Explaining First Graders' Achievements in Spelling and Word Separation in Shallow Orthographies

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Abstract: We examine the explanatory weight of child-related and contextual factors on first graders' achievements in spelling and separation between words. The participants were 215 kindergartners, 113 boys and 102 girls (M = 5 years 4 months, SD = 4 months) from both monolingual and bilingual communities in Spain. They were native speakers of Spanish in the monolingual communities and bilingual Spanish/Catalan or Spanish/Basque speakers in the bilingual communities and had Catalan and Basque, respectively, as the language of instruction. The three languages have shallow orthographies. Children were first examined in kindergarten in a number of literacy related abilities (e.g., knowledge of letters, writing) to detect predictors of spelling and separation between words that were, in turn, evaluated at the end of first grade of elementary school. All the participants were assessed in their language of instruction. The best explanatory models were those including interactions among child-level factors and between these factors and contextual variables. Only knowledge of writing in kindergarten appeared as the common explanatory factor for first graders' attainments. Attainments in spelling were predicted by children's level of literacy and knowledge of letters moderated by parent's education; performance in word separation was predicted by phonological awareness and vocabulary knowledge moderated by parental education. Teaching practices affected spelling performance but not learning to separate between words.

Keywords: spelling, separation between words, kindergarten, first grade, shallow orthographies

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Early literacy development is a central issue in current research and in the educational agenda. Although the bulk of research efforts has been devoted to early reading acquisition and the diverse consequences of reading failure, increasing attention is being paid to beginning writing as this is a crucial component of linguistic literacy (Myhill & Fisher, 2010; Ravid & Tolchinsky, 2002; Ritchtey, 2008). We focus on two components of writing: spelling and separation between words. *Spelling* relates to intra-word rules while *separation between words* relates to the rules defining the boundaries of the inter-word domain.

The participants were tested in kindergarten and in first grade in both monolingual and bilingual communities in Spain. They were native speakers of Spanish in the monolingual communities and bilingual Spanish/Catalan or Spanish/Basque speakers in the bilingual communities. The aim of this study was to identify what literacy related abilities and contextual characteristics, such as teaching practices and the bilingual environment in which children are schooled, better explain first graders' achievements in spelling and separation between words. We were particularly interested in targeting how child-level abilities interact among each other and with the characteristics of the environment. We assumed that learning to write, as with most learning processes, results from a trade-off between children's abilities and environmental characteristics. Therefore, in line with studies carried out in other languages (Tazouti et al., 2011). we expected to find that the best account of differences in writing performance lies in the interaction between the different factors under scrutinity.

1. Spelling and Child-level Abilities

The graphic units (graphemes) of alphabetic writing systems represent phonological rather than semantic units of language (Coulmas, 1989). Graphemes do not transcribe the sounds of speech, as the sounds people produce in speech are subject to personal and regional variations that are not captured by writing systems. Rather, the phonological units represented in writing are categories of sounds - phonemes - that are abstract entities. A child learning to spell in an alphabetic system needs to develop an awareness of these phonological units. This is known as phonological awareness. Certainly, one source of difficulty for young spellers is their difficulty in analyzing speech at the level of subsyllabic units and phonemes (Bourassa, Treiman, & Kessler, 2006; Caravolas & Bruck, 1993; Lervåg, Bråten, & Hulme, 2009; Muter, Hulme, Snowling, & Stevenson, 2004). Thus, phonological awareness is a crucial predictor of successful literacy learning (e.g., Bradley & Bryant, 1985; Carlisle & Nomanbhoy, 1993; Treiman & Zukowski, 1990).

Alphabetic writing systems are realized in a diversity of spelling systems (or orthographies), which contain the rules for pairing phonological to graphic units in a particular language (Perfetti & Liu, 2005). Thus, apart from discovering the alphabetic principle - the idea that the letters in a written string stand for the sounds in a spoken word (Byrne, 1996) - children who are learning to spell must attune themselves to the

particular graphophonemic rules of the orthography they are learning. The orthographies of the three languages involved in this study (Spanish, Catalan, and Basque) have consistent pairing rules: the pronunciation of graphemes has no variation across words except for three consonants in Spanish (Cuetos & Suárez-Coalla, 2009); four consonants in Catalan (Wheeler, 1988), and three in Basque. Orthographies with consistent graphophonemic rules are termed shallow or transparent and contrasted to more opaque or deep ones. The spelling system of English is an example of deep orthography because one letter may have many different readings or one category of sounds different spellings. Studies have established that learning to read and spell is faster in transparent orthographies than in opaque systems (Seymour, Aro, & Erskine, 2003).

However, spelling systems do not represent phonology alone; they also represent other levels of language. Morphology - the forms and formation of words in a language, and even syntax - the way words are combined, play a role in spelling. For instance, one must know that in English the past tense of regular verbs is formed by attaching <-ed> at the end of the verb, regardless of how the past tense is pronounced. In addition to accessing the phonological and morphological structure of the word, spelling requires having at one's disposal an orthographic lexicon (Ehri, 1980; Olson, Forsberg, & Wise, 1994) in which word-specific features are stored and accessed. Good spelling requires using word-specific features, which are not always essential in the reading of words. A learner of Spanish can read a word just as well when it contains a spelling mistake as when it is correctly spelled (e.g. <*baca> /*vaca*/ 'cow')." But, in order to spell this word correctly the learner needs a complete orthographic representation of it.

Learning to spell thus involves understanding the relationship of the graphic elements with the different levels of language: phonology, morphology, syntax, and the lexicon (Bahr, Silliman, Berninger, & Dow, 2012; Llaurado & Tolchinsky, in press). Nevertheless, phonological awareness plays a prominent role during the earliest stages of spelling acquisition when children must discover the alphabetic principle in any orthographic system. In addition to that, phonological awareness is especially relevant for building an orthographic representation of the word in shallow orthographies. This is so because of the consistent grapheme to phoneme pairing (Frost, Katz, & Bentin, 1987). Orthographic transparency is, however, a matter of degree (Llaurado & Tolchinsky, in press). There is a certain degree of ambiguity in the oral-to-written direction in most shallow orthographies but this ambiguity is of a much lesser degree than in deep orthographies (Caravolas, 2004). Studies on spelling development in several languages with shallow orthographies demonstrate a strong link between phonological awareness and spelling skills in early gradeschool (Defior & Tudela, 1994; Goikoetxea, 2005; Jiménez & Ortiz, 2000). Although sensitivity to morphology is very relevant for developing spelling abilities in English and other deep orthographies (Bryant, Nunes, & Bindman, 2000; Ravid, 2011; Treiman & Cassar, 1996), it is less crucial for shallow orthographies (Pacton & Fayol, 2003; Sanchez, Magnan, & Ecalle, 2012). The role of phonology is directly proportional to the shallowness of the

orthography and inverse to the role of morphology; the deeper the orthography is, the more morphological information is needed to find the correct spelling. In Italian, a language with rich morphology and shallow orthography, words could, in principle, be (almost) accurately spelled using nonlexical phoneme-to-grapheme conversion rules alone. When spelling problems occur, they normally affect more irregular words, and spelling errors are normally phonologically plausible (Arfe, 2011). In general, spellers must resort to their morphological and lexical knowledge more frequently in English than in Spanish or other transparent orthographies in order to spell accurately (Defior, Alegría, Titos, & Martos, 2008). Studies have shown that there is a stronger reliance on sublexical procedures for shallow than for deep orthographies (Caravolas & Bruck, 1993; Defior & Serrano, 2005; Landerl, Wimmer, & Frith, 1997; Notarnicola, Angelelli, Judica, & Zoccolotti, 2012). In the current study, children's phonological awareness in kindergarten was considered a potential predictor of successful spelling in first grade. We also considered the potential contribution of letter knowledge.

In effect, knowing the names and the sounds letters stand for also contributes to the orthographic representation of a word. Consequently, letter knowledge has been found to be a powerful preschool predictor of learning to spell across spelling and educational systems (Cardoso-Martins, 1995; De Jong & van der Leij, 1999; Levin & Ehri, 2009; Lonigan, Burgess, & Anthony, 2000; Pennington & Lefly, 2001; Tolchinsky, Levin, Aram, & McBride, 2011). Knowledge of letter names boosts spelling indirectly through its influence on children's grasp of letter-to-sound correspondences and on their phonemic awareness (Foulin, 2005; Share, 1995). There is converging evidence showing that a combination of phonemic awareness and letter sound correspondence training strongly benefits understanding the alphabetic principle (Adams, 1990; Byrne & Fielding-Barnsley, 1989).

One of the properties of letter names, their iconicity, helps children to grasp the fact that letters stand for sounds. Iconicity refers to the property of letter names to contain the phoneme that the letter represents. For example, the English name of *s*, /ɛs/, contains /s/. All letter-name systems that we know of are iconic (Treiman & Kessler, 2003) and therefore are useful in helping children to learn letter to sound correspondences. One limitation of iconicity in English (and other deep orthographies) is that several letters have more than one sound, but letter names almost always use only one of those sounds (Treiman & Kessler, 2003). This limitation is weaker in transparent orthographies like Spanish, Catalan, and Basque because of the higher consistency of their graphophonemic rules. For example, in the three languages the name of the vowels is the vowel sound (e.g., *a* stands for /a/) and is only pronounced one way in Spanish and Basque whereas in Catalan only two vowels have one additional sound, different from its name. This straightforwardness makes letter names in transparent orthographies particularly useful for learning how to spell. In a previous study we have found that in Spanish, letter naming and phonological awareness explained a substantial portion (70%) of word writing variance in kindergarten (Tolchinsky et al., 2011).

As for letter sound knowledge, it seems its role in transparent orthographies is stronger than the one it plays in English where it is preceded and facilitated by letter name knowledge (McBride-Chang, 1999). Greek preschoolers, for example, learn sooner and better the sound of the letters (Manolitsis & Tafa, 2011; Tafa & Manolitsis, 2008) and for them letter sound knowledge is a stronger predictor of reading accuracy than letter name knowledge (Mouzaki, Protopapas, & Tsantoula, 2008).

Phonological awareness and knowledge of letters are not the only factors that affect spelling. In English, children's vocabulary has also been associated with early literacy skills (Strattman & Hodson, 2005). Children with larger vocabularies have more detailed phonological representations of words and this serves to foster spelling development (Dockrell & Messer, 2004). In contrast, children who enter kindergarten with weak language skills - among them knowledge of vocabulary - are likely to encounter difficulty in learning to read and spell (Scarborough, 2001). Previous studies have shown that complex measures such as the ability to define words are more strongly related to later literacy achievement than measures of simple vocabulary knowledge (Lonigan, Schatschneider, & Westberg, 2008). The ability to define words taps vocabulary depth rather than breadth (Ouellette, 2006) and involves the capacity to explicitly reflect on the lexical item, not just to recognize it. In this sense, word definition is considered a metalexical ability that reflects children's participation in cultural practices related to literacy (Snow, Tabors & Dickinson, 2001; Tabors, Roach, & Snow, 2001) and for that reason it was measured in our study.

Apart from examining phonological awareness, knowledge of letters, and word definition in kindergarten as potentially predictive variables of spelling attainments in first grade, we also examined children's level of writing when entering kindergarten. Studies on emergent literacy have shown that prior to being formally taught to read and write, children develop relevant knowledge about the formal features of writing - linearity, discreteness, directionality - and about the way graphic units relate to the word sounds (Tolchinsky, 2003, 2004). We supposed that this implicit knowledge children develop about writing might pave the way to further spelling achievements after formal instruction begins. In order to address this question we looked at the extent to which level of writing when starting kindergarten could be related to spelling performance at the end of first grade.

2. Separation between Words and Child-level Abilities

Unlike spoken language, written texts require words to be separated by blank spaces. Although strictly speaking blank spaces are not a *punctum,* they are part of the punctuation system of alphabetic systems. One of the functions of these blank spaces is to indicate the boundaries of graphic words. Literate people treat the way in which words are separated by blank spaces in their written language as natural but it was only around AD 600–800 that blank spaces started being inserted between words in Latin.

That practice was carried over afterwards to all languages using alphabetic systems (Günther, 1997).

In addition, conventions for what linguistic categories are separated by blank spaces in a written string are language dependent (Ferreiro, 1999; Correa & Dockrell, 2007; Tolchinsky, 2006). Consider for instance an utterance composed by preposition + article + noun, such as /to the beach/. This utterance should be written in both Spanish and English with two blank spaces: one separating the preposition from the article, and the other one, separating the article from the noun: <*a la playa*> for Spanish and <*to the beach*> for English. However, the same utterance should be written with only one space in Italian and with no blank space in Hebrew. According to Italian conventions the preposition and the article must be written with no space between them <*alla spiaggia*> and, according to Hebrew conventions, the preposition and the article should be attached to the noun <*layam*>. Thus, a child who creates a blank space between the preposition and the article in Italian would be committing a segmentation mistake because he/she is creating a space where there should not be any. However, a child who writes the preposition attached to the article in Spanish would also be committing a segmentation mistake because he/she is not producing a space where there should be one. In fact, there is no clear-cut definition of correct conventional separation of words outside a specific orthographic system (Ferreiro, 1999). Even for children who have mastered graphophonemic correspondences, defining word boundaries in text writing is not a straightforward task. The occurrence of unconventional segmentation in children's writing has been reported in Spanish (Tolchinsky & Cintas, 2001), in Italian (Ferreiro & Pontecorvo, 1996) in Portuguese (Correa & Dockrell, 2007), in Hebrew (Sandbank, 2001), in Mayan (Pellicer, 2004) and also in English, although no systematic description of the children's written productions has been produced (Nunes, 1999).

Identifying the boundaries between lexical units in spoken language is also an indispensable task. For adults, word segmentation is necessary for them to perceive novel lexical items in their input. For infants, word segmentation paves the way to attribution of meaning to lexical units and for syntax. It seems, though, that it is a difficult task because in normal speech people do not insert pauses between words. Consecutive words are usually being uttered with no pauses between them and assimilation processes blend the final sounds of one word with the initial sounds of the next one.

It has been shown that word recognition is of substantial benefit to word segmentation because the presence of a known word facilitates segmentation of the following one. If many words are known already, the recognition of novel word boundaries is facilitated. Actually, connectionist models (McClelland & Elman, 1986; Norris & McQueen, 2008) explain word segmentation in adults as an epiphenomenon of word recognition. Infants, however, cannot resort to their known vocabulary, as adults appear to do. Studies on the development of word segmentations have shown that from about 6 months infants use their own name (a known word) to segment the

following word (Bortfeld, Morgan, Golinkoff, & Rathbun, 2005). But, from that age on, infants learn to exploit the phonotactic and prosodic features of their language in order to detect word-sized unit boundaries. In other words, from generalizations over the phonological structure of their language infants can segment speech even when they do not recognize all of the words they hear (e.g., Jusczyk, Luce, & Charles-Luce, 1994).

The question we are addressing here is to what extent phonological awareness and lexical knowledge are likely to support identification of conventional word boundaries in written language. Studies in Portuguese have shown that vocabulary makes an important contribution to children's understanding of word boundaries in writing (Correa & Dockrell, 2007). Vocabulary knowledge provides both phonological and morphological information, and this information in turn might help children to single out words within sentences (Dockrell & Messer, 2004). However, unconventional word segmentations were found to be related to spelling errors that reflected children's poor phonological skills such as illegal letter use or letter omission (Correa & Dockrell, 2007). We expected to find, therefore, that phonological awareness also plays a role in children`s detection of word boundaries as is the case in the spoken modality.

Besides examining differences in children's literacy related abilities when beginning formal instruction, their parents' educational level was also examined as a possible predictor of achievements in spelling and word separation. Research suggests that parental education is a significant, unique predictor of child achievement (e.g., Dubow, Boxer, & Huesmann, 2009; Duncan & Brooks-Gunn, 1997). There is evidence that parents' educational level is highly correlated with children's literacy development for English-speaking children (Bryant, MacLean, Bradley, & Crossland, 1990) as well as for Korean-speaking children (Kim, 2007), and it exerts an important influence on students' book reading quality (Leseman & de Jong, 1998) and reading performance (Sénechal & LeFevre, 2002; Sonnenschein, Stapleton, & Benson, 2010). Parental education is linked to the parents providing a more stimulating physical, cognitive, and emotional environment in the home, and more accurate beliefs about their children's actual achievement (Alexander, Entwisle, & Bedinger, 1994; Davis-Kean, 2005; Umek, Podlesek, & Fekonja, 2005). It is therefore reasonable to expect parental education to interact with other child-level abilities to explain differences in spelling and word separation achievements.

3. Spelling, Word Separation and Contextual Characteristics

Achievements in spelling and separation between words may be also affected by environmental-contextual characteristics such as the linguistic environment in which children grow up and the teaching practices they are exposed to. Multilingual experience, whether occurring in natural settings (Silvén & Rubinov, 2010) or in formal school settings (van der Leij, Bekebrede, & Kotterink, 2010; Laurent & Martinot, 2010), does not negatively affect the development of language and literacy in bilingual children. Rather, there is some evidence of the beneficial effects of biliteracy on literacy

development (Schwartz, Share, Leikin, & Kozminsky, 2008). A qualitative study on early writing development showed that writing development in Spanish/English bilinguals mirrors both monolingual Spanish and monolingual English development (Rubin & Galvan-Carlan, 2005). Evidence on the effect of bilingualism on spelling performance is less straightforward. Bilinguals learning to spell in different writing systems - English and Chinese - showed a similar performance in real-word spelling to that of monolingual English-speaking children in grade 2 (Wang & Geva, 2003). Although, in general, first language writing system influences bilingual children's spelling performance in their second language, bilinguals showed similar or better performance in spelling (Dixon, Zhao, & Joshi, 2010; Marinova-Todd, & Hall, 2013). In contrast, a longitudinal study, grade 2 through 5, on Spanish and English spelling demonstrated that while the mean Spanish spelling performance of both language groups was almost indistinguishable, the mean English spelling performance of native Spanish speakers tended to lag behind that of native English speakers at all grade levels (Howard & Sugarman, 2007). The difference in favor of Spanish against English is related to English having a more opaque orthography than Spanish. The precise influence of bilingualism on spelling development is still an open question.

Finally, we took into account another contextual variable that distinguished between groups of participants and was experienced by all the participants in each group: teaching practices. There is cumulative evidence demonstrating the impact of instructional practices on children's learning of literacy (Center, Freeman, & Robertson, 2001; Connor, Morrison, & Katch, 2004; Roberts & Meiring, 2006). Most studies have examined this impact by comparing methods for teaching reading; in particular, code-oriented versus meaning-oriented methods (Connelly, Johnston, & Thompson, 2001; Jiménez & Guzmán, 2003). Code-oriented methods stress the explicit and systematic instruction of phonological awareness, correspondences between letters and sounds in a graded presentation, word recognition, and decoding. Meaning-oriented methods are built on enhanced literate environments, strategic reading of different genres, use of 'authentic texts' (Purcell-Gates & Duke, 2007), and they encourage autonomous writing from the initial stages of literacy teaching.

It seems, however, that the two approaches become less distinctive in the classroom (Hoefflin, Cusinay, Pini, Rouèche, & Gombert, 2007), since many teachers use a mixture of approaches. They incorporate both code-oriented strategies with more holistic meaning-oriented strategies that seem to them to be more effective in supporting students' literacy growth (Anguera, et al., 2004; Donaldson, 1993; Gibson, 1996). That is why most studies on teaching practices point to the need to consider other aspects that are involved in the process of literacy teaching - planning, evaluation, class dynamics, and organization - in order to gain a finer distinction between approaches to teaching literacy (Castells, 2006; Jiménez, Yáñez, & Artiles, 1997; Strauss, Selzer, Ravid, & Berliner, 1999).

For the present study, teaching practices were established on the basis of a previous study aimed at identifying profiles of pedagogical practices for early literacy teaching

(Tolchinsky, Bigas, & Barragán, 2012). The purpose was to provide a more comprehensive view of the teaching/learning environment beyond the identification of teachers' stated method. The three profiles that emerged from that study were used for identifying teachers' profiles in this study: *instructional, situational,* and *multidimensional*.

Teachers who match the profile of *instructional* teaching practices are those who state that they set aside a specific amount of time in the school timetable for reading and writing activities. They also rely heavily on code-oriented activities such as letter naming, letter to sound correspondences, phonological awareness, and accuracy of decoding. These teachers tend to use a narrow range of text types, usually a unique textbook, and they rarely encourage autonomous writing in classroom activities.

Teachers in the group of *situational* practices state that they frequently organize reading and writing activities in small groups; seize occasions for incidental literacy learning in the many unexpected situations that arise in the classroom; decide what vocabulary to teach by taking into account the life experiences shared by children; assess progress by observing the autonomous writing of short texts; and use a wide range of printed materials in class.

Lastly, teachers assigned to the profile of *multidimensional* teaching practices say that they set aside specific time for reading and writing activities; make use of children's knowledge of letters and sounds when teaching them to read and write but also include independent writing of short texts; propose special activities to encourage reading out loud; and work on reading and writing by using situations that spontaneously arise in the classroom.

4. The Current Study

We assessed kindergartners' level of literacy, phonological awareness, knowledge of letters, vocabulary, writing level, and parental education as child-related characteristics that might contribute to explain first graders attainments in spelling and word separation. We hypothesized that letter knowledge and phonological awareness would predict children's spelling attainments because of the central role they play in learning to spell in shallow orthographies. We also expected a moderating role of parental education in the relationship between these abilities and spelling. As for separation between words, we expected a direct contribution of vocabulary knowledge on first graders' achievements because of the facilitating role that word knowledge has on the identification of words' boundaries and a moderating role of parental education.

A main assumption of the study was that children's achievement in the two writing components - spelling and separation between words - will be affected by the linguistic environment in which chidren are raised and by the teaching practices they are exposed to.

The study includes a group of native Spanish speakers growing and schooled in a monolingual community and a group of Catalan and Basque bilingual speakers raised

in a bilingual community. The two groups of participants were assessed in their language of instruction. The type of community (monolingual or bilingual) was taken as the contextual variable that distinguishes between the two groups of participants and is shared by all the participants in each group. This design enabled us to determine the extent to which spelling achievements in first grade differ for monolingual children raised in a monolingual environment relative to bilingual children raised in a bilingual environment. Finally, the profiles of teaching practices identified in kindergartners' classrooms were considered as a second contextual variable that might also influence first graders' performance in writing.

5. Method

5.1 Participants

Participants were part of a larger project designed to test the effect of kindergartens' literacy and teaching practices on initial learning of writing and reading (813 children from 39 schools – one class in each school was observed). Seven classes dropped out of the study due to school structural changes. For the current study, in each class, a target sub-sample was selected which included four children from the lowest literacy level and four children from the highest literacy level based on a prior cluster analysis of the scores obtained for familiarity with texts of social use (e.g., a shop receipt, a newspaper), identification of written words, and ability to explicitly segment words into syllables (Buisán, Rios, & Tolchinsky, 2011; Tolchinsky, Ribera, & Garcia Parejo, 2012). The final target sample included 215 children, 113 boys and 102 girls (*M* age = 5 years 4 months, SD = 4 months, Range 50.10 - 73.71 months) attending 32 kindergarten and first-grade classrooms in Spanish schools (Table 1 displays the descriptive data for the participants). Cluster size (a classroom at each school) varied from six to eight children. This means that the data are structured in two levels. Level one is based on data at the child level and level two is based on classroom data.

5.2 Background Parents' Education

Apart from children's level of literacy, we considered the level of parents' education, assessed on an ordinal scale from low- primary school, through middle - secondary school, to high - university level (see Table 1). This background variable also varied across participants and was therefore considered as level one data. That is, parental education is a contextual variable measured at the individual child level.

Table 1. Descriptive Statistics for Child Participants (N=215)

	Category	Count	Percentage
Parents' education	Low	63	29.3
	Middle	73	34.0
	High	79	36.7
Literacy level	Low	109	50.7
	High	106	49.3
	M	SD	Range
Time 1			
Sub-syllabic segmentation	09.65	25.86	0-100
Vocabulary	55.50	27.19	0-100
Letter knowledge	82.05	27.33	0-100
Writing	12.46	21.89	0-100
Time 2			
Spelling	63.90	25.21	0-100
Word separation	65.31	29.25	0-100

5.3 Schools and Teachers

Teachers at schools were characterized by different pedagogical practices for the initial teaching of reading and writing. The teaching practices of each teacher in the participant classrooms were identified by means of a questionnaire used in a previous study devoted to detecting profiles of teaching practices (González, Buisán, & Sánchez, 2009; Tolchinsky, Bigas, & Barragán, 2012). For the present study, the initial identification of profiles by means of the questionnaire was confirmed by an individual interview and, at least, three classroom observations during the school year in kindergarten (October to May 2006) and in first grade (October to May 2007). There was total agreement between the initial adscription of teacher's profile by means of the questionnaire and later adscription by means of the personal interview and classroom observations (Fons-Esteve & Buisán-Serradell, 2012).

A main distinguishing feature of the profiles of practices was the teachers' concern with promoting activities of autonomous writing and using an ample range of texts in their classrooms. While teachers with an instructional profile were code-oriented, teachers with a situational profile preferred to stimulate text-writing activities, and teachers with a multidimensional profile were concerned with both code-oriented and text writing activities. The three profiles of practice were represented in kindergarten in a rather balanced way. For the analyses two dummy variables for kindergarten teaching

profile were created: Kindergarten teacher profile 1 (K1_1) 1 = multidimensional versus 0 = instructional; Kindergarten teacher profile 2 (K1_2) 1 = situational versus 0 = instructional.

5.4 Tasks and Materials

Our final measurements assessed performance on a number of different tasks. Each task consisted of a number of items, with performance on each item assessed on a task-specific rating scale. With the exception of the letter knowledge measure, these ratings were then collapsed into a binary classification of an item as largely incorrect (0) or largely correct (1). The final score for each task consisted of the total number of items classified as correct. All measurements were transformed into a 0-100 scale (0 = no success, 100 = full success) to achieve overall standardization. A detailed description of each measurement is provided below.

5.5 Initial Assessment (Kindergarten)

Phonological awareness: subsyllabic segmentation

Children were asked to segment four words into individual sounds. The words denominated the characters of well-known tales whose covers children had in view. The interviewer provided two examples demonstrating that a phonemic segmentation was expected. Segmentation for each word was assessed by a scale (0-3) based on the unit and the exhaustiveness of the segmentation: 0 = no segmentation, the child repeated the word without producing any pause between segments; 1 = partial segmentation, the child said only part of the word; 2 = complete segmentation but not into individual sounds, the child said all the word but segmented into syllables or syllables and individual sounds; 3 = complete, the child said all the word and segmented it into individual sounds. The final sub-syllabic score was the number of times the child's answer was scored "2" or "3" across the four words, $\alpha = .86$ (alpha represents reliability across four measurements rescaled as binary variables: 0, 1=none subsyllabic segmentation as zero; 2, 3=significant subsyllabic segmentation as one). This sum over the number of items (0-4) was transformed into a percentage scale (0-100).

Letter knowledge

Children were asked to pronounce the letters that formed their name and the name of the interviewer. The two names stood written in front of them. They were also asked to pronounce, one by one, the corresponding sound of each letter that made up both names. Letter naming and sounding for each word was assessed on a scale of 0 to 3, based on the number of letter names the child knew and the number of letter sounds he/she was able to pronounce 0 = none to one letter or sound, 1 = less than half of the letters or letter sounds, 2 = more than half of the letters or letter sounds, 3 = all the letters or letter sounds, $\alpha = .91$ for the child's name and $\alpha = .83$ for the interviewer's

name. The final letter knowledge score was the following ordinal scale based on a combination of the two measurements, where L1 stands for the child's name and L2 stands for the interviewer's name: if L1 = 0, and L2 = any, letter knowledge = 0; if L1 = 1 and L2 < 2, letter knowledge = 1; if L1 = 2 and L2 = any, letter knowledge = 2, that is high knowledge of his/her name regardless of the knowledge level of the interviewer's name; if L1 > 2 and L2 < 2, letter knowledge = 3, that is knowledge of most of his/her name's letters and some or none of the interviewer's name; if both L1 and L2 > 1 but either L1or L2 <3), letter knowledge = 4, that is high knowledge but not complete; if L1 = 3 and L2 = 3, letter knowledge = 5, that is knowledge of all letters from both names. The final score ranged between 0–5, and was converted to a percentage.

Vocabulary: word definition

Children were asked to define six words of increasing difficulty selected from the WISC for children in both Spanish and Catalan (Wechsler, 2005). In Basque all but one word were translated from Spanish. The question was *What is x*? The definition of each word was assessed on a 0-3 scale: 0 = don't know, no answer; 1 = deixis, the child points at his arm and says *esto* 'this' when asked to define *piel* 'skin'; 2 = definition by context of appearance, the child says *está en el cuerpo* 'it's in your body' when asked to define *piel* 'skin'; 3 = formal definition and definitional features, the child says *uno que salva toda la gente que está en peligro* 'someone that saves all the people that are in danger' for defining *heroe* 'hero'. The final word-definition score was the number of times category 2 or category 3 were achieved across the items (0-6, converted to percentage) (α = .61). Similar to earlier measurements, categories two and three represent meaningful word definition.

Initial level of writing

Children were asked to write four words dictated by the interviewer. The words were chosen from the character names of well-known tales. The level of writing of each word was assessed by a scale (0-4) based on the unity and comprehensiveness of graphophonemic correspondences: 0 = no graphophonemic correspondences; 1 = syllabic graphophonemic, one letter for one syllable or larger unit; 2 = mixed syllabic-alphabetic correspondences; 3 = alphabetic correspondences, one letter for each vowel and consonants in the word irrespective of spelling mistakes; 4 = correct spelling. The final initial writing level score was the number of times category 3 and category 4 were achieved across the items (0-4, converted to percentage) (α = .89).

Final Assessment (First Grade)

Spelling

Children were asked to write 11 words containing six different syllabic structures according to the more common structures in each of the languages in the study. The final spelling score was obtained by counting the number of words in which correct spelling was observed (0-11, converted to percentage), $\alpha = .76$

Word separation

Children were asked to graphically mark the separation of words in two sentences. The interviewer first exemplified the task in another sentence. A score from 0 to 10 was calculated for each sentence by computing the number of marks produced by the child to indicate separation between words over the total number of blank spaces that were required by the conventional segmentation in each language. For example, for the sentence *La ratita se fue a comprar un lazo para el pelo* ('The little mouse went to buy a ribbon for the hair') the child had to mark 10 blank spaces. Thus, a child who marked *La/ratitasefue acomprar/unlazo/paraelpelo* was scored 3. The final word separation score was the average score across the two sentences, $\alpha = .76$.

5.6 Procedure

Permission to conduct the study was provided by each school principal, and informed consent was obtained from parents. The authors collected the data in all the communities, except for Cantabria and Catalonia, where two research assistants collected it. The interviewers were native speakers of the language of instruction in their respective communities. Assessments were carried out in the language of instruction for all the tasks. Interviews were carried out individually and lasted around 20 minutes.

Strategy of analysis

A Random Coefficient model was estimated (HLM v7.1) to examine the effect of child-level and contextual variables on spelling and separation between words. This strategy of analysis was used to control for the nested nature of the data: students nested within classes ($N = 32$). Three successive models were structured to analyze the explanatory power of the independent variables in explaining spelling and separation between words. For both outcomes, the first model included the intercept only. The second model included all the main effects, and the third model included, in addition, within and across-level interactions. For model 2 all explanatory variables, child-level variables (Level 1) as well as contextual variables (Level 2), were entered together. A significant result indicated that the variable made a unique contribution to explaining

word separation or spelling (main effects). For model 3 potential two-way interactions within Level 1 variables, within Level 2 variables, and across Level 1 and Level 2 were entered into the model. For testing and probing of two-way interactions estimated in multi-level models, we used Preacher, Curran, & Bauer's (2006) method. The interaction can be between two dichotomous variables, two continuous variables, or between a dichotomous and a continuous variable. The testing, probing, and interpretation of interactions in these multi-level models are similar to the interpretation of interactions in multiple linear regressions (e.g., Aiken & West, 1991). All Level 1 and Level 2 continuous independent variables were grand-mean centered, thereby allowing coefficients to be interpreted relative to the sample mean and reducing the correlation among interaction terms (Aiken & West, 1991). The intercept represented the expected scores for children performing at the mean of all included explanatory variables (see Table 1) attending schools in monolingual communities.

6. Results

Children's performance on writing, letter knowledge, vocabulary, and sub-syllabic segmentation in kindergarten as well as word spelling and separation between words in first grade are displayed in Table 1. Contextual variables – type of community and kindergarten teacher profile of practices - are reported in Table 2 and Appendix A shows correlations among child-level variables.

Table 2. School and Teacher Descriptive Statistics (N=32)

Variable	Category	Count	Percent
Community	Monolingual	17	53.1
	Bilingual	15	46.9
Kindergarten teacher profile of practices	Instructional	13	40.6
	Multidimensional	10	31.3
	Situational	9	28.1

Parental level of education, initial literacy level, level of writing and vocabulary were significantly positively correlated with both spelling and separation between words at the end of first grade. Subsyllabic segmentation was positively correlated with word separation but not with spelling whereas letter knowledge was not correlated with either spelling or with separation between words.

6.1 Spelling

Table 3a displays the three models that were structured to analyze the explanatory power of the independent variables in explaining spelling.

Model 1 shows considerable variability among schools, Unconditional Intraclass Correlation (ICC) for Spelling = 0.40. Model 2 shows that two contextual variables, one at child-level and one at level two, were significantly related to individual scores in spelling: parents' education level and type of community. These explanatory factors reduced the residual variance: Pseudo R^2 for Spelling was .43, the amount of explained variability within school was .10, and the amount of explained variability between schools was .33. The deviance difference comparing the baseline model with the second model was $\Delta\chi^2(10) = 71.73$, $p < .001$. The best explanatory model was model 3 including the contributions of the interactions. Including the interaction reduced the residual variance: Pseudo R^2 was .45. The amount of variability occurring within school was .16, and the amount of variability explained between schools was .29. The deviance difference comparing only the main effects model and this model was $\Delta\chi^2(7) = 19.24$, $p < .01$. The model shows a main effect of the contextual variable type of community, and five significant interactions: one interaction between a child-level and a contextual level variable and four within child level variables. Children attended school in bilingual communities got lower scores in spelling than monolingual children who attended school in monolingual communities, $b = -24.14$, $p < .01$. The presentation of interactions hereafter uses two points for the sake of simplicity, one standard deviation below the mean and one standard deviation above the mean (e.g., low writing, high writing). Slopes and their significance levels are provided (Aiken & West, 1991).

Table 3a. Estimates for Fixed and Random Effects in a Multi-Level Regression predicting Spelling Performance. [ICC spelling = .40]

	Model 1	**Model 2**	**Model 3**
		Fixed effects	
Intercept	64.41 (3.14)***	67.89 (4.12)	72.47 (3.86)
Level 1 – Child variables			
Literacy level		4.51 (3.41)	1.82 (3.23)
Sub-syllabic segmentation - Kindergarten		0.04 (0.03)	0.07 (0.04)
Vocabulary - Kindergarten		0.18 (0.06)	0.06 (0.72)
Letters knowledge - Kindergarten		0.11 (0.06)	0.03 (0.13)
Writing - Kindergarten		0.14 (0.79)	0.69 (0.17) ***
Parent's education - low vs. high		9.27 (3.69) **	7.23 (2.82)*
Parent's education - low vs. medium		7.87 (4.15)	5.84 (3.43)

Level 2 – Contextual variables			
Type of Community		-24.99 (4.19)**	-24.14 (4.52) **
Teacher profile: Multidimensional vs. Instructional		-2.78 (4.78)	-3.70 (5.15)
Teacher profile: Situational vs. Instructional		3.45 (3.65)	4.34 (4.15)
Across Level 1 and Level 2 Interactions			
Writing x Teacher profile Situational vs. Instructional			0.31 (0.10)**
Writing x Teacher profile Multidimensional vs. Instructional			-0.00 (0.14)
Within Level 1 Interactions			
Writing x Parent's education – medium vs. low			-0.43 (0.16)**
Writing x Parent's education – high vs. low			-0.51 (0.13)***
Letter knowledge x Parent's education – medium vs. low			-0.11 (0.18)
Letter knowledge x Parent's education – high vs. low			-0.24 (0.12)*
Writing x Literacy level			-0.28 (0.12)**
		Random effects	
Intercept u_0	252.78 (78.77)***	46.04 (23.91)***	69.32 (28.28)***
Level -1	381.65 (39.86)	316.84 (33.03)	277.18 (28.91)
Deviance	1939.60	1867.87	1848.63
Deviance Difference - df	252.78 (78.77)***	10	7
Deviance Difference - X^2=	381.65 (39.86)	71.73***	19.24**
Total Pseudo R^2	1939.60	0.43	0.45

Note. Standard errors are in parentheses for fixed effects and standard deviation for random parameters; *** p < .001, ** p < .01, * p < .05.

Table 3b summarises the results of the overall tests for the significance of the interactions, and these are plotted in figure 1 (a-d).

Table 3b. Analysis of Interaction Effects on Spelling

Outcome	Interaction	b	se(b)
Spelling	1. Writing x Multidimensional vs. Instructional	-.0002	.20
	2. Writing x Situational vs. Instructional	.31**	.11
	3. Writing x Multidimensional vs. Situational	-.31*	.14
Spelling	1. Writing x Medium vs. Low education	-.43*	.17
	2. Writing x High vs. Low education	-.51**	.13
	3. Writing x Medium vs. High education	.08	.12
Spelling	1. Letter x Medium vs. Low education	-.11	.61
	2. Letter x High vs. Low education	-.24*	.12
	3. Letter x Medium vs. High education	.13	1.00
Spelling	1. Writing Level x Literacy	-.28*	.12

Note. All slopes were calculated by Preacher's calculator (Preacher, et al., 2006);
*** $p < .001$, ** $p < .01$, * $p < .05$.

In order to identify the source of these interactions we looked at the variables involved in the interaction as independent or moderator variable alternatively. For example, to identify the source of interaction between level of writing in kindergarten and teaching practices on spelling we treated level of writing as the independent variable and teaching practices as moderator. Afterwards, teaching practices was treated as the independent variable whereas level of writing was treated as the moderator. Slopes were estimated following Aiken & West's technique for estimating the source of interaction (1991) using Preacher's calculator (Preacher, Curran, & Bauer, 2006).

Figures 1 (a-d) represent the interaction analysis for Sources on Spelling. Figure 1a. presents the relationships between the level of writing and spelling achievements plotted separately for the three different teaching practices. As can be seen in figure 1a there were significant positive relationships between writing ability and spelling for all three types of teaching ($p < .001$ in all cases).

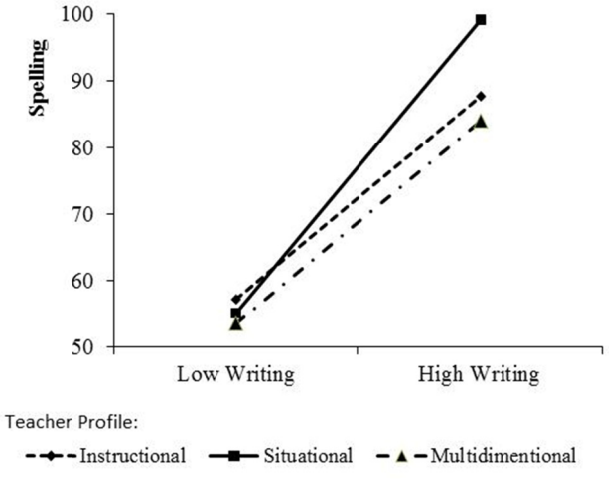

Figure1a. Writing Level x Teacher's Profile on Spelling

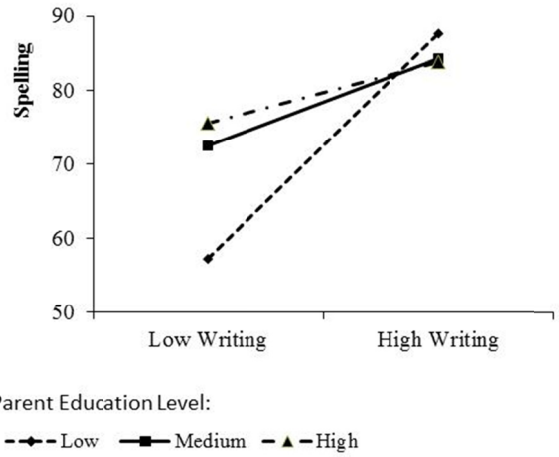

Figure1b. Writing Level x Parent's Education on Spelling

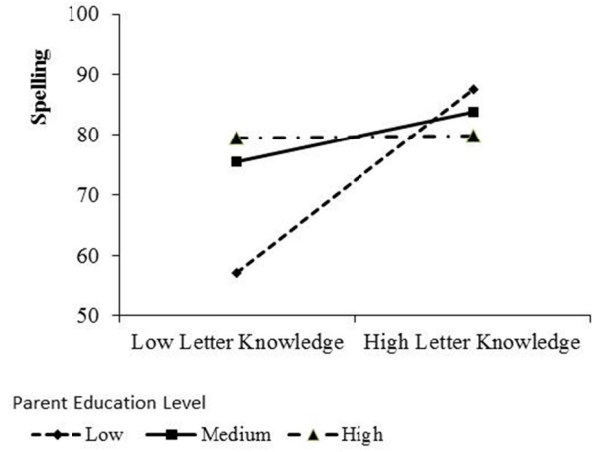

Figure1c. Letter Knowledge x Parent's Education on Spelling

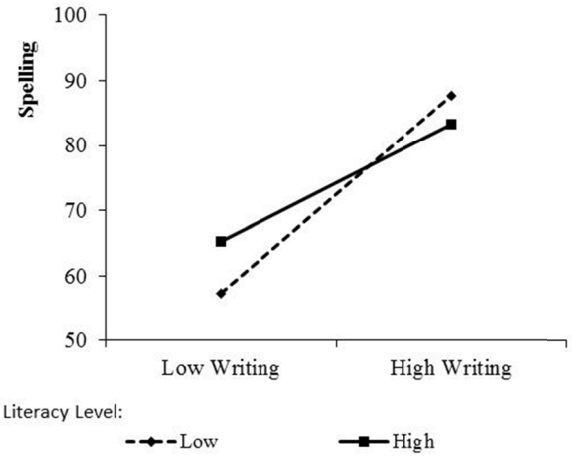

Figure1d. Writing Level x Literacy on Spelling

However, the results of the overall tests of interaction (table 3b) show a steeper slope for the situational teaching practice (b = 1.00, se= 0.17 $p < .001$) as compared with instructional (b = 0.70, se=0.17, $p < .001$) and multidimensional practices (b = 0.69, se=0.17, $p < .001$). There were no significant differences between the teaching practices for children with low initial writing performance (situational v instructional, b=-2.13, se= 4.73, n.s.; situational v multidimensional, b= -1.56, se= 6.24, n.s.) Note that the reference category for these comparisons is situational practices.

The same methodology was applied for analyzing the interaction between level of writing and parents' education level on spelling. The relationship between writing ability and spelling is plotted separately for the different levels of parental education in figure 1b.

As can be seen, there was a significant positive relationship between level of early writing and spelling only for low level of parental education (b = 0.70, se= 0.17, $p < .001$) while the relationships at higher levels of parental education were not significant (medium level of education, b = 0.27, se= 0.16, n.s.; high level of parental education, b = 0.19, se= 0.12, n.s.). Thus, the effect of parental education varied depending on children's initial level of writing ability. At a low level of writing ability, low level of parental education was associated with poorer spelling perfomance in comparison to medium (b = 15.17, se= 5.44, $p < .01$) and high levels of parental education (b = 18.31, se=4.73, $p < .001$). At high levels of writing ability, there were no differential effects of parental education ($p > .05$ in all cases). This means that parents' education affected spelling achievement when initial writing ability was low but had no effect when initial writing ability was high.

A similar picture was obtained for the relationships between knowledge of letters, parental education, and spelling plotted in figure 1c.

For children with low initial letter knowledge, a low level of parental education was associated with poorer spelling performance than high levels of parental education (b = 13.78, se= 5.74, $p < .05$). By contrast, level of parental education had no effect when letter knowledge was high ($p > .05$ for all comparsisons). This means that higher level of parental education helped children to overcome their early low level of letter knowledge.

Finally, the relationship between level of writing and spelling is plotted separately for low and high literacy level (figure 1d). The effect of initial writing ability on spelling was steeper for children with a low initial literacy level (b = 0.70, se= 0.17, $p < .001$) than for children with a higher initial literacy level (b = 0.41, se=0.24, n.s.). Thus, children with a low initial literacy level had poorer spelling performance than those with a high initial literacy level when their initial writing ability performance was also low (b = 8.02, se= 3.77, $p < .01$) but there was no difference when their initial writing ability was high (b = -4.38, se= 4.47, n.s.). In other words, when a low level of initial writing ability was combined with a low initial level of literacy, children's later spelling performance was poorest.

In sum, for children whose parents had a low level of education, low initial levels of writing ability (figure 1b) and little initial letter knowledge (figure 1c) were associated with poorer spelling performance. However, these effects were removed when parents had higher levels of education. In addition, for children with low initial writing ability, low initial levels of literacy were associated with poorer spelling performance but this effect was removed when initial writng ability was at a higher level. Finally, for teaching, situational practices were more effective than other forms of teaching for children with higher initial writing ability, but all forms of teaching had a similar effect for children with lower ability.

6.2 Separation between Words

Table 4a displays the three successive models that were structured to analyze the explanatory power of the independent variables in explaining performance in separation between words.

Table 4a. Estimates for Fixed and Random Effects in a Multi-Level Regression predicting Performance on Word Separation [ICC separation between words =.06]

	Separation Between Words		
	Model 1	Model 2	Model 3
		Fixed effects	
Intercept	65.24(2.33)***	54.64 (5.48)	62.97 (4.93)
Level 1 – Child variables			
Literacy level		5.97 (3.47)	3.47(3.82)
Sub-syllabic segmentation - Kindergarten		0.04 (0.003)	0.58 (0.07)***
Vocabulary - Kindergarten		0.18(0.51) ***	0.32 (0.09)***
Letters knowledge - Kindergarten		0.11 (0.06)	0.03 (0.06)
Writing -Kindergarten		0.33 (0.07) ***	0.93 (0.11)***
Parent's education – high vs. low		14.87(4.41) ***	9.12 (3.68)**
Parent's education – medium vs. low		8.41 (5.06)	0.81 (3.86)
Level 2 – Contextual variables			
Type of community		-3.51 (4.70)	-2.51 (4.44)
Teacher profile: Multidimensional vs.		-1.67 (4.55)	-3.671 (4.69)

Instructional			
Teacher profile: Situational vs. Instructional		6.12 (3.62)	7.17 (3.66)
Within Level 1 Interactions			
Writing x Parents education - high vs. low			-0.69 (0.13)***
Writing x Parents education – medium vs. low			-0.64 (0.16)***
Vocabulary x Parents education –high vs. low			-0.24 (0.13)*
Vocabulary x Parents education –medium vs. low			-0.14 (0.13)
Sub-syllabic segmentation x Parent's education – high vs. low			0.49 (0.07) ***
Sub-syllabic segmentation x Parent's education – medium vs. low			-0.64 (0.11)***
		Random Effects	
Intercept u_0	47.84 (44.33)	0.34 (24.49)	0.56 (22.31)
Level -1	803.26 (85.27)	606.32 (64.27)	550.58 (58.36)
Deviance	1991.91	1923.11	1903.15
Deviance Difference - df	-	10	6
Deviance Difference - X^2=	-	68.79***	19.96**
Total Pseudo R^2	-	.28	.35

Note. Standard errors are in parentheses for fixed effects and Standard deviation for random parameters; *** p < .001, ** p < .01, * p < .05.

Model 1 shows some variability among schools (Unconditional Intraclass Correlation (ICC) for separation between words = 0.06). Model 2 shows that three child-level variables are significantly related to individual scores in separation between words. The remaining child-level variables did not relate significantly with children's ability to separate words according to convention. No other contextual variable was directly related to scores in separation between words. These explanatory factors have reduced the residual variance: Pseudo R^2 for separation between words is .29, the amount of explained variability within school is .23 and the amount of explained variability

between schools is .06. The deviance difference comparing the baseline and this model is $\Delta\chi^2 = 68.79$, df = 10, $p < .001$.

As with spelling, the best explanatory model was model 3 including the interactions. Five interactions within child-level variables emerged that contributed significantly to explaining differences in separation between words. No interactions between child-level and contextual-level variables emerged. Adding the interactions has reduced the residual variance: Pseudo R^2 is .35. The amount of variability explained within school is .29 and the amount of variability explained between schools is .06. The deviance difference comparing model 2 and this model is $\Delta\chi^2 = 19.96$, df = 6, $p < .01$.

Next, interaction effects on word separation were analyzed (table 4b). Patterns of interactions analogous to those that emerged for spelling were found for separation between words.

Table 4b Analysis of Interaction Effects on Word Separation

Outcome	Interaction	b	se (b)
Word Separation			
	1. Writing x Medium vs. Low education	-.64***	.16
	2. Writing x High vs. Low education	-.69***	.13
	3. Writing x Medium vs. High education	.05	.13
Word Separation			
	1. Vocabulary x Medium vs. Low education	-.14	.13
	2. Vocabulary x High vs. Low education	-.24	.13
	3. Vocabulary x Medium vs. High education	.11	.23
Word Separation			
	1. Subsyllabic x Medium vs. Low education	-.64***	.12
	2. Subsyllabic x High vs. Low education	-.49***	.07
	3. Subsyllabic x Medium vs. High education	-.14	.08

Note. All slopes were calculated by Preacher's calculator (Preacher, et al., 2006);
*** p < .001, ** p < .01, * p < .05.

Figure 2a shows the relationships between initial writing level and word separation plotted separately for the different levels of parental education.

There was a positive relationship between initial writing level and word separation, but this association was moderated by the level of the parents' education (see table 4b). The strongest association between initial writing level and word separation was found for children whose parents had low-level education ($b = 0.93$, se=0.12, $p < .001$). This association was weaker for children whose parents had higher educational levels (medium level, $b = 0.24$, se= 0.08, $p < .01$; higher level, $b = 0.29$, se= 0.10, $p < .05$). Tests of the differences across parents' education levels showed that the effect of parental education varied depending on children's initial writing ability.

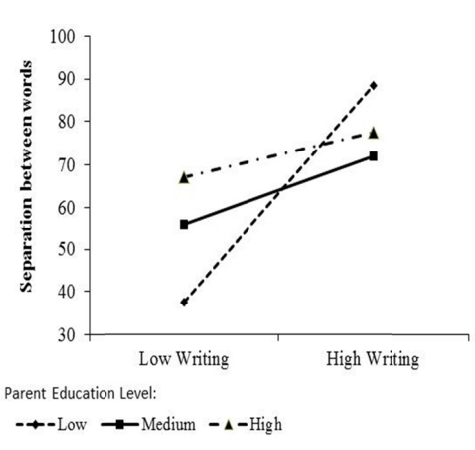

Figure 2a. Writing Level x Parent's Education on Word Separation

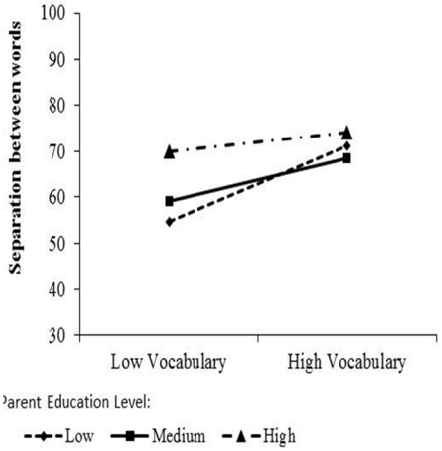

Figure 2b. Vocabulary x Parent's Education on Word Separation

At low levels of writing ability, both children whose parents had medium (b = 14.73, se= 6.49, $p < .05$) and high levels of education (b = 24.24, se= 5.61, $p < .001$ got higher scores on word separation than children whose parents had lower levels of education. By contrast, at high levels of initial writing ability, this difference was either no longer significant for the comparison between children with high and low educated parents (b = -6.00, se= 3.43, n.s.) or was in the opposite direction, with children whose parents had low education performing better at word separation than children whose parents had low levels of education (b = -13.12, se= 3.36, $p < .001$). Overall, then, children whose parents had low levels of education did worse at word separation when they had low levels of initial writing ability, but just as well as, if not better than, other children when they had high levels of initial writing ability.

The relationship between vocabulary knowledge and word separation is plotted separately for the different levels of parental education in figure 2b. At a low level of parental education, performance in word separation increased when vocabulary knowledge increased (b = 0.32, se= 0.09, $p < .001$), but at higher levels of parental education levels, this relationship was not significant (p >.05 in both cases). For children with low level of vocabulary knowledge, those whose parents had low levels of education performed worse at word separation than those whose parents had high levels of education (b = 15.75, se= 4.54, $p < .001$) but not compared to children with medium levels of education (b = 4.56, se= 5.63, n.s.). Overall, parents' low level of education had a negative effect for childen with low initial writing ability but not those with higher initial writing ability.

A similar effect was found for phonological awareness (sub-syllabic segmentation). As can be seen in figure 2c, the relationship between phonological awareness and

word separation performance was steeper for children whose parents had low education (b = 0.58, se= 0.07, p < .001) than for children whose parents had medium (b = 0.09, se= 0.06, n.s.) or higher levels of education (b = -0.06, se= 0.09, n.s.) where neither relationship was significant.

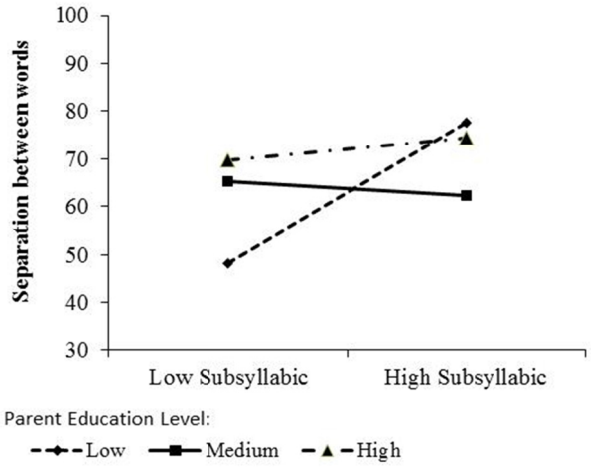

Figure 2c. Phonological awareness x Parent's Education on Word Separation

At low phonological awareness levels, children's word separation performance was lower when their parents had low levels of education than when their parents had medium (b = 17.26, se= 6.03, p < .01) or high levels of education (b = 26.99, se= 6.04, p < .001). By contrast, for children with high levels of initial phonological awareness, those whose parents had low levels of education performed better than those whose parents had medium (b = -15.65, se= 3.37, p < .001) or high levels of education (b = -8.74, se= 3.63, p < .05). This means that when initial level of phonological awareness was low, a low level of parental education had a negative effect on word separation, while this effect switched for children who had an initial high level of phonological awareness.

In sum, for children with low levels of initial writing ability, vocabulary or phonological awareness, those whose parents had low levels of education performed significantly worse at word segmentation than both groups of other children. The one exception being for vocabulary, where the difference with children whose parents had medium levels of education was not significant. By contrast, at high levels of the three initial measures, children whose parents had low parental education performed as well as, or better than the other two groups. A low level of parental education appeared to handicap childen with low levels of initial ability on these measures but not those with high levels of initial ability.

7. Discussion

The primary goal of the present study was to detect which child-related and/or contextual factors assessed in kindergarten better explain first graders' performance in spelling and separation between words and to determine how the two types of factors interact to account for this performance. We examined the contribution of selected literacy-related abilities whose influence on writing achievements has been demonstrated: phonological awareness (e.g., Defior & Tudela, 1994), knowledge of letters (e.g., Tolchinsky et al., 2011), and vocabulary (Dockrell & Messer, 2004). We also considered parental education as it has been shown to have an impact on literacy achievements (Myrberg & Rosén, 2009; Sénechal & LeFevre, 2002; Sonnenschein et al., 2010). We assumed as well that students' achievements would be affected by the linguistic environment in which students are raised as well as by the teaching practices they are exposed to.

One main finding of the current study was that only the linguistic environment, whether children are educated in a bilingual or monolingual community, had a main effect on first graders' performance. And this impact was found only for spelling but not for separation between words. A second finding was that, against predictions, we did not find a direct link between teaching practices in kindergarten and first graders' attainments in spelling or in conventional separation between words. Rather, teaching practices had a significant effect only in interaction with children's initial level of writing. A third main finding was that, as a rule, none of the examined literacy-related abilities explained first graders' achievements in isolation but rather in interaction with level of parental education. In what follows, we elaborate on each of these findings.

Being a bilingual student living in a multilingual environment directly affected performance in spelling: monolingual first graders produced better performance on isolated word spelling than bilingual ones. The detrimental effect of bilingualism on spelling achievements that we have found contrasts with previous research showing no difference between monolingual and bilinguals both in early writing development (Rubin & Galvan-Carlan, 2010) and in spelling of real words after second grade (Dixon et al., 2010; Marinova-Todd, & Hall, 2013; Wang & Geva, 2003). A possible explanation for this contrasting result may lie in the different school level at which spelling was assessed. In our study, spelling outcomes were measured at the end of first grade, when children's spellings in transparent orthographies are still very much dependent on the links between spoken pronunciation and written rendering of words (Llaurado & Tolchinsky, in press). In previous research, in contrast, measures were taken either at preschool and kindergarten (Rubin & Galvan-Carlan, 2010), when children are far more concerned with the formal features of writing, or after second grade (Marinova-Todd, & Hall, 2013; Wang and Geva, 2003), when children are becoming attuned with the morphological and lexical underpinning of spelling in opaque orthographies (Caravolas & Bruck, 1993; Landerl et al., 1997; Notarnicola et al., 2012). We suppose that the dissonances in pronunciation and in the written representation of similar words, which are typical of multilingual environments, may

hinder children spelling at a time when their spelling is guided by phonographic correspondences. Dissonances in pronunciation do not seem to disturb the process of learning conventional separation between words. First graders' achievement in separation between words was not affected by linguistic environment, probably because this ability is more closely related to lexical knowledge and to phonological generalizations than to differences in pronunciation.

The extent to which teachers were focused on the explicit teaching of the code or more inclined to work with texts and stimulate autonomous writing did not have a direct effect on their students' success in learning to spell or to conventionally separate words. However, the way teachers approached literacy teaching interacted significantly with their students' level of writing to predict achievements in spelling. For all three teaching profiles (instructional, multidimensional, and situational) a positive relation between early writing level and later spelling level was observed (figure 1a). That is, low writing ability in kindergarten led to later low spelling performance, and high writing ability in kindergarten led to later high spelling performance. However, this positive relation was more pronounced among children taught by situational teachers. This means that situational teaching practices were more effective than other teaching practices in empowering the relationship between kindergartners' writing and first graders' spelling. For children with a low level of initial writing ability, teaching practices did not make much of a difference, but for children with high level of initial writing ability, situational teachers maximized their achievements. Spelling requires specific teaching (Rieben, Ntamakiliro, Gonthier, & Fayol, 2005) and, most probably, differential approaches adapted to whether children have little or more advanced knowledge of writing. This finding suggests that for kindergartners displaying a low level of writing, no teaching profile was particularly effective; whereas for higher levels of writing, situational approaches were more effective. Children with higher levels of writing ability benefited more from working with a diversity of texts and autonomous writing activities than children with lower writing achievements.

A different picture emerged for the effect of teaching practices on learning to separate between words. None of the approaches taken by the teachers affected performance in separation between words. Learning to separate between words appeared as less likely to be influenced by teaching than learning to spell. This apparent contrast in the amenability to direct instruction in the early years may explain the difference in ICCs we found between spelling and separation between words. The ICC implies the percent-unexplained variance that may be explained by the level 2 elements, here: the variability between classrooms and the teacher profile. The ICC for spelling indicates that 40% of the unexplained variance has the potential to be explained by variation between classrooms, while only 6% of the unexplained variations in separation between words have the potential to be explained by classroom variation. Children in the same classroom (with the same teacher) had similar performance in spelling which differed from the performance of children in other classes (with teachers that varied in their instructional profile). This kind of disparity did

not appear in relation to separation between words, and it might be explained by the nature of spelling in shallow orthographies compared to the nature of conventions for word separation. In shallow orthographies, teaching of spelling can be based on explicit instruction of letter to sound correspondences and spelling rules because of their consistent graphophonemic pairing and the limited number of contextual rules they have. In contrast, teaching of the conventions of word separation cannot be based on correspondences between graphic and spoken words. At least in Latin systems, graphic words correspond with a wide range of units. In Spanish, a graphic word may represent a single morpheme (*fin* 'end'); clauses (*dámelo* 'give it to me"); complex lexical constituents including more than one morpheme (*agricultura* 'agriculture') and, a sort of "infra-morpheme" (Reichler Beguelin, 1992), which means as part of a formulae (like in Spanish *a fuer de sano)* but not in isolation. All these units are written with blanks on both sides. There is not a unique morphological correlate to graphic words beyond the writing system of a particular language.

Moreover, paying attention to speech does not support the identification of written word boundaries, as people do not speak in words. It is difficult to understand what exactly a speaker (and a teacher) means when they say that blanks separate between words. Words are easy to define in writing (one letter or a string of letters with blanks spaces on both sides) but not outside the written mode. Future research should be devoted to examining ways of approaching explicit teaching of this aspect of writing, which is crucial for text legibility, and continues to posit problems, at least in Spanish and Catalan, even in higher levels of schooling (Tolchinsky & Cintas, 2001).

None of the literacy-related abilities in isolation explained the differences in children's attainments either in spelling or in conventional separation between words. A similar pattern of interaction between children's abilities and parental education emerged for both components of writing: the higher children's attainments at literacy-related abilities were, the lower the explanatory power of parental education was (Figure 1 b-c and 2a-c). For spelling, this pattern was obtained for the interaction between level of writing and level of parental education (Figure 1b) and between knowledge of letters and parental education (Figure 1c). For word separation, it was obtained for the interaction between knowledge of writing and parents' education (Figure 2a), knowledge of vocabulary and parents' education (Figure 2b), and subsyllabic segmentation and parents' education (Figure 2c). In all these cases, the higher a child's achievements in school-related abilities were, the lower the dependency was on out-of-school variables such as parental education. Somehow the improvement in school-related knowledge decreased the explanatory power of out-of-school conditioning.

It should be noted that the only common predictor of spelling and word separation was level of writing in kindergarten. That is**,** only initial level of writing interacted with parental education to predict both spelling and word separation attainments. On the one hand, this is a rather obvious finding: the higher children's knowledge of writing is when starting kindergarten, the better their achievements at the end of first grade will

be. On the other hand, this finding highlights how helpful this early knowledge is for learning how to spell and to segment words conventionally. Early writing development paves the way to spelling and to separation between words. Except for writing, different abilities entered in interaction with parental education to explain first graders' achivements. For spelling, children's level of literacy and letter knowledge were found to interact with parental education whereas for word separation it was phonological awareness and vocabulary knowledge. Thus, in spite of being two notational components of writing, mastery of these two components is explained by different abilities.

In accordance with previous studies (Cardoso-Martins, 1995; De Jong & van der Leij, 1999; Levin & Ehri, 2009; Lonigan et al., 2000; Pennington & Lefly, 2001; Tolchinsky et al., 2011), letter knowledge made a contribution to spelling but lexical knowledge contributed to learning how to create boundaries between words (Correa & Dockrell, 2004). Certainly, attaining correct spelling in shallow orthographies requires learning to pair graphic and phonological units, but letter names and letter sounds provide a helpful support. Our study shows that children who could both name and sound out letters were in a better position to learn spelling than children who could not. Knowledge of letters provided reliable clues for the orthographic representation of word (Treiman & Kessler, 2003). In contrast, knowledge of letters was not involved in learning how to separate words in a sentence.

However, and in contrast to what has been found in English (Dockrell & Messer, 2004), knowledge of vocabulary did not emerge as relevant ability for predicting spelling achievements. A possible interpretation of this difference is that lexical knowledge plays a weaker role in learning how to spell in shallow orthographies as compared to the role it plays in English (Caravolas & Bruck, 1993; Landerl et al., 1997; Notarnicola et al., 2012).

Separation between words required phonological awareness and word identification, and lexical knowledge provided the means for it. This finding is in line with developmental findings on word segmentation in spoken language (Jusczyk et al., 1994) and recognition of novel word boundries in adults (McClelland & Elman, 1986; Norris & McQueen, 2008). It suggests that similar factors (generalizations over the phonological structure of language and lexical knowledge) facilitate identification of word boundaries in the spoken and the written modality. This possibility requires further investigation systematically comparing word segmentation in the two modalities of production, spoken and written.

Children's level of writing and their level of vocabulary appeared as relevant abilities for learning where to produce blank spaces for separating words in a sentence. This finding aligns with studies showing that children who write alphabetically, helped by the lexical representation of words, managed better to define word boundaries than children who are still struggling with the formal features of writing and who have a weaker vocabulary (Correa & Dockrell, 2004). The same study by Correa & Dockrell (2004) showed that unconventional segmentation was associated with spelling

mistakes. It seems reasonable that children who correctly spelled isolated words produced fewer mistakes in singling out words than children who were struggling with word spelling or still in pre-alphabetic phases of writing development. Nevertheless, the precise relationship between the ability to spell words and the ability to separate between words in a sentence or a text requires further research.

Our study demonstrates how complex it is to explain first graders' achievements even in restricted domains of knowledge such as spelling and the separation between words. As seen, attainments in the domain of writing could only be explained in the light of interactions between learner's, abilities and the educational level of their parents. Our findings pointed at one prevalent pattern of interaction: spelling and word separation outcomes were associated with the level of education of parents, but particularly for children with a low level of literacy-related abilities. There are two possible interpretations of this pattern of interaction. A pessimistic one posits that if the child did not succeed in learning to write (or the letter names, or to perform sub-syllabic segmentation) and his/her parents have low education he/she will probably attain lower achievements in both spelling and separation between words. There is also a more challenging interpretation of this interaction: if educators invest early in writing (and other related abilities) children might overcome the otherwise deterministic role of parents' education. Following the above, if educators invest in developing writing skills this may help to overcome the effect of low educated parents on later performance.

Our findings also emphasize the particularity of each component of writing. Beyond the generalized influence of early writing, children's performance in each component was explained by distinct abilities moderated by parental education and each component was differently open to contextual influences such as the linguistic environment in which children were schooled and the teaching practices. While multilingualism affected spelling performance it did not affect word separation. Moreover, while teaching practices affected learning how to spell they did not seem to influence learning to separate between words.

8. Limitations of the Study

The main limitation of the study is that it only accounted for 35% of the variance in the case of spelling and 45% of the variance for word separation. This finding implies that other factors beyond those examined in the study are contributing to the observed differences in performance. Future research should be devoted to examining the possible implication of processing factors such as working memory on spelling and/or other less complex measures of expressive vocabulary in both spelling and word separation. Moreover, future research should clarify better the role of teaching the conventions of word separation. The characterization of teaching profiles in the current study might not be sufficiently fine grained to account for such specific aspects of literacy teaching. We have also pointed at the need to compare word segmentation in the spoken and written modality systematically so as to corroborate whether the same

mechanisms are involved in the identification of word boundaries in the two modalities, a comparison that was not carried out in the current study. Finally, we think it is imperative to examine the development of spelling in multilingual environments beyond first grade so as to determine the generality of our finding about the negative effect of multilingualism. This negative effect might be limited to the initial stages of learning how to spell.

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APPENDIX A

Correlations among Child-Level Variables (N=215)

Variable	Literacy Level	Writing Kindergarten	Vocabulary Kindergarten	Sub-syllabic Segmentation Kindergarten	Letter Knowledge Kindergarten	Spelling First grade	Word Separation First grade
Parents' education	0.19**	0.19**	0.30***	0.22**	0.03	0.28***	0.35***
Literacy level	-	0.43***	0.31***	0.31***	0.29***	0.25***	0.32***
Writing Kindergarten		-	0.16*	0.22**	0.18**	0.31***	0.38***
Vocabulary Kindergarten			-	0.02	0.19**	0.45***	0.32***
Sub-syllabic segmentation Kindergarten				-	0.07	0.07	0.22**
Letter knowledge Kindergarten					-	0.13	0.07
Spelling First grade							0.46***

*** $p < .001$, ** $p < .01$, * $p < .05$; for categorical variables, Spearman's correlation was used