon, Wade-Woolley, & Kirby, 2009). As Deacon, et al. (2009) explained, the “likelihood of transfer increases as the distance between the written representation of the languages decreases” (p. 224).

In addition to being classified as either *positive* or *negative*, transfer can also be classified in terms of the direction in which it occurs. While most transfer research looks for the potential effects of L1 abilities on L2 development, it is also acknowledged that bilinguals may apply principles from their L2 back to their L1 in a process known as *reverse* transfer or *bidirectional* transfer (Pavlenko & Jarvis, 2002). Pavlenko and Jarvis (2002) maintain that this is most frequently documented among younger children who are simultaneously acquiring language and literacy abilities in two languages (e.g. Muller, 1998, cited in Pavlenko & Jarvis, 2002), but they provide evidence of it for adult L2 learners with established L1 language and literacy skills as well.

A Theory of Bilingualism

Clearly the process of parsing transfer into these different quadrants of *positive* vs. *negative* and *unidirectional* vs. *bidirectional* is quite complex, and in some cases may not be completely accurate. For example, the largest population of ELLs in the United States is Latinos (NEA, 2011), most of whom are born in this country (Capps, Fix, Murray, Ost, Passel & Herwanto, 2005) and who are therefore exposed to varying levels of both Spanish and English from birth, thereby acquiring varying proficiencies in both languages by the time they enter school. Likewise, for researchers who investigate the development of oral and written language of bilingual students in two-way immersion programs, in which native English speakers and native speakers of another language – usually Spanish – are taught literacy and academic subjects through both languages (Howard & Christian, 2002), it can be problematic to classify the same observed behaviors (such as cross-linguistic spelling errors) as unidirectional transfer for one group and reverse transfer for the other.

Other researchers have called for a more holistic theory that views the development of oral and written language skills in two languages in a way that is distinct from their development in a single language for monolinguals (Escamilla, 2006; Grosjean, 1989). As Escamilla (2006) states about the writing development of bilinguals, “Linguistic rules from the first

language that transfer to ELLs' writing in English are often misinterpreted as a language problem rather than a natural progression of second-language literacy development" (p. 2332). In other words, even instances of what may be considered negative transfer can provide evidence of language awareness and promote insight into a student's development along a continuum of language and literacy development in both languages.

Building on this research, this study takes a bilingual view of the cross-linguistic spelling of Spanish-English bilinguals – both native English speakers and native Spanish speakers – in two-way immersion programs. Instead of seeing Spanish-influenced spelling errors as problems, we see them as part of a natural progression in the spelling development of students being educated bilingually through both Spanish and English.

The research questions that guide this study are as follows:

1. Among two-way immersion students, what is the frequency of cross-linguistic (Spanish-influenced) spelling errors in English as student progress from second grade to fourth grade? At each grade level, does the frequency vary by native language and/or program model?
2. Among two-way immersion students, are cross-linguistic spelling errors a significant predictor of English reading comprehension?

METHODS

Sample

The sample for these analyses consisted of 220 students who attended four different TWI programs, all of which were well-established programs that had been in existence for at least five years at the time of data collection. Two of the programs employed a 90/10 approach, in which the majority of instruction in the primary grades was in Spanish and all students, both native Spanish speakers and native English speakers, received initial literacy instruction through Spanish only, with formal English literacy instruction added by third or fourth grade. The other two programs employed a 50/50 approach, in which instruction at all grade levels was divided equally between English and Spanish. In one of these programs, all students received initial literacy instruction through both English and Spanish, while in the other, students received initial literacy instruction in their native language, with second language literacy added in second grade. In order to ensure the model fidelity of the programs that we worked with, we recruited established programs that were known to us and to the field for being strong exemplars of dual language in general and their respective program models in particular. We also collected various forms of data to confirm ongoing fidelity throughout the study, such as classroom observations, administrator interviews, and teacher surveys of literacy practices.

All of the 220 participating students were in second grade at the onset of the study, and had been continuously enrolled in their respective programs since at least first grade. Of the 220 students, 124 (56%) were native Spanish speakers and 96 (44%) were native English speakers. Approximately half of the students were male ($n=108$; 49%); half were female ($n=112$, 51%). Approximately half of the sample qualified for free or reduced price lunches

($n=115$, 52%); however, native Spanish speakers were significantly more likely than English speakers to qualify for free or reduced price lunches ($p<.001$). Whereas 75% of the Spanish speakers qualified for free and reduced price lunches, only 23% of the native English speakers qualified for free or reduced price lunches.

Data Collection and Measures

Data were collected across three school years, from second grade to fourth grade. A single wave of data was collected each winter by trained research assistants who administered the same battery of language and literacy assessments each year. The assessments include the real-word subtest of the English Developmental Contrastive Spelling Test battery (a study-specific measure designed to investigate both developmental and cross-linguistic spelling errors among Spanish-English bilingual students) and three subtests of the English Woodcock Language Proficiency Battery-Revised (WLPB-R) (Woodcock, 1991) – picture vocabulary, word attack, and reading comprehension. For all analyses reported here, WLPB-R standard scores were used for each subtest, with a range of 0 to 200 points, a mean of 100 points, and a standard deviation of 15 points. All of the WLPB-R subtests were individually administered, while the study-specific spelling measure was whole-group administered. Further descriptions of the individual measures are provided below.

English Developmental Contrastive Spelling Test (EDCST) (Howard, Arteagoitia, Lougit, Malabonga, & Kenyon, 2006)—The EDCST is an assessment battery consisting of two whole-group administered measures, each of which is designed to tap into both intralinguistic and cross-linguistic spelling errors. The real-word subtest has 40 items and follows a traditional spelling test format, while the pseudoword subtest has 20 items and employs a cloze format. The subtests were developed through a parallel but separate process, and each has its own specific psychometric properties. As such, the subtests are intended to be scored, interpreted, and discussed independently of one another. We based the analyses presented here on the real word subtest because it was our first exploration of the issue and the real-word subtest includes a greater number of potential cross-linguistic features, thus allowing for a richer analysis. In future analyses, we will look at performance on the pseudoword subtest to determine whether or not patterns are similar to the real-word findings presented here.

The real-word subtest can be scored in three different ways – accuracy at the whole word level, accuracy at the feature level, and contrastive influence. Because this study focuses on cross-linguistic influence on English spelling, the contrastive scores are used in the analyses presented here. An item is scored for contrastive analysis if the spelling could be derived from the application of Spanish phoneme-grapheme correspondences and/or knowledge of orthographic conventions in Spanish (e.g., *sit* for *seat*). Each word has one or more contrastive feature, such as long vowels, short vowels, and nasal clusters (see Table 1 for the full array of contrastive features and corresponding sample items from the test, along with actual spelling patterns demonstrated by participating students). These contrastive features were either previously identified in the literature (Fashola, et al., 1996; Ferroli, 1991; Terrebone, 1973; Zutell & Allen, 1988) or were identified through pilot work for this study, which involved culling spelling errors from writing samples collected from two-way

immersion students as part of an earlier study (Howard, Christian, & Genesee, 2004) as well as administering a pilot version of the measure to students in one two-way immersion program and one mainstream English only program and analyzing their responses (Howard, et al., 2006). Because some words have more than one contrastive feature, the real-word subtest has a total possible contrastive raw score of 55 points. The reliability of the real-word subtest is .94.

English vocabulary knowledge (Woodcock, 1991)—We used the Woodcock Picture Vocabulary test as our measure of English vocabulary knowledge. In this subtest, students are shown a series of pictures and are asked to provide the names of the objects that they see. The median internal consistency reliability for this subtest is .86.

English decoding (Woodcock, 1991)—We used the WLPB-R Word Attack subtest as our measure of English decoding ability. In this subtest, students are asked to read a series of orthographically acceptable nonsense words. The median internal consistency reliability for this subtest is .91.

English reading comprehension (Woodcock, 1991)—We used the Woodcock Passage Comprehension subtest as our measure of English reading comprehension. In this subtest, students are presented with a cloze activity where they are asked to silently read a series of passages and supply the missing word for each passage. The median internal consistency reliability for this subtest is .90.

Data Analysis

All spelling responses were entered and cross-checked by two project team members. Responses were likewise scored and cross-checked to ensure accuracy. Data were then analyzed using a variety of quantitative approaches, including descriptive statistics, two-tailed t-tests, and multiple regression. The first research question, regarding the frequency of cross-linguistic spelling errors and potential differences across native language groups or students in different program models, was explored by generating descriptive statistics for each subgroup at each grade level, and then conducting two-tailed t-tests to determine if there were significant differences across the two groups. For the second research question, regarding the potential relationship between cross-linguistic spelling errors and reading comprehension, a series of multiple regression models was constructed to test for relationships between the two variables at each grade level, controlling for other factors such as program model, native language, free or reduced lunch eligibility, and English vocabulary knowledge. Program model and native language were both included in the models as they are key areas of interest for this study that yielded significant differences in the spelling outcomes of participating students. Free or reduced lunch eligibility was included as a control variable given the known effects of socioeconomic status on ELLs' literacy development (August & Shanahan, 2006), and English vocabulary knowledge was likewise included as a control variable because of prior research showing its impact on English spelling ability for ELLs (Proctor et al., 2010, Raynold & Uhrly, 2010; Rolla San Francisco, et al., 2006).

FINDINGS

The first research question deals with the frequency of cross-linguistic spelling errors among two-way immersion students as they progress from grade 2 to grade 4, and in particular, the issue of whether or not the frequency of errors at each grade level differs by the native language of the student or the program model.

First, looking at the performance of students by native language (Table 2) we see that on average, for both native Spanish speakers and native English speakers, the incidence of cross-linguistic spelling errors was highest in second grade, considerably lower in third grade, and virtually non-existent in fourth grade. Two-tailed t-tests with unequal variances were conducted to compare the performance of the two native language groups, and because the distributions were not normal, Mann Whitney *U* non-parametric tests were also conducted to confirm the findings of the t-tests. On average, there were significant native language differences at all three grade levels ($p < .001$), with native Spanish speakers consistently demonstrating significantly more cross-linguistic spelling errors than native English speakers. Again, though, the mean number of errors by each group in fourth grade was quite small, with native Spanish speakers averaging a 6% error rate and native English speakers averaging a 2% error rate.

Turning our attention now to the issue of potential program model differences (Table 3), we see a similar pattern whereby on average, for both 50/50 students and 90/10 students, the incidence of cross-linguistic errors dropped considerably from second grade to fourth grade. Again, two-tailed t-tests with unequal variances were conducted to compare the performance of students in the two program models, and because the distributions were not normal, Mann Whitney *U* non-parametric tests were also conducted to confirm the findings of the t-tests. Here, there were significant program differences ($p < .001$) in the early elementary grades (2nd & 3rd), with 90/10 students producing more errors than 50/50 students. By fourth grade, however, there were no longer significant program differences. This mirrors other two-way immersion program model research that has found early advantages in English literacy performance for 50/50 students that disappear by the upper elementary grades (Lindholm-Leary & Howard, 2008).

To explore the issue further, we identified the students who exhibited the highest number of cross-linguistic errors at each grade level as evidenced by a frequency of errors that was 2 or more standard deviations above the mean. Our rationale in doing this was to determine if there were a subset of students for whom this was an ongoing concern, despite the evidence in Tables 2 and 3 that on average, it was not a long-term issue for native English speakers or native Spanish speakers in either 90/10 or 50/50 programs. As shown in Table 4, only 17 students (7.7% of the total sample) fit this profile at any point during the three years of the study, with only 5 of the 17 students (2.3% of the total sample) exhibiting a high incidence of cross-linguistic spelling patterns for 2 or 3 years. Looking year by year, there were 6 students who fit the profile in 2nd grade, 9 in 3rd grade, and 8 in 4th grade. While the percentages of students who demonstrated very high frequencies of cross-linguistic spelling errors were higher in grades 3 and 4 than in grade 2, this by no means indicates that the problem is getting worse over time, as the mean number of errors and standard deviation

both decreased substantially in each subsequent grade, thus making it far easier to be classified as a student with a high frequency of errors.

Continuing with this line of investigation, for each of the 17 students, we identified the grade levels in which their frequency of cross-linguistic errors was 2 or more standard deviations above the mean and put this information in a table along with each student's school, the program model followed by their school, and each student's native language, gender, and free or reduced price lunch eligibility (Table 5) in order to determine if there was anything systematic about these students that would help us to better understand the phenomenon. As summarized in Table 6, all but 1 of the 17 students are native Spanish speakers, and most also attended one of the two 90/10 programs and were eligible for free or reduced price lunch. These individual student profiles mirror the group findings reported earlier that demonstrated that native Spanish speakers made significantly more cross-linguistic errors than native English speakers at all grade levels, and that 90/10 students made significantly more cross-linguistic errors than 50/50 students in grades 2 and 3. However, as those mean findings demonstrated, the total number of cross-linguistic errors by both native language groups and students in both program models was quite small, indicating that this is not a long-term concern; likewise, these individual findings show that with the possible exception of the 5 students who demonstrated this pattern for 2 or more years, this is not a long-term concern at the individual level, either.

The second research question had to do with the potential relationship between cross-linguistic spelling errors and English reading comprehension at each grade level. Using multiple regression, we created models of the predicted effects of cross-linguistic spelling errors on English reading comprehension at each grade, controlling for English vocabulary ability, English decoding ability, native language, and program model. We also tested for an interaction between native language and cross-linguistic errors to determine if the potential effects of cross-linguistic errors were different for native English speakers and native Spanish speakers.

In 2nd grade, cross-linguistic spelling errors were significantly and negatively associated with English reading comprehension, controlling for English picture vocabulary, English decoding ability, native language, and program type (Table 7). Interestingly, there was an interaction such that the effects for native Spanish speakers were not as large as those for native English speakers. For native English speakers, every additional cross-linguistic error was associated with a .78 decrease in English reading comprehension score, whereas for native Spanish speakers, every additional cross-linguistic error was associated with only a .44 decrease in English reading comprehension score. This is most likely due to the fact that native Spanish speakers have both significantly lower performance on English reading comprehension and significantly more cross-linguistic errors, so that once native language is included in the model, the effects of cross-linguistic errors on English reading comprehension are mitigated for native Spanish speakers.

In 3rd and 4th grade, cross-linguistic errors were no longer significantly associated with English reading ability, indicating that this is not a long-term concern. Moreover, a final multiple regression model of predicted 4th grade English reading performance was generated

to determine the potential long-term effects of 2nd grade cross-linguistic errors. In this model, controlling for all of the same variables as in the other models, 2nd grade cross-linguistic errors were not significantly associated with 4th grade reading comprehension. In other words, while 2nd grade cross-linguistic errors were significantly and negatively associated with 2nd grade reading outcomes, there was no persistent long-term negative effect of these errors on English reading comprehension.

Finally, of the 17 children with the highest incidence of cross-linguistic spelling errors, only 3 had fourth grade reading comprehension scores more than one standard deviation below the mean, while most were within a standard deviation of the mean and 2 actually scored above the mean, suggesting that even for these children, there was no long-term negative influence of cross-linguistic spelling errors on reading comprehension.

DISCUSSION

Our findings for both native Spanish speakers and native English speakers in both 90/10 and 50/50 programs indicate that on average, the incidence of cross-linguistic errors was never that high, and virtually disappeared by 4th grade. This finding lends support to the earlier assertion that cross-linguistic spelling errors decrease with age (Fashola, et al. 1996), but does so in a more powerful way as the current study was longitudinal rather than cross-sectional. One could also argue that as students get older they learn more about the two different orthographic systems and can separate them as needed. While the analyses presented here did not extend beyond fourth grade, there is no reason to believe that the pattern would change at the secondary level, as the three-year pattern of decreasing errors over time is quite clear and compelling in these data. Moreover, English spelling becomes more morphological in nature at the upper levels (Bear, et al., 2007), meaning that meaning-based units such as roots and affixes become more important than letter-sound mapping.

Because this study also included native English speakers who were developing Spanish-English bilingual proficiency, it allowed for a comparison of the performance of native Spanish speakers, the usual focus of this line of research, with a bilingual group of native English speakers. This differs from previous research that has compared the performance of bilingual native Spanish speakers to that of monolingual native English speakers (Dressler, 2002; Rolla San Francisco, et al., 2006). The inclusion of monolingual native English speakers is important for establishing that certain types of errors are in fact Spanish-influenced. However, having established that through prior research, it is also very interesting to note that cross-linguistic influence is present not only among native Spanish speakers, but also among native English speakers who are being educated bilingually. This leads back to the challenge in using a transfer orientation to explain the findings, as the exact same spelling patterns would be classified as negative transfer for the native Spanish speakers and reverse transfer for the native English speakers. While it is not incorrect to classify the spelling patterns of each subgroup accordingly, it does seem artificial to impose these classifications rather than employing a more holistic theory of bilingualism to describe a common phenomenon for students who are all emergent bilingualisms along a constantly shifting continuum of English and Spanish proficiency.

Like the Dressler (2002) and Rolla San Francisco, et al. (2006) studies, this study was carried out in two different instructional settings with varying amounts of English instruction, and like the Rolla San Francisco, et al. (2006) study, this study compared the English spelling performance of students across program models. The Rolla San Francisco, et al. (2006) study found that students in the monolingual English program demonstrated fewer English spelling errors overall and fewer cross-linguistic errors in particular than the students in the bilingual programs, and concluded that it was important to provide explicit English literacy instruction early on to prevent this. As our study was longitudinal, it allowed us to observe patterns over time and come to a different conclusion. This study, like other two-way immersion program model research (Lindholm-Leary & Howard, 2008) found initial differences that favored the 50/50 model (which provides 50% of instruction in English at all grades) over the 90/10 model (which provides 90% of instruction through Spanish in the primary grades); however, these differences disappeared by 4th grade, indicating that language of instruction does not present a long-term concern.

Finally, this study found that cross-linguistic errors were not significantly associated with reading comprehension beyond 2nd grade, indicating no long-term concern about this behavior as it relates to reading comprehension. Having a strong orthographic base in Spanish may be beneficial to reading. For example, Sun-Alperin and Wang (2011) suggest that knowledge of Spanish spelling and orthography is positively correlated with English reading and that Spanish phonemic awareness is likewise beneficial to English reading.

Overall, cross-linguistic errors appear to be a normal, developmental event for some bilingual children that is never of very high frequency, virtually disappears by 4th grade, and is not negatively associated with English reading comprehension beyond 2nd grade. In other words, there is no evidence that this represents a long-term English literacy concern for either native Spanish speakers or native English speakers in 90/10 or 50/50 two-way immersion programs. From a practitioner perspective, these findings indicate that while teachers would be well-advised to help bilingual students make connections across languages and notice similarities and differences, there is no need to provide remedial instruction related to cross-linguistic spelling errors, as these errors do not fossilize over time or create issues for larger literacy skills such as reading comprehension. From a research perspective, it is clear that longitudinal research that incorporates students from varying language backgrounds enrolled in a variety of program models is most appropriate and illuminating. Future research could explore the issue using an individual growth modeling framework, begin with younger students who would be more likely to exhibit a greater percentage of errors, include native English speakers and native Spanish speakers educated in monolingual English settings, and possibly investigate cross-linguistic spelling patterns from English to Spanish as well as from Spanish to English. Studies such as these would continue to develop the knowledge base of cross-linguistic influence in the literacy development of bilingual students.

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Biographies

Elizabeth Howard is an assistant professor in the Neag School of Education, where she teaches graduate courses related to the education of English Language Learners. She also directs a number of research projects focusing on dual language education, biliteracy development, and the pre-service and in-service preparation of teachers.

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Table 1

Focus Features, Sample Items, and Observed Cross-Linguistic Spellings

Features	Sample items	Observed spellings
Long <i>e</i> as <i>i</i>	<i>seed</i>	<i>sid</i>
Long <i>i</i> as <i>ai</i> , <i>ay</i>	<i>alive</i>	<i>alaiv</i>
Long <i>a</i> as <i>ei</i> , <i>ey</i> , <i>e</i>	<i>paint</i>	<i>peint</i>
Short <i>o</i> as <i>a</i>	<i>drops</i>	<i>draps</i>
Short <i>u</i> (oo) as <i>u</i>	<i>stood</i>	<i>stud</i>
Short <i>u</i> (Λ) as <i>a</i> , <i>o</i>	<i>summer</i>	<i>samer</i> , <i>somer</i>
Nasal clusters <i>nt</i> or <i>nd</i> as <i>n</i>	<i>stand</i>	<i>stan</i>
Interdental diphthong <i>th</i> as <i>t</i> , <i>f</i> , <i>d</i>	<i>thanked</i> , <i>faith</i> , <i>weather</i>	<i>tanked</i> , <i>fief</i> , <i>weder</i>
<i>w</i> as <i>gu</i> , <i>gü</i> , <i>u</i>	<i>sandwiches</i>	<i>sandguiches</i>
flap as <i>r</i>	<i>hospital</i>	<i>hospiral</i>
<i>h</i> as <i>j</i>	<i>hospital</i>	<i>jospital</i>
<i>z</i> as <i>s</i>	<i>zipped</i>	<i>sipt</i>
<i>sh</i> as <i>ch</i> , <i>s</i>	<i>ashamed</i>	<i>achamed</i> , <i>asamed</i>

Table 2

Descriptive Statistics of Cross-Linguistic Spelling Errors by Native Language Over Time

Grade	Native Language	N	M	SD	Min	Max
2	Spanish	117	17.42	13.56	0	47
	English	91	10.38***	10.92	0	37
3	Spanish	100	8.19	8.42	0	37
	English	71	3.06***	5.98	0	42
4	Spanish	93	3.34	4.99	0	30
	English	74	1.05***	2.54	0	19

 $p < .001$

Table 3

Descriptive Statistics of Cross-Linguistic Spelling Errors by Program Model Over Time

Grade	Program Type	N	M	SD	Min	Max
2	50/50	102	5.69***	6.68	0	31
	90/10	106	22.67	11.99	1	47
3	50/50	90	3.41***	4.82	0	26
	90/10	81	9.00	9.50	0	42
4	50/50	84	1.89 ns	3.61	0	18
	90/10	83	2.77	4.77	0	30

 $p < .001$

Table 4

Students with the Highest Incidence of Cross-linguistic Errors (> 2 SD above mean)

	By Grade			Over Time	
	2	3	4	1 year	2 years
n of test takers	208	171	167	220	220
n with errors > 2sd above mean	6	9	8	17	5
% with errors > 2sd above mean	2.9%	5.3%	4.8%	7.7%	2.3%

Table 5
Detail of Students with the Highest Incidence of Cross-Linguistic Errors (7.7% of Total Sample)

Student	2 nd Grade	3 rd Grade	4 th Grade	School	Program Type	Native Language	Gender	Qualified for Free/Reduced Lunch
1	X#					Spanish	Female	
2	X	X#	X#			English	Female	
3	X#					Spanish	Female	
4	X	X#	X#			Spanish	Female	
5	X	X#	X			Spanish	Male	
6	X	X#	X	a	90/10	Spanish	Female	
7	X		X#			Spanish	Male	
8	X#	X#	X#			Spanish	Male	
9		X#				Spanish	Male	
10	X#					Spanish	Female	no
11	X#	X#	X			Spanish	Female	no
12	X	X#		b	90/10	Spanish	Male	
13	X#	X				Spanish	Female	no
14	X	X	X#			Spanish	Male	
15	X	X	X#			Spanish	Female	
16	X	X	X#	c	50/50	Spanish	Male	
17	X	X#	X#			Spanish	Female	

Note: X signifies that data exists, that the student took the test. X# signifies that the errors are >2 SD above the mean.

Table 6
Summary of Background Characteristics of Students with the Highest Incidence of Cross-Linguistic Errors

	Total	Program Type		Native Language-Spanish	Female	Qualified for Free/Reduced Lunch
		90/10	50/50			
n	17	13	4	16	10	14
% of n	100.0%	76.5%	23.5%	94.1%	58.8%	82.4%

Table 7Final Multiple Regression Model for 2nd Grade English Passage Comprehension

Variable	Parameter Estimate	Standard Error	<i>t, p-value</i>
Intercept	49.76	6.41	7.76***
English Picture Vocabulary	.14	.03	4.07***
English Word Attach	.42	.05	8.61***
Cross-Linguistic Errors	-.78	.12	-6.67***
Native Language	-7.47	1.98	-3.77***
L1/Cross-Linguistic Error Interaction	.44	.10	4.32***
Program Model	6.80	1.62	4.21***

Note: $R^2 = .76$, df (6, 191)

 $p > .001$