



# Crosslinguistic influence on spelling in written compositions: Evidence from English-Spanish dual language learners in primary grades

Alissa Patricia Wolters<sup>1</sup> · Young-suk Grace Kim<sup>1</sup>

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## Abstract

We investigated spelling errors in English and Spanish essays by Spanish-English dual language learners in Grades 1, 2, and 3 ( $N=278$ ; 51% female) enrolled in either English immersion or English-Spanish dual immersion programs. We examined what types of spelling errors students made, whether they made spelling errors that could be due to crosslinguistic influence, and whether errors were associated with instructional program, English learner status, and grade level. Compositions were transcribed and coded using the Systematic Analysis of Language Transcripts (SALT) software. Spelling errors were suggestive of crosslinguistic influence that was mostly unidirectional from one language to the other rather than bidirectional. Spelling errors were related to instructional program such that students in Spanish-English dual immersion made more English spelling errors in English compositions due to Spanish influence, and students in English immersion made more spelling errors in Spanish compositions due to English influence. Students in higher grades also made less English spelling errors in English compositions due to Spanish influence than students in lower grades. These findings suggest that dual language learners acquire spelling patterns in one language influenced by instruction and home language, which transfers to spelling in the other language.

**Keywords** Dual language learners · Spelling · Dual immersion instruction · Writing · Crosslinguistic influence · Primary grades

Spelling—the ability to encode sounds to written words that adhere to a language’s orthographic system—is a challenging task that develops over time (Lombart-Huesca & Zyzik, 2019). Theoretical models of writing such as the simple-view-of-

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✉ Alissa Patricia Wolters  
awolters@uci.edu

<sup>1</sup> Education, University of California, Irvine, USA

writing (Juel et al., 1986), the not-so-simple-view-of-writing (Berninger & Winn, 2006), and the Direct and Indirect Effects Model of Writing (DIEW; Kim, 2020; Kim & Park, 2019), posit that writing requires proficient spelling. If spelling skills are not proficient, the transcription process requires cognitive resources (e.g., working memory), constraining the writer's ability to focus on higher order processes such as ideation and organization of ideas coherently and cohesively. Thus, research investigating spelling in context is warranted, especially of under-researched populations, such as dual language learners.

So far, spelling research has focused primarily on monolingual students. A small body of research has studied the spelling of dual language learners, and evidence from Spanish-English speakers suggests Spanish L1 has a crosslinguistic influence on English L2 spelling. However, most previous studies focused on the influence of L1 on L2. L2 influence on L1 spelling has been less investigated. Furthermore, previous research has examined dual language learners in English immersion or English as a Second Language instruction, but comparison of the spelling patterns of dual language learners in different instructional environments is scarce. To our knowledge, no research has addressed whether spelling errors potentially due to crosslinguistic influence vary within and across languages and, if so, whether they are moderated by instructional program, English learner status, or development (by proxy, grade). Therefore, the current study addresses these gaps by analyzing spelling patterns potentially due to crosslinguistic influence in English and Spanish compositions written by Grades 1, 2, and 3 Spanish-English dual language learners in either English immersion or English-Spanish dual immersion programs.

## English-Spanish dual language learners' spelling development

Spelling develops in stages (Defior & Serrano, 2005; Ehri, 2000; Treiman, 2017). During the first stage, known as the "prealphabetic stage," children learn that images can represent ideas. Then they transition to the "partial alphabetic stage" where they understand that and use grapheme-phoneme correspondences for some letters and sounds. They combine letters to write words, though most are misspelled or incomplete. Often, early spelling only includes the letters of the most salient sounds. Next, in the "full alphabetic stage," children have and use knowledge of grapheme-phoneme correspondences in their spelling. English monolinguals learning to spell tend to have challenges such as omitting nasals or internal consonants (Bourassa & Treiman, 2001), and Spanish monolinguals tend to have trouble with silent letters (e.g., *h*), accent marks, and distinguishing between similar phonemes (Defior & Serrano, 2005; Defior et al., 2009). Finally, as children further develop their spelling skill, they recognize and use common spelling patterns in the "consolidated alphabetic stage."

Spanish-English dual language learners may make some of the same spelling errors as those made by English and Spanish monolinguals, but because they are juggling the acquisition of two languages simultaneously, there are some important distinctions. Rubin and Carlan (2005) analyzed bilingual students' Spanish and English written compositions and proposed that although the stages of bilingual students' spelling development are generally similar to monolingual students' development,

Spanish-English bilingual writers show signs of crosslinguistic influence in the early stages. After they develop the understanding that spelling (i.e., writing words) is different from drawing, bilingual children write the same letters and symbols in both languages, but orally pronounce them differently. Next letter-sound mapping is acquired, and writers begin to use vowels to represent each syllable. Children will often spell a word the same way in both languages—especially for cognates—but read them differently; they are aware of two different phonological systems. Then, in both languages, children begin to write words by including letters of the salient sounds. At this developmental point, crosslinguistic influence is evident as children struggle with distinguishing between spelling patterns of the two languages. After this stage, spelling begins to adhere to the orthographic rules of each language, including silent letters, although there is still the presence of spelling patterns due to crosslinguistic influence in more advanced words. Finally, in the last stage, writing becomes generally correct in each language with limited evidence of crosslinguistic influence.

### Crosslinguistically influenced spelling errors

A language's grammar is made up of linguistic rules—phonological, orthographic, and morphological. Some rules are shared with other languages while others are unique to the language. The usage-based theories suggest that L1 (Ellis, 2002; Tomasello, 2000) and L2 (Wulff & Ellis, 2018) are acquired as a result of interaction with chunks of language that follow these rules. These chunks, referred to as “psychological units,” are acquired over time and the learner abstracts and modifies rules in response. Units the learner is exposed to more frequently will most likely be acquired faster than those that are less frequent (Ellis, 2002; Wulff & Ellis, 2018). When units are in competition, more salient units may block less salient ones (blocking theory, Ellis & Sagarra 2010). Similarly, the Unified Model of Bilingualism (MacWhinney, 2005) argues that positive and negative crosslinguistic influence happens when a unit in a less developed language cues a unit in the other more developed language. Features shared across languages may also activate crosslinguistic transfer (see Interdependence Hypothesis, Cummins, 1979).

These theories along with the writing systems of English and Spanish may help explain the occurrence of crosslinguistically influenced spelling errors by Spanish-English dual language learners. For instance, Spanish and English share some important grapheme-phoneme correspondences. All letters in the English alphabet exist in the Spanish alphabet, and the shared consonant letters tend to have similar pronunciations. In addition, there are many cognates that are orthographically and phonologically similar (e.g., *class, clase; family, familia; photo, foto; rock, roca*). Therefore, a dual language learner who starts to spell a word in a target language in which they are less proficient may employ the spelling pattern of the more acquired or salient language. However, there are also distinct differences between the orthography and phonology of the two languages. For example, even though the Spanish alphabet includes letters that are not present in English (e.g., ñ, ll), these letters are similar to other letters shared by the two languages (e.g., n, l). Also, the phonemic inventories and letter-sound mapping of the two languages have some stark contrasts. Spanish

has about 25 phonemes (unique sound categories) while English has 44 (these numbers may vary by dialect). However, most Spanish sounds have a phonemic sounding counterpart in English (e.g., most consonants and some long vowels), and, although many of the sounds in English do not have a similarly sounding phoneme in Spanish (e.g., short vowels), they are often allophones of a Spanish phonemic category. Additionally, Spanish has a consistent orthography while English has a highly inconsistent one with a large variety in spelling patterns for the same sound (e.g., *I, fine, sign, kind* for /ai/) as well as many homonyms (e.g., *band/band, well/well*), homophones (e.g., *role/roll, their/there/they're*), and homographs (e.g., *wind/wind, bass/bass*). Since writing requires proficient transcription skills (Berninger, 2000), a dual language learner who has developed oral proficiency in their target language, but not spelling, may draw from the spelling rules of their other language to not constrict writing. This may be especially prevalent when two languages share many orthographic and phonological features, as do English and Spanish, and the majority of either language can be written phonemically using the other language's spelling patterns.

Previous research has suggested crosslinguistic influence in spelling patterns. Spanish-English dual language learners tend to exhibit regular spelling errors in English that seem to be due to Spanish spelling influence (e.g., Bebout 1985; Fashola et al., 1996; Howard et al., 2006; Zutell & Allen, 1988). One common pattern is applying Spanish spelling rules to English sounds that do not exist in Spanish (e.g., short vowels). For example, it is common to see words such as *funny* spelled as *fonny* (Bahr et al., 2015) because /ʌ/ is not present in Spanish, and the writer inserts a letter that represents a nearby phoneme instead—in this case the letter and sound *o* (/o/), of which /ʌ/ could be an allophone of in Spanish. Another common pattern is the deletion of word-final silent *e*. Spanish silent letters—other than silent *h*—serve as consistent orthographic markers (e.g., *u* after *q* and *g*) to distinguish between phonemic renderings. In English, silent *e* often marks a long vowel, and Spanish-English dual language learners often struggle with how to spell these sounds (Bebout, 1985; Raynolds et al., 2013), even similar sounds exist in Spanish. Other common errors include reducing double consonants, using consistent orthographic spelling, and applying Spanish phonological rules.

Significantly fewer studies have explored the influence of English on Spanish spelling (e.g., Bahr et al., 2015), but extant evidence suggests that, for Spanish-English emergent bilinguals, English spelling may also influence Spanish spelling. Bahr and colleagues (2015) analyzed common spelling errors in Spanish and English narrative and expository essays written by twenty bilingual middle school children receiving English instruction for speakers of other languages (ESOL). They coded for type of error (phonological, morphological, orthographic, phonological-orthographic), code-switching, and Spanish dialectal differences. Many of the errors were similar to those made by developing English immersion writers (e.g., capitalization of proper nouns), but crosslinguistic patterns were also found. One common spelling pattern—similar to Spanish-influenced English texts—was vowel substitutions. For example, the Spanish *o* (/o:/) is more rounded than the English *o* (/ou/) and is typically formed farther back in the mouth. They found that students would spell *podia* as *pudia*, replacing the *o* with a *u*. Another common spelling pattern was the use of linguistic features from the nontarget language. For example, children used spelling

patterns and sounds that do not exist in Spanish (e.g., /f/), such as spelling *máquina* as *mashina* or *machina*, drawing from the English cognate, *machine*. Rubin and Carlan (2005) presented several samples of student writing in their text, which revealed that some spelling errors made by English monolinguals are also common for Spanish monolinguals, such as silent word-initial *h* deletion, switching *s* and *z* for /s/, and switching *b* and *v* for /b/ or /β/.

Transfer may not be unidirectional in a learner. This is especially likely for students in a dual immersion program as children may find features of both languages salient, leading to a more balanced competition between their two languages (Cummins, 1979; Rubin & Carlan, 2005). On the other hand, MacWhinney (2012, p. 20) suggested a one-way influence because the less developed language is dependent, or “parasitic,” on the more developed language. However, no research to our knowledge has investigated whether a same dual language learner transfers in both directions, from their less proficient language to their more proficient language and vice versa.

### **Influence of instruction, English learner status, and grade level**

Language is acquired over time through interaction at home, in the community, and at school, and, thus, crosslinguistic transfer of spelling patterns may be moderated by instructional program, English learner status, and grade level (as a proxy for development). A dual language learner may acquire English spelling patterns even if they are less proficient in English than Spanish if they receive sufficient exposure to English print in school in either English immersion, dual immersion instruction, or elsewhere (e.g., community, home). However, even if they develop some English literacy, they may transfer spelling patterns from Spanish to English if Spanish is more proficient and salient. This may be especially true if they receive dual immersion instruction that includes both Spanish and English spelling instruction. Over time, a dual language learner may become more proficient in English than Spanish if they receive sufficient English exposure (Cummins, 1976). A study with Grade 1 Spanish-English dual language learners in either English or Spanish instruction found that only the students in Spanish instruction used spelling patterns in English that could be attributed to Spanish crosslinguistic influence while the students in English immersion instruction made fewer spelling mistakes and tended to follow English orthographic rules (San Francisco et al., 2006). However, greater proficiency in English than Spanish could also lead to crosslinguistic influence on Spanish production, and the student may misspell Spanish words using English grapheme-phoneme correspondences. To the best of our knowledge, this has not been previously investigated.

English learner status may also lead to use of crosslinguistic spelling patterns. The student may be an English language learner and not sufficiently proficient in English for English spelling instruction to be salient if home and community use a language other than the school language, such as Spanish. Cummins (1976) suggested that a certain threshold of language proficiency must be reached in the learner’s first and second language for acquisition of the second language to be additive rather than either not make an impact or lead to attrition of the first language. If a learner does not have sufficient proficiency in the second language, when writing in English, a

language learner may instead draw from their Spanish language knowledge leading to crosslinguistic influence. However, as more English instruction is received, this would become less likely. Research regarding young English learners spelling in English has had mixed results. Some studies have found that English learners made significantly more errors than monolinguals (e.g., Wang & Geva, 2003) while others found no significant difference between the two groups (Harrison et al., 2016; Jongejan et al., 2007). Figueredo (2006) reviewed twenty-seven studies of English language learners' spelling skills in different developmental stages (Grade 1 to University) and of various linguistic backgrounds and found that many of the studies identified spelling errors that suggested crosslinguistic influence.

Grade levels may also moderate crosslinguistic transfer. Monolingual children and English learners tend to make less spelling errors in higher grades than lower grades (e.g., Apel et al., 2012; Caravolas et al., 2001; Jongejan et al., 2007). A dual language learner may also show a change in spelling over time and spell with less crosslinguistic influence in higher grades than younger grades as they learn to distinguish between the two languages. When Grade 2 students in Spanish-English dual immersion program were asked to write in English (Linan-Thompson et al., 2017), many common crosslinguistic spelling errors were found (*b* for *v*, *ei* for /*ei*/, *i* for /*i*/, *j* for /*h*/, *ll* for *y* or *j*, *d* for *th*, *u* for *oo*, a.i. for /*ai*/, reducing double consonants, and deleting word-initial *h*) at the beginning of the school year (approximately 74%). The number of errors decreased to 58% by the end of the year. In another study (Zutell & Allen, 1988), grade did not capture spelling development. Instead, Spanish-English dual language learners in Grades 2, 3, and 4 differed by language proficiency level.

## The current study

The purpose of this study is to investigate patterns of spelling errors potentially due to crosslinguistic influence for Spanish-English dual language learners in Grades 1 to 3 in either English immersion or English-Spanish dual immersion programs. The following were guiding research questions. First, are there consistent spelling error patterns potentially due to crosslinguistic influence in Spanish and English essays (narrative, opinion) written by Spanish-English dual language learners in Grades 1, 2 and 3? Second, if so, do dual language learners tend to show crosslinguistic influence in spelling errors in only one direction (English to Spanish or Spanish to English) or both directions (English to Spanish and Spanish to English)? Third, do spelling error patterns differ by instruction program (dual immersion vs. English immersion), English learner status, and grade level?

We predicted that there will be consistent spelling error patterns that are potentially due to crosslinguistic influence (e.g., Bebout, 1985). We may also find some patterns not previously identified such as spelling phonologically ambiguous consonants with the orthographic rules of the other language's system (e.g., replacing Spanish's dental stops, /*d̪*/ and /*t̪*/ with English's interdental, /*ð*/ and /*θ*/ instead of English's alveolar stops, /*d*/ and /*t*/). We also posited crosslinguistic influence of spelling patterns in both directions, particularly for those in the dual immersion program. To our knowledge, no previous research has explored whether dual language learners who make cross-

linguistic spelling errors in one language also make crosslinguistic spelling errors in the other language. Lastly, we hypothesized that spelling error patterns would be significantly associated with instructional programs, language status, and grade level. For example, we hypothesized that students in dual immersion instruction will use Spanish-influenced spelling patterns in English spelling. On the other hand, participants in English immersion instruction may be more likely to use English-influenced spelling patterns in Spanish spelling. We also expected that English language learners will make more Spanish-influenced errors in English than dual language learners who are classified as fluent in English (Figueredo, 2006), and that spelling errors will decrease as students develop (grade level as proxy; Jongejan et al., 2007).

## Method

### Participants

Spanish-English dual language learners in Grades 1 to 3 in a high poverty (81% of students eligible for the free and reduced lunch program), Title I school district in the Southwest of US were invited to participate in a larger study (Kim et al., 2022). These children attended either dual immersion or English immersion instruction. Of the total 380 participants, 278 (Female=51%) exhibited some biliteracy skill in both Spanish and English—defined as the ability to write at least one word in the target language on one of their two essays (one narrative, one opinion) per language—were included in the current study. Thirty-one students used at least one Spanish word in their English essay, and three of them wrote the majority (50% or more) of their English essays in Spanish. These three students were enrolled in dual immersion instruction (two in Grade 1, one in Grade 2). One-hundred-and-five students who used at least one English word in their Spanish essay, and 12 of them wrote the majority of their Spanish essay in English. Two of the 12 students were enrolled in Grade 1 dual immersion, and the remaining were enrolled in English immersion (nine in Grade 2, one in Grade 3).

In addition, also regarding the analysis sample ( $n=278$ ), most were in dual immersion instruction ( $n=229$ ), classified as English language learners by the district ( $n=214$ ), and of Latinx/Hispanic descent ( $n=247$ ). Dual immersion instruction at these schools is made up of 90% Spanish instruction for Grade 1 and 80% Spanish instruction for Grade 3. English immersion students received the English version of Benchmarks Events curriculum while dual immersion students received both English and Spanish versions. Approximately 3% of the students were receiving school services for disabilities (Autism Spectrum Disorder:  $n=1$ , learning disability:  $n=3$ , language impairment:  $n=5$ ). Two-hundred-and-thirty-two students received free or reduced lunch services. Table 1 shows the student descriptive information.

### Writing measures

Two writing samples in English and Spanish respectively were collected. First, students completed a narrative task adapted from the Test of Early Written Language-



**Table 1** Descriptive information of participant sample

	Grade 1		Grade 2		Grade 3	
	Dual	English	Dual	English	Dual	English
Total participants ( <i>n</i> )	79	14	110	25	40	10
English learner (%)	0.85	0.86	0.83	0.56	0.70	0.20
Free or reduced lunch (%)	0.82	0.64	0.88	0.84	0.80	0.80
Disability (%)	0.01	0.07	0.04	0.12	0	0
Latinx/Hispanic (%)	0.87	0.86	0.93	0.84	0.85	0.80
Female (%)	0.54	0.36	0.55	0.60	0.35	0.60
Mean Age	6.98	6.95	7.96	8.22	8.93	8.99

Note. Dual=Spanish-English dual immersion instruction. English=English immersion instruction

Third Edition. The assessor explained qualities of a good story (beginning, middle, and ending with characters) and read an example story based on three sequential cartoons (a boy blowing balloons). After the demonstration, children were given a different prompt of three sequential cartoons (English: children skateboarding, Spanish: children playing soccer) and were told to write their own story based on the new images.

Second, an opinion task (Wechsler Individual Achievement Test-Third Edition in English and an experimental task in Spanish, adapted from English, Kim et al., 2015) was completed. In English, children were asked to write about their favorite game, and, in Spanish, they were asked to write about their favorite animal.

Writing assessments were administered by language in a quiet place at their school by trained bilingual research assistants. In a one-hour session, Spanish narrative and opinion tasks were administered and, typically later that week, in another one-hour session, English narrative and opinion tasks were administered. Students had 30 min to complete each writing assignment.

## Spelling patterns

Essays were transcribed verbatim by English-Spanish bilingual research assistants following Systematic Analysis of Language Transcripts (SALT) guidelines. To prepare compositions for SALT analysis, essays were broken up by utterance. An utterance was considered a finished thought that included a subject and verb (i.e., T-unit). During this process, all transcriptions were cross-checked with the handwritten version to confirm accurate interpretation of handwriting.

Then spelling codes were created to record sounds and patterns misspelled potentially due to crosslinguistic influence. Codes were developed from a literature review (e.g., Fashola et al., 1996) and survey of the compositions. Some patterns in previous research, such as *ck/cc* replaced by *k* (e.g., Fashola, 1996), were not included since these grapheme-phoneme correspondences are acceptable in English and *k* is not commonly used in Spanish except in borrowed words. A total of 45 English transcription codes and a total of 15 Spanish transcription codes were used. More variation of Spanish influence on English spelling than English influence on Spanish spelling was identified. A summary of the spelling codes that were used are in Table 2. Interrater reliability in both languages was 97% for SALT analysis preparation coding (e.g., separating utterances and morphemes) and 95% for experimental codes. SALT soft-



**Table 2** Common crosslinguistic spelling errors made by dual language learners in grades 1 to 3 in English and Spanish compositions

Sound/Spelling	Description	Example
<i>English</i>		
Long-e /i:/	Frequency long-e vowel (e.g., ee, ea, eo, ey, i.e.) in English was replaced by <i>i</i> per utterance.	people → pipol
Interdental /θ/, /ð/	Frequency interdental (e.g., th) in English was replaced by dental (e.g., d, t) per utterance.	the → de wit (with) a oder (another)
Long-i /ai/	Frequency long-i vowel (e.g., iCe) in English was replaced by <i>a.i.</i> , <i>ay</i> , or <i>a</i> per utterance.	I → Ai laic (like)
Short-i and schwa /ɪ/, /ə/	Frequency short-i vowel (e.g., iC) in English was replaced by <i>e</i> per utterance.	it → et
Short-a /æ/	Frequency short-a vowel (e.g., oC) in English was replaced by <i>a</i> per utterance.	from → fram
Bilabials /p/, /b/, /v/	Frequency <i>b/v/p</i> were switched per utterance.	bleeding → vleeding gives → gibs fipetre (favorite)
Long-a /ei/	Frequency long-a (e.g., a.i., aCe, ay) was replaced by <i>ei</i> or <i>e</i> .	game → gem
Glottal fricative /h/	Frequency <i>h</i> was replaced by <i>j</i> , <i>g</i> , or <i>x</i> per utterance.	him → jim jauces (houses) gort (hurt)
Long-u /u:/	Frequency long-u (e.g., oo) was replaced by <i>u</i> per utterance.	balloons → balluns
Alveolar stop /k/, /g/	Frequency <i>qu</i> replaced <i>k-</i> or <i>g-</i> sounds per utterance.	beginning → viuenin basquet (basket) piques (because)
W-sound /w/	Frequency <i>w</i> -sound was replaced by <i>u</i> per utterance.	one → uan llant (want)
E-initial insertion	Frequency <i>e</i> was added before <i>s</i> initial words per utterance.	skateboard → skateboard eslaym (slime)
<i>Spanish</i>		
Alveolar stop switch /k/, /g/	Frequency <i>c</i> and <i>g</i> were switched.	gol → col
E-initial deletion	Frequency that <i>e</i> -initial is deleted per utterance.	estaba → staba
Glottal fricative /h/, /x/	Frequency that <i>h</i> -sound (j, g, x) was replaced by <i>h</i> per utterance.	hugando (jugando) protehe (protege)
Long-e /i:/	Frequency that long-e sound (i, y) was replaced by English spelling (e.g., ee) per utterance.	equipo → equeepo faforeetho (favorito)
Long-u /u:/	Frequency that long-u (u) was replaced by English spelling (e.g., oo) per utterance.	footbol (fútbol)
Long-o /o:/	Frequency that long-o (o) was replaced by English spelling (e.g., oCe) per utterance.	equipos → equipose
Dentals /d/, /t/	Frequency that dentals (t, d) were replaced by English interdental (th) per utterance.	de → the thambien (también) petho (puedo)
U replaced by W /uV/	Frequency that <i>w</i> was inserted to make diphthongs with <i>u</i> -sounds per utterance.	Eduardo → Edwardo

**Table 2** (continued)

Sound/Spelling	Description	Example
Qu-spelling /k/	Frequency that <i>qu</i> was replaced by English spelling (e.g., k, c) per utterance.	que → ke ckerer (querer) ekipo (equipo)

**Table 3** Most common cross-linguistic spelling errors per utterance averaged across the two prompts by language

<i>English spelling errors potentially influenced by Spanish</i>	
Total	1.15
Long-e replacement (e.g., he → hi)	0.19
Interdentals replaced with dentals (e.g., they → de)	0.18
Long-i replacement (e.g., I → Ai)	0.12
Short-i replacement (e.g., it → et)	0.15
Short-a sound with a/o switches (e.g., from → fram)	0.12
Bilabial switches (e.g., favorite → faborite)	0.09
Long-a replacement (e.g., game → geim)	0.08
Glottal fricative switches (e.g., his → jis)	0.07
Long-u replacement (e.g., shoot → shut)	0.07
E-initial insertion before <i>s</i>	0.06
K-sound replaced with <i>qu</i>	0.02
W-sound replaced with <i>u</i>	0.01
<i>Spanish spelling errors potentially influenced by English</i>	
Total	0.32
Long-e replacement (e.g., favorito → favoreeto)	0.10
K-sound replacement (e.g., que → ke)	0.07
Long-o replacement (e.g., equipos → equipose)	0.03
E-initial deletion (e.g., estaban → staban)	0.03
Dental replaced with interdental (e.g., también → thambién)	0.02
H-sound replacement with <i>h</i> (e.g., jugar → hugar)	0.02
U-sound replaced with <i>w</i> (e.g., sueño → sweno)	0.02
Alveolar switch <i>c/g</i> (e.g., ganar → canar)	0.01
Long-u replaced with <i>oo</i> (e.g., luna → loona)	0.01

ware was used to tally experimental spelling codes, giving both a total essay count and an average count per utterance; the latter was used for analysis.

## Results

### Are there consistent spelling error patterns potentially due to crosslinguistic influence in Spanish and English essays?

Table 3 shows common spelling errors in the two writing tasks. Spelling errors made by at least once by 10 different students were determined to be the threshold to indicate a possible pattern and were included in the current analysis. In English compositions, 12 spelling patterns were identified as potentially due to crosslinguistic influence (see the top panel of Table 3), averaging to 1.15 spelling errors per utter-

ance. The most common errors were replacement of long-e /i/ (e.g., *ee*, *ea*, and *ey*) with Spanish spelling *i*, replacement of interdental (*th-*) with the Spanish dentals *t* or *d*, and replacement of long-i (e.g., *I* or *iCe*) with Spanish spelling *a.i*.

In Spanish compositions, nine spelling patterns were identified as potentially due to crosslinguistic influence, averaging to 0.32 spelling errors per utterance. The most common spelling errors were replacement of long-e *i* and *y* with English spellings (e.g., *ee*), replacement of Spanish *qu* spelling with English *k* or *c*, and replacement of Spanish long-o (*o*) with English *oCe*.

### What types of patterns were identified with spelling errors, if any?

Table 4 shows the correlation matrix between types of spelling errors potentially due to crosslinguistic influence both within and across languages for the entire sample. Within language correlations were positive and mostly significant weak to moderate magnitudes for English ( $r_s=0.13-0.56$ ,  $p<.05$ ) and Spanish ( $r_s=0.13-0.51$ ,  $p<.05$ ). For example, in English, short-a errors with e-initial insertion ( $r=.56$ ) and interdental errors ( $r=.44$ ), short-i errors with long-i ( $r=.55$ ) and interdental ( $r=.48$ ) errors, switching bilabials with short-i ( $r=.52$ ) and long-i ( $r=.48$ ) errors, and long-e errors with long-u errors ( $r=.43$ ) all showed evidence of moderate positive relations. In Spanish, strong relations were shown between c/g switching with e-initial deletion ( $r_s=0.51$ ), replacing *u* with *w* with long-e ( $r=.49$ ), e-initial deletion ( $r=.47$ ), and interdental ( $r=.47$ ) errors all showed positive moderate relations.

Correlations across languages were mostly not significantly related. Significant bivariate relations had negative weak magnitudes ( $r_s=-0.17$  to  $-0.12$ ,  $p<.05$ ). For instance, long-e errors in Spanish were weakly negatively related to long-e errors ( $r=-.17$ ), glottal ( $r=-.15$ ), interdental ( $r=-.14$ ), and long-i ( $r=-.14$ ) errors in English. Similarly, errors with the h-sound in Spanish were weakly negatively related to interdental ( $r=-.14$ ) and long-e ( $r=-.13$ ) errors in English. Overall, participants who made crosslinguistic spelling errors in English or Spanish were likely to make other crosslinguistic spelling errors within the same language and were not likely to make crosslinguistic spelling errors in the other language. Examples of student essays are in the Supplemental Materials.

### Do these patterns differ by instructional program, English learner status, and grade level?

Instructional program, English learner status, and grade level were included as predictors for a composite of total spelling errors potentially due to crosslinguistic influence as the outcome variable in a regression model by language controlling for free or reduced lunch. Table 5 shows the results. For the English spelling error pattern that were potentially influenced by Spanish, the regressions model showed that spelling patterns were significantly predicted by instructional program ( $\beta=1.11$ ,  $p<.000$ ) and grade level (Grade 2:  $\beta=-0.41$ ,  $p=.01$ ; Grade 3:  $\beta=-0.93$ ,  $p=.00$ ), but not by English learner status ( $\beta=0.32$ ,  $p=.06$ ). Students in dual immersion program made significantly more English spelling errors potentially due to Spanish influence than students who were in English immersion instruction. In addition, students in higher

**Table 4** Correlations between crosslinguistic spelling errors (n = 278)

	English												Spanish											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21			
<i>English</i>																								
1. long-e	-																							
2. interdent	.32*	-																						
3. long-i	.29*	.31*	-																					
4. short-i	.40*	.48*	.55*	-																				
5. short-a	.38*	.44*	.23*	.41*	-																			
6. bilabial	.29*	.38*	.48*	.52*	.36*	-																		
7. long-a	.24*	.35*	.21*	.30*	.14*	.35*	-																	
8. glottal	.34*	.26*	.27*	.20*	.21*	.19*	.23*	-																
9. long-u	.43*	.19*	.16*	.16*	.25*	.00	.09	.31*	.30*	-														
10. e-initial	.36*	.40*	.11	.21*	.56*	.31*	.24*	.15*	.09	.09	-													
11. k-sound	.15*	.16*	.06	.16*	.06	.23*	.20*	.14*	.11	.10	.10	-												
12. w-sound	.16*	.21*	.24*	.15*	.19*	.14*	.11	.13*	.15*	.08	-.04	-.04	-											
<i>Spanish</i>																								
13. long-e	-.17*	-.14*	-.14*	-.06	-.13*	-.12*	-.04	-.15*	-.10	-.12*	-.07	.02	-											
14. k-sound	.05	.02	-.03	.04	-.01	.10	.11	-.04	.12*	.05	-.06	-.04	.29*	-										
15. long-o	-.03	-.11	-.02	.03	-.07	-.11	-.11	-.05	-.08	-.07	-.06	-.06	.19*	.10	-									
16. e-initial	.05	-.10	-.08	-.03	-.05	-.02	-.05	.00	.06	-.09	-.06	-.02	.34*	.51*	.05	-								
17. interdent	-.12	-.10	-.10	-.08	-.09	-.06	-.08	-.10	-.09	-.08	-.05	-.05	.40*	.27*	.18*	.20*	-							
18. h-sound	-.13*	-.14*	-.12	-.08	-.07	-.08	-.10	-.12*	-.07	-.05	-.06	-.02	.41*	.20*	.15*	.20*	.38*	-						
19. u-sound	-.08	-.05	-.10	-.11	-.12*	-.08	-.08	.01	-.06	-.12	-.06	-.04	.49*	.38*	.11	.47*	.47*	.19*	-					
20. c/g switch	.06	.00	.04	.02	-.02	.03	.11	-.05	.00	.03	.00	-.05	.17*	.32*	.06	.38*	.15*	-.01	.38*	-				
21. long-u	-.09	-.06	-.07	-.06	-.07	-.06	-.06	-.08	-.05	-.07	-.04	-.03	.16*	-.01	.04	.14*	.19*	.13*	-.01	.08	-			

Notes. Correlations are between summed per utterance scores from the two compositions per language. Significant at  $p < .05$  denoted by asterisk (\*)

grades made significantly less crosslinguistic spelling errors than students in lower grades.

For Spanish spelling error patterns that were potentially influenced by English, instructional program was statistically significant ( $\beta = -1.12$ ,  $p < .000$ ) and Grade 2 was significantly different from Grade 1 ( $\beta = -0.14$ ,  $p = .04$ , see Table 5). Students in English immersion instruction made significantly more spelling errors in Spanish compositions potentially due to English influence than students who were enrolled in dual immersion instruction. Grade 2 students made significantly less crosslinguistic errors in Spanish than Grade 1 students.

## Discussion

We investigated spelling errors in compositions written by Spanish-English dual language learners in Grades 1, 2, and 3 enrolled in either English immersion or dual immersion instruction. We hypothesized that students would make crosslinguistic spelling errors, that spelling errors would be made in both directions (English to Spanish and Spanish to English), and that errors would be moderated by instruction, English language status, and grade level. Most of our hypotheses were confirmed.

First, dual language learners used orthographic and phonological rules of their other language to support writing in the target language, suggesting crosslinguistic influence and confirming our first hypothesis. Spelling errors were present in both English and Spanish compositions. In English compositions, we identified an average of 1.15 Spanish-influenced spelling errors per utterance. The complexity and inconsistency of English spelling may contribute to the high number of misspellings per utterance. Many words contained multiple patterns, such as “happy” spelled as “japi” (glottal fricative and long-e), “bleeding” spelled as “vliding” (bilabial switch and long-e), “kid” spelled as “queds” (k-sound and short-i), or “skateboard” spelled as “esceidbor” (e-insertion and long-a). Many of these patterns have also been found in previous research (e.g., Fashola et al., 1996). In addition, most English words cannot be spelled correctly by using Spanish graphophoneme rules. Therefore, drawing from crosslinguistic graphophoneme rules of Spanish to spell English words would most likely lead to an error.

We investigated spelling in written compositions to examine the spelling process of dual language learners while they manage the other constraints of the writing process. Our approach was different from prior research on dual language learner’s spelling that instead assessed spelling in isolation through wordlists that included patterns to capture crosslinguistic influence (e.g., Fashola et al., 1996). On one hand, our approach limited the variability in potential spelling patterns due to crosslinguistic transfer. For example, essays included very few words with letters such as z/s, ch/sh/s, ll/y/j, other graphophoneme correspondences in English and Spanish that were not analyzed in the current work. Although some students wrote words with these sounds that did make the predicted crosslinguistic spelling errors, there was an insufficient number of occurrences to consider it a pattern (i.e., made by less than ten students). On the other hand, our approach was beneficial because we identified some Spanish on English spelling patterns that were not previously identified. For instance,

**Table 5** Regression models predicting spelling patterns due to crosslinguistic influence in English and Spanish compositions

	$\beta$	SE	p	CI.LB	CI.UB
<i>English spelling errors potentially influenced by Spanish in English Composition</i>					
Dual	1.11	0.19	0.00	0.74	1.48
EL status	0.32	0.17	0.06	-0.02	0.66
Grade 2	-0.41	0.15	0.01	-0.71	-0.11
Grade 3	-0.93	0.20	0.00	-1.34	-0.53
FARL	0.58	0.21	0.01	0.18	0.99
Intercept	-0.16	0.27	0.55	-0.68	0.37
<i>Spanish spelling errors potentially influenced by English in Spanish Composition</i>					
Dual	-1.12	0.08	0.00	-1.29	-0.96
EL status	-0.04	0.09	0.64	-0.19	0.12
Grade 2	-0.14	0.07	0.04	-0.28	-0.01
Grade 3	-0.04	0.09	0.70	-0.22	0.15
FARL	-0.04	0.09	0.64	-0.23	0.14
Intercept	1.40	0.12	0.00	1.16	1.63

*Notes.* Outcome variables are composites across all spelling patterns (Table 4) per utterance. Dual=Enrolled in Spanish-English dual immersion instruction. EL status=English language learner. FARL=Free and reduced lunch status

to our knowledge, no previous studies examined how English short-i and schwa were replaced by *e*, switching of *c* and *g*, nor insertion of *e* before *s*. We recommend future research combine the two approaches, that is use wordlists with predicted crosslinguistic patterns and examining spelling patterns in context (i.e., authentic writing tasks), to provide the most complete picture of crosslinguistic patterns.

We also investigated whether there was evidence of English influence on Spanish spelling. To our knowledge, this is the first study to examine this relation. We identified an average of 0.32 English-influenced spelling errors per utterance. Unlike in English compositions, there was typically only one spelling pattern per word, such as “y” spelled as “ee” (long-e), “jugando” spelled as “hugando” (glottal fricative), “gol” spelled as “col” (alveolar switch), and “queria” spelled as “keria” (k-sound). There may have been significantly less crosslinguistic spelling errors per utterance due to shared and non-shared letter-sound mappings in the two languages. For instance, many words in Spanish could potentially be spelled by sounding out in English letters (e.g., gol, uno). In fact, the words that broke English graphophoneme rules were the ones that were often misspelled (e.g., jugando, equipo). Therefore, English graphophonemic knowledge may crosslinguistically support some spelling in Spanish.

Overall, there was a greater number of crosslinguistic errors made due to Spanish influence on English than English influence on Spanish. One reason for this may be that students did not have balanced oral language skills in both languages. One potential explanation is that students were more proficient in Spanish than in English and therefore, they drew on their Spanish language resources. However, many more students borrowed English words in their Spanish writing than borrowed Spanish words for their English writing, which suggests greater vocabulary knowledge in English than in Spanish. It might be that students utilized Spanish phonological systems even though they had high proficiency in English vocabulary. We explored variables related to proficiency, such as grade level (as a proxy for development) and English learner status, but we did not measure proficiency. Future research that includes language

proficiency assessments is needed to further investigate our finding that crosslinguistic transfer is possible in both directions for dual language learners.

Another reason there may have been more evidence of Spanish influence on English than English influence on Spanish may be due to orthographic depth. Seymour and colleague's (2003) survey of 13 European languages found that children learning to read in mostly consistent orthographies developed a high level of accuracy in word reading within their first year of instruction while children learning to read in English tended to take more than twice as long. Therefore, when dual language learners receive input from two competing languages simultaneously, they may acquire the graphophoneme rules of the more consistent spelling system more easily than the more complex, inconsistent spelling system. Therefore, even if dual language learners did have balanced oral language skills, they may develop the spelling patterns of the two languages at different rates. This speculation was further supported by our findings discussed below regarding grade as a moderator.

Another unique aspect of the present study is an examination of whether there was a pattern of participants' misspelling within and across languages, which has not been investigated in prior research to the best of our knowledge. We found evidence of unidirectional crosslinguistic transfer of spelling patterns. Our bivariate correlational analysis found overall positive weak to moderate relations within language and weak negative relations across languages. Participants who used Spanish-influenced spelling errors in English typically made other Spanish-influenced spelling errors in English, and the same was true for English-influenced spelling errors in Spanish. Learners tended to make crosslinguistic errors in one direction (Spanish on English or English on Spanish) but not both. Student examples (Supplemental Materials) corroborates this finding. Students often made multiple spelling errors potentially due to crosslinguistic influence in one language and demonstrated proficient spelling with minimal mistakes in their other language. For instance, students 1, 2, 3, and 5 borrowed Spanish patterns to spell words in English while students 4, 7, and 8 borrowed English patterns to spell words in Spanish. Student 6 is one of the few students who showed that crosslinguistic transfer is possible both ways in the same student (e.g., "nid" for "need," "al" for "I'll," "hugando" for "jugando," and "kando" for "ganaron"), but this was rare. Prior research investigating crosslinguistic transfer has found evidence that a more proficient language can influence spelling in a less proficient language (e.g., Figueredo, 2006), but this is the first research to investigate the other direction. However, as previously stated, some students may have been more proficient in English than Spanish, explaining why crosslinguistic transfer was found in both directions.

We also predicted that instructional program, English learner status, and grade levels would moderate crosslinguistic spelling errors in both languages. We found that instructional program and grade levels were related to the quantity of crosslinguistic spelling patterns, but not to English learner status once instructional program, grade levels, and free and reduced lunch status were controlled for. Students in the dual immersion program compared to those in the English immersion program were significantly more likely to make Spanish-influenced English spelling errors, but significantly less likely to make English-influenced Spanish spelling errors. These findings held true controlling for English learner status, grade level, and free or reduced



lunch status. The current study's dual immersion participants, who received 80–90% of their instruction in Spanish, tended to source Spanish for graphophonemic rules, regardless of English learner status. These findings underscore the impact of instruction on spelling development.

Grade levels were significantly associated with Spanish-influenced errors in English, but only Grade 2 was significantly different from Grade 1 with English-influenced errors in Spanish. Models controlling for instructional program, English learner status, and free or reduced lunch status showed that, in English, students in higher grades made significantly less crosslinguistic spelling errors than students in lower grades. On the other hand, in Spanish, there was no significant association between English-influenced errors and grade. Most prior research exploring spelling development overtime on both monolinguals (e.g., Apel et al., 2012; Caravolas et al., 2001; Jongejan et al., 2007) and English language learners (e.g., Jongejan et al., 2007; Linan-Thompson et al., 2017) has also found that grade moderated errors. Usage-based theories (e.g., Tomasello, 2000) suggest that language skills develop from interaction and frequency of exposure. According to MacWhinney (2005), crosslinguistic transfer occurs when one language cues the other language and the more salient, developed language is sourced. Our findings suggest that participants in both dual immersion and English immersion instruction received sufficient exposure to make significantly less crosslinguistic spelling patterns over time in English, but not in Spanish. Regarding English, this makes sense. English immersion instruction provides consistent English exposure which leads to a reduction in student spelling errors. However, we do not have an explanation as to why grade levels did not moderate spelling errors made in Spanish. As previously hypothesized, perhaps the two languages develop at different rates. Due to the different orthographic depths, Spanish's consistent orthography may be acquired more rapidly to a certain level of proficiency then development slows while English's inconsistent orthography is developed more slowly. Rubin and Carlan (2005) proposed that dual language learners develop slower than monolinguals as they learn to differentiate between two phonological and spelling systems during early writing stages and, as a result, transfer spelling patterns between languages. They did not address, however, whether the languages develop at the same speeds. Our findings suggest they may not. Future research that follows dual language learners in dual immersion and English immersion programs beyond the primary grades can further explore spelling development in both languages.

Lastly, English learner status was not significantly related to crosslinguistic spelling errors when controlling for instruction program, grade level, and free and reduced lunch status. Therefore, instruction and development primarily explained any differences in crosslinguistic spelling errors regardless of English learner status.

This study extends our understanding of crosslinguistic influence in early writing development, specifically spelling. We found that dual language learners in Grades 1 to 3 make crosslinguistically-influenced spelling errors in both languages. Multilingual development theories (e.g., Cummins, 1979; MacWhinney, 2005) posit that languages share cognitive space and resources. Similar linguistic features and competition between linguistic structures, such as phonological, lexical, and syntactic systems, can lead to crosslinguistic transfer. Spelling ability requires phonological, morphological, and orthographic knowledge (Apel & Masterson, 2001; Bear &

Templeton, 1998; Ehri & McCormick, 1998), and Spanish and English share many alphabetic and phonological properties. It seems reasonable to hypothesize that this applies to dual language learners' spelling development. Furthermore, phonemic or orthographic features in one language cued more salient spelling patterns in the other language. MacWhinney (2012) theorized that for adult learners, transfer only happens in one direction, L1 transferring to L2, but did not address patterns in children. We found that transfer tended to be only in one direction in our sample of dual language children. Also, transfer errors in both languages were significantly associated with instructional program as well as grade level for English compositions. This emphasizes that instruction is an important source of exposure that is needed for spelling proficiency.

Our study also has practical implications. Our findings, such as Spanish-English crosslinguistic spelling error list (Table 2), includes some consistent spelling errors not identified in previous research. This information, together with findings from prior studies, can be used by practitioners to explicitly instruct students (MacWhinney, 1997), create error correction activities (Gettinger, 1993), analyze student writing for spelling errors that may be due to crosslinguistic influence, and develop spelling assessments that target these patterns.

## Limitations and future directions

The current study had the following limitations. First, the majority of our biliterate sample was enrolled in dual immersion programs. Many students who were considered by teachers as dual language learners and enrolled in English immersion instruction did not show biliteracy only oral bilingualism; they were unable to write at least one word in both languages. Future studies should further compare biliterate students in various in education settings. However, this may be a challenge considering the impact that instruction has on spelling and writing development. Second, we did not measure oral language skills (e.g., vocabulary) or spelling in isolation. Proficiency in these skills may have impacted what types of errors children made and whether or not they transferred spelling patterns crosslinguistically. We used grade level as a proxy for development and English learner status as a proxy for English proficiency, but these may not be sufficient measures (e.g., Zutell & Allen, 1988). We recommend that future studies collect proficiency measures in both languages. Next, our study collected cross-sectional data of the early primary grades, but we recommend that future research is longitudinal and continues into later primary grades. Lastly, no classroom observation data were collection. Therefore, we do not know what type of instruction students received beyond the curriculum. Future research that includes teacher practices and classroom instruction is needed to investigate how they relate to dual language spelling and writing development.

## Conclusion

These findings build upon prior research on crosslinguistic spelling patterns of dual language learners and indicate the importance of instruction for dual language learners. We hope our findings help practitioners support the spelling development of Spanish-English dual language learners. We urge researchers to conduct more studies on dual language learners in different instructional programs, an important gap in the research in the field of literacy development. Future investigations should not only replicate our study but also extend it by assessing language proficiency in both languages.

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## References

- Apel, K., & Masterson, J. (2001). Theory-guided spelling assessment and intervention: A case study. *Language, Speech, and Hearing Services in Schools, 32*, 182–195. [https://doi.org/10.1044/0161-1461\(2001/017\)](https://doi.org/10.1044/0161-1461(2001/017))
- Apel, K., Wilson-Fowler, E. B., Brimo, D., & Perrin, N. A. (2012). Metalinguistic contributions to reading and spelling in second and third grade students. *Reading and Writing, 25*(6), 1283–1305. <https://doi.org/10.1007/s11145-011-9317-8>.
- Bahr, R. H., Silliman, E. R., Danzak, R. L., & Wilkinson, L. C. (2015). Bilingual spelling patterns in middle school: it is more than transfer. *International Journal of Bilingual Education and Bilingualism, 18*(1), 73–91. <https://doi.org/10.1080/13670050.2013.878304>.
- Bear, D. R., & Templeton, S. (1998). Explorations for developmental spelling: foundations for learning and teaching phonics, spelling, and vocabulary. *The Reading Teacher, 52*(3), 222–242. <http://www.learningsolutions.us/msde/reading2/phases/docs/BearTempletonSpelling.pdf>.
- Bebout, L. (1985). An error analysis of Misspellings made by Learners of English as a First and as a Second Language. *Journal of Psycholinguistic Research, 14*(6), 569. <https://doi.org/10.1007/BF01067386>.
- Berninger, V. W. (2000). Development of language by hand and its connections with language by ear, mouth, and eye. *Topics in Language Disorders, 20*(4), 65–84. <https://doi.org/10.1097/00011363-200020040-00007>.
- Berninger, V. W., & Winn, W. D. (2006). Implications of advancements in brain research and technology for writing development, writing instruction, and educational evolution. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing Research* (pp. 96–114). Guilford Press.

- Bourassa, D., & Treiman, R. (2001). Spelling development and disability: The importance of linguistic factors. *Language, Speech, and Hearing Services in Schools*, 32, 172–181. [https://doi.org/10.1044/0161-1461\(2001\)016](https://doi.org/10.1044/0161-1461(2001)016)
- Caravolas, M., Hulme, C., & Snowling, M. J. (2001). The foundations of spelling ability: evidence from a 3-year longitudinal study. *Journal of Memory and Language*, 45(4), 751–774. <https://doi.org/10.1006/jmla.2000.2785>.
- Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypotheses. *Working Papers on Bilingualism*, 9, 1–43.
- Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of educational research*, 49(2), 222–251. <https://doi.org/10.3102/00346543049002222>.
- Defior, S., Jiménez-Fernández, G., & Serrano, F. (2009). Complexity and lexicality effects on the acquisition of Spanish spelling. *Learning and Instruction*, 19(1), 55–65. <https://doi.org/10.1016/j.learninstruc.2008.01.005>.
- Defior, S., & Serrano, F. (2005). The initial development of spelling in Spanish: from global to analytical. *Reading and Writing*, 18(1), 81–98. DOI <https://doi.org/10.1007/s11145-004-5893-1>.
- Ehri, L. C. (2000). Learning to read and learning to spell: two sides of a coin. *Topics in Language Disorders*, 20(3), 19–36. <https://doi.org/10.1097/00011363-200020030-00005>.
- Ehri, L. C., & McCormick, S. (1998). Phases of word learning: implications for instruction with delayed and disabled readers. *Reading & Writing Quarterly: Overcoming Learning Difficulties*, 14(2), 135–163. <https://doi.org/10.1080/1057356980140202>.
- Ellis, N. C. (2002). Frequency effects in language processing: a review with implications for theories of implicit and explicit language acquisition. *Studies in Second Language Acquisition*, 24(2), 143–188. 10.1017/S0272263102002024.
- Ellis, N. C., & Sagarra, N. (2010). The bounds of adult language acquisition: blocking and learned attention. *Studies in Second Language Acquisition*, 32(4), 553–580. <https://doi.org/10.1017/S0272263110000264>.
- Fashola, O. S., Drum, P. A., Mayer, R. E., & Kang, S. J. (1996). A cognitive theory of orthographic transitioning: predictable errors in how Spanish-speaking children spell English words. *American Educational Research Journal*, 33(4), 825–843. <https://doi.org/10.3102/00028312033004825>.
- Figueredo, L. (2006). Using the known to chart the unknown: a review of first-language influence on the development of English-as-a-second-language spelling skill. *Reading and Writing*, 19(8), 873–905. <https://doi.org/10.1007/s11145-006-9014-1>.
- Gettinger, M. (1993). Effects of error correction on third graders' spelling. *The Journal of Educational Research*, 87(1), 39–45. <https://doi.org/10.1080/00220671.1993.9941164>.
- Harrison, G. L., Goegan, L. D., Jalbert, R., McManus, K., Sinclair, K., & Spurling, J. (2016). Predictors of spelling and writing skills in first- and second-language learners. *Reading and Writing*, 29(1), 69–89. <https://doi.org/10.1007/s11145-015-9580-1>.
- Howard, E. R., Arteagoitia, I., Louguit, M., Malabonga, V., & Kenyon, D. M. (2006). The development of the English developmental contrastive spelling test: a tool for investigating Spanish influence on English spelling development. *Tesol Quarterly*, 40(2), 399–420. <https://doi.org/10.2307/40264528>.
- Jongejan, W., Verhoeven, L., & Siegel, L. S. (2007). Predictors of reading and spelling abilities in first- and second-language learners. *Journal of Educational Psychology*, 99(4), 835–851. <https://doi.org/10.1037/0022-0663.99.4.835>.
- Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: a longitudinal study of children in first and second grade. *Journal of Educational Psychology*, 78(4), 243–255. <https://doi.org/10.1037/0022-0663.78.4.243>.
- Kim, Y. S. G. (2020). Structural relations of language and cognitive skills, and topic knowledge to written composition: a test of the direct and indirect effects model of writing. *British Journal of Educational Psychology*, 90(4), 910–932. <https://doi.org/10.1111/bjep.12330>.
- Kim, Y.-S. G., Wolters, A., Mercado, J., & Quinn, J. (2022). Crosslinguistic transfer of higher order cognitive skills and their roles in writing for English-Spanish dual language learners. *Journal of Educational Psychology* 114(1) 1–15. <https://doi.org/10.1037/edu0000516>.
- Kim, Y. S. G., & Park, S. H. (2019). Unpacking pathways using the direct and indirect effects model of writing (DIEW) and the contributions of higher order cognitive skills to writing. *Reading and Writing*, 32(5), 1319–1343. <https://doi.org/10.1007/s11145-018-9913-y>.
- Kim, Y. S., Otaiba, A., S., & Wanzek, J. (2015). Kindergarten predictors of third grade writing. *Learning and Individual Differences*, 37, 27–37. <https://doi.org/10.1016/j.lindif.2014.11.009>.

- Linan-Thompson, S., Degollado, E., & Ingram, M. (2017). Spelling it out, one por uno: patterns of emergent bilinguals in a dual language classroom. *TESOL Journal*, 9(2), 330–347. <https://doi.org/10.1002/tesj.328>.
- Llombart-Huesca, A., & Zyzik, E. (2019). Linguistic factors and the Spelling ability of spanish Heritage Language Learners. *Frontiers in Education*, 4, 1–12. <https://doi.org/10.3389/educ.2019.00150>.
- MacWhinney, B. (1997). Implicit and explicit processes: Commentary. *Studies in Second Language Acquisition*, 19(2), 277–281. <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/462624489C10BD0F9A65E87854FD42/S0272263197002076a.pdf/implicit-and-explicit-processes-commentary.pdf>
- MacWhinney, B. (2005). A unified model of language acquisition. In J. F. Kroll, & A. M. B. De Groot (Eds.), *Handbook of Bilingualism: psycholinguistic approaches* (pp. 50–70). Incorporated: Oxford University Press.
- MacWhinney, B. (2012). The logic of the Unified Model. In S. M. Gass, & A. Mackey (Eds.), *Handbook of second Language Acquisition* (pp. 211–227). New York: Routledge/Taylor & Francis. <https://sla.talkbank.org/pubs/UCMlogic.pdf>.
- Raynolds, L. B., Uhry, J. K., & Brunner, J. (2013). Vowel representations in the invented spellings of spanish–english bilingual kindergartners. *Reading and Writing*, 26(5), 647–664. <https://doi.org/10.1007/s11145-012-9380-9>.
- Rubin, R., & Carlan, V. G. (2005). Using writing to understand bilingual children’s literacy development. *The Reading Teacher*, 58(8), 728–739. <https://doi.org/10.1598/RT.58.8.3>.
- San Francisco, A. R., Mo, E., Carlo, M., August, D., & Snow, C. (2006). The influences of language of literacy instruction and vocabulary on the spelling of spanish–english bilinguals. *Reading and Writing*, 19(6), 627–642. <https://doi.org/10.1007/s11145-006-9012-3>.
- Seymour, P., Aro, M., & Erskine, J. (2003). Foundation literacy acquisition in european orthographies. *British Journal of Psychology*, 94, 143–174. <https://doi.org/10.1348/000712603321661859>.
- Tomasello, M. (2000, September). A usage-based approach to child language acquisition. In Annual Meeting of the Berkeley Linguistics Society (Vol. 26, No. 1, pp. 305–319). <https://doi.org/10.3765/bls.v26i1.1123>
- Treiman, R. (2017). Learning to spell words: findings, theories, and issues. *Scientific Studies of Reading*, 21(4), 265–276. <https://doi.org/10.1080/10888438.2017.1296449>.
- Wang, M., & Geva, E. (2003). Spelling performance of chinese children using English as a second language: Lexical and visual–orthographic processes. *Applied Psycholinguistics*, 24(1), 1–25. 10.1017/S0142716403000018.
- Wulff, S., & Ellis, N. C. (2018). Usage-based approaches to SLA. In D. Miller, F. Bayram, J. Rothman, & L. Serratrice (Eds.), *Bilingual Cognition and Language: the state of the Science across its Subfields* (pp. 37–56). Amsterdam: John Benjamins.
- Zutell, J., & Allen, V. (1988). The English spelling strategies of spanish-speaking bilingual children. *TESOL Quarterly*, 22(2), 333–340.

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