Running head: THE EFFECT OF LANGUAGE SPECIFIC FACTORS ON EARLY WRITTEN COMPOSITION

Abstract

Spelling skills have been identified as one of the major barriers to written text production in young English writers. By contrast oral language skills and text generation have been found to be less influential in the texts produced by beginning writers. To date, our understanding of the role of spelling skills in transparent orthographies is limited. The current study addressed this gap by examining the contribution of spelling, oral language and text generation skills in written text production in Italian beginner writers. Eighty-three children aged 7-8 years participated in the study. Spelling, lexical retrieval, receptive grammar, and written sentence generation and reformulation skills were assessed and children were asked to write a text on a set topic. A factor analysis revealed that the children's written text production was captured by three factors: productivity, complexity and accuracy. In contrast to results from children learning to write in opaque orthographies, such as English, this study demonstrated that from the initial stages of writing receptive grammar and written sentence generation skills accounted for significant variance in measures of productivity, accuracy and complexity in Italian children's written text production. Spelling skills contributed to text accuracy and quality and explained more variance than receptive grammar in microstructural accuracy. By contrast, oral grammatical skills explained more variance in text quality than spelling. The current study demonstrates the differential impact of language systems, such as Italian, on written text production. Implications for assessment and instruction are outlined.

Keywords: writing development, spelling, text generation, lexical retrieval, and grammatical skills.

The Effect of Language Specific Factors on Early Written Composition:

The Role of Spelling, Oral Language and Text Generation Skills in a Shallow Orthography

Developing writing skills is the focus of education agendas in both English and non-English speaking countries (COST Action IS0703, LWE, Torrance et al., 2012; NAEP, 2007). However, to date, most of our knowledge on writing development is based on the investigation of children who learn to write in English. The validity of current models of writing development, like the simple view of writing (Juel, 1988) and the not-so-simple view of writing (Berninger, 2000), must still be tested across languages (but see Babayigit & Stainthorp, 2010). As a result, the extent to which the developmental components of written text production identified in English are applicable across languages is uncertain. The present paper addresses this issue, by examining whether the factors that explain early written composition in English can be extended to Italian, a language with a more shallow and simpler spelling system than English, but a more complex morphology.

Language Specific Factors in Writing

Mature writing is described as a goal directed cognitive process consisting of three sub processes: *planning*, that is, goal setting, and idea generation and organization, *translating,* which consists in transforming ideas into written sentences, and *revising,* which involves editing and correcting processes (Hayes & Flower, 1986). These cognitive processes are assumed to be invariant across languages and orthographic systems. However, language specific factors may influence the development of early writing skills by impacting on the development of *translation.*

In beginning writers, writing proficiency consists of developing *translation* abilities, which comprise both *transcription* and *text generation* (Abbott & Berninger, 1993; Berninger, 2000; Berninger et al., 1992; Kim et al., 2011). *Transcription* involves spelling and handwriting, whereas

text generation is the process through which children encode their ideas into words, phrases and sentences, which are transcribed as written text. This process is dependent on oral language skills, such as lexical and grammatical knowledge (Abbott & Berninger, 1993).

Beginning writers in deep orthographies, such as English, are often challenged by spelling (Dockrell & Connelly, 2013). Thus, in English speaking children, transcription skills have been found to influence early written text production significantly more than oral language and text generation skills (Abbott, Berninger, & Fayol, 2010; Berninger et al., 1992; Berninger, Nagy, & Beers, 2011; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Juel, 1988). Oral language and text generation skills are also necessary for the development of early writing skills (Berninger & Swanson, 1994; Kim, Al Oltaiba, Folsom, Greulich, & Puranik, 2014; Kim, Al Otaiba, Wanzek, & Gatlin, 2015). However, in comparison to spelling, they typically account for a smaller proportion of variance in the children's early written products (see for example Berninger et al., 1992; Berninger et al., 2011; Juel, 1988; Kim et al., 2011).

The most parsimonious explanation of these results is that in young children the impact of text generation skills on writing is constrained by the children's limited spelling skills, which thereby reduce the effect of oral language on the written product. Juel (1988) followed young writers from grade 1 to grade 4 and found that spelling skills controlled the act of writing in beginning writers and accounted for 29% of the quality of their writing products. By grade four this had decreased to 10%, when arguably spelling had become more fluent. With few exceptions (see Kim, Al Oltaiba, Folsom, Greulich, & Puranik, 2014), more recent developmental writing research supports the original findings of Juel (Abbott, Berninger & Fayol, 2010; Berninger, Nagy, & Beers, 2011; Kim et al., 2011). Berninger, Nagy and Beers (2011), found that although beginning writers (first, second and third graders) possessed syntactic knowledge of what constituted a complete sentence, it was not until grade four that this knowledge contributed uniquely to their ability to translate ideas into sentences. By contrast, spelling skills influenced writing performance much

earlier. Spelling abilities also affect children's writing productivity (Graham et al., 1997; Kim et al., 2011), writing fluency (Kent, Wanzek, Petscher, Al Oltaiba, & Kim, 2014) and writing quality (Kent et al., 2014; Kim, Al Oltaiba & Wanzek, 2015; Kim, Al Otaiba, Wanzek, & Gatlin, 2015). Finally, intervention studies demonstrate that spelling instruction has significant effects on the writing performance of English speaking children (Berninger et al., 1998). By contrast, instructional practices based on oral language skills (such as grammatical skills) have not been found to significantly enhance written composition (Graham, McKeown, Kiuhara, & Harris, 2012).

Developmental models of writing, like the simple view of writing (Juel, 1988) and its revision, Berninger's not-so simple view of writing, which extends the earlier model to include executive functions and working memory (Berninger, 2000; Berninger et al., 2002), are underpinned by these studies, and highlight the role of transcription skills as a key factor in the development of early written text production (see also Dockrell, Marshall & Wyse, in press). However, children who learn to write in languages other than English may encounter different difficulties in producing written texts. For example, languages such as Italian, Greek, and Turkish have more shallow orthographies than English, but a more complex inflectional morphology (Arfé, Dockrell, Berninger, 2014; Babayigit & Stainthorp, 2010; Nikolopoulos, Goulandris, Hulme, & Snowling, 2006). The regularity of the orthography may reduce the demands placed on text production by spelling, while the complexity of the grammar or morphology may increase the demands on text generation (Arfé et al., 2014; Berman, 2014; Reilly et al., 2014). Reilly et al. (2014) demonstrated that the structural complexity of a language affects the writing performance of its young writers and indicated where variation was most likely to occur in the children's written products. The authors found that French children made significantly more morphological errors in their texts than English children, due to the greater complexity of the French inflectional morphology. Moreover, they produced texts which contained less complex syntax in comparison to their English speaking peers. Hence, morphological accuracy was more important in French

speaking children's written production, whereas syntactic complexity captured more variance in English speaking children's written products.

In addition to Reilly et al.'s work (2014), research on bilingual writing has demonstrated that spelling and grammatical skills are language specific factors, which do not transfer directly from one language to another: i.e. from L1 (first language) writing to L2 (second language) writing (Authors, accepted). Moreover, in L1 and L2 spelling and grammar appear to constrain writing performance according to the characteristics of the language system in which writers are producing the text (Authors, accepted). In sum the data indicate that there may be features of the children's language that affect written text production (Arfè, Dockrell, & Berninger, 2014; Babayigit & Stainthorp, 2010, 2011; Maki, Voeten, Vauras, & Poskiparta, 2001). If differences are found to exist this should inform current models of writing development.

Traditionally, writing researchers have adopted two main approaches to studying writing development. The first examines the structure of children's written products with the aim of identifying the different textual factors or dimensions that underlie the variance in children's writing (Puranik, Lombardino, & Altmann, 2008; Wagner et al., 2011). This approach is based on the idea that written production is a multidimensional phenomenon and that the development of writing abilities cannot be fully captured when only one dimension, such as text quality is examined (Kim, Al Otaiba, Wanzek, & Gatlin, 2015; Puranik et al., 2008). Textual dimensions may include productivity, accuracy and complexity and are argued to reflect the lexical, grammatical and discourse level features of the texts produced (Puranik et al., 2008; Wagner et al., 2011). When the focus is on early written text production such analyses tend to focus on the microstructure of children's texts, that is, organization at word and sentence level. Since the initial phase of learning to write consists mainly of learning to produce written words and sentences, an analysis of the structure of writing in beginning writers must capture these microstructural aspects of the organization of the text (Abbott & Berninger, 1993; Puranik et al., 2008).

The second approach aims to identify the individual's skills that underpin text production (Berninger et al., 1992; Mackie, Dockrell, & Lindsay, 2013). For early text production, these include spelling, handwriting and text generation skills (Babayigit & Stainthorp, 2010, 2011; Berninger et al., 1992; Juel, 1988; Kim et al., 2011; Mackie et al., 2013). Writing researchers have investigated their influence on both global text quality and fluency (e.g. Berninger et al., 1992; Juel, 1988; Kim et al., 2011; Limpo & Alves, 2013). However, in early text production, their contribution to the text microstructure, at word and sentence level, is also important (Mackie et al., 2013). The current study uses both approaches to provide an analysis of the textual and individual factors underlying early text production in Italian and the ways in which these factors are related to each other.

The Structure of Early Written Composition

To identify the structural dimensions underlying variance in children's texts, both text analyses and factor analytic methods have been used (Puranik et al., 2008; Wagner et al., 2011). Puranik et al. (2008) examined the text generation skills of 120 English speaking children aged between eight and 11, by assessing the microstructure of their texts. Measures at word level included the number of words produced and the percentage of misspelled words in the texts. Measures at sentence level included the number of clauses and T-units, that is thematic units corresponding to a main clause plus all the subordinate clauses embedded in it (Hunt, 1965). In addition the mean length of T-units in words, clause density, or the number of clauses per T-unit, and the percentage of grammatically accurate T-units were calculated. Children's use of writing conventions, such as punctuation and capitalization were also evaluated. A factor analysis conducted on these data identified three independent factors in children's writing: *productivity*, *complexity*, and *accuracy*. *Productivity*, captured by number of words, ideas, T-units and clauses in the text, accounted for the majority of the variance in children's written products (42%). *Complexity*, captured by mean length of T-units and clause density, explained a further 21% of variance in the texts microstructure. Finally,

accuracy, captured by the proportion of spelling errors, writing conventions and grammatical T-units in the text, accounted for an additional 16% of the variance.

Subsequent studies in English have tested and confirmed these three structural dimensions of written composition identified by Puranik et al. (Mackie et al., 2013; Wagner et al., 2011). Hence, measures of text productivity, complexity, and accuracy appear to capture the developing writing skills of young English speaking children. Yet, as we have argued, the structural dimensions accounting for variance in early written composition in different language systems may vary (Reilly et al., 2014).

To our knowledge, no studies have yet employed micro-analytic methods of textual analysis to explore the structure of text production in languages with shallow orthographies. Verifying whether the same structural dimensions characterize developmental writing across writing and language systems (e.g. English and Italian) can contribute to establish whether current developmental writing models generalize across orthographies.

Individual Skills Underpinning Early Written Text Production

The second approach to the study of writing development focuses on the individual skills that underpin text production. Early writing builds on the development of oral language and transcription skills (Berninger et al., 1992; Kim et al., 2011). The most recent revision of the simple view of writing, the not so simple view of writing, describes writing development as the product of the development of transcription, text generation skills, and executive functions (Berninger 2000; Berninger et al., 2002). Hence, oral language skills are not an explicit component of the model. However, it is assumed that oral language supports text generation, as writers use their oral vocabulary and grammatical knowledge to generate words and sentences for their written texts (Abbott & Berninger, 1993; Babayigit & Stainthorp, 2010). According to the not-so-simple view of writing (Berninger 2000), transcription processes (spelling and handwriting) require considerable cognitive effort for the young writers. This limits the working memory and attentional resources

available for the linguistic generation of the text, and thereby reduces the potential impact of oral language on early written composition.

This view is supported by research conducted in English-speaking countries and with English-speaking children (see for example Berninger et al., 1992; Berninger et al., 2011; Graham et al., 1997). However, to date, only a limited number of studies have explored whether the model is appropriate for other orthographies and languages (Babayigit & Stainthorp, 2011; Limpo & Alves, 2013; Maki et al., 2001). The significant role played by transcription in learning to write in Portuguese, a language with a shallower orthography than English, offers cross-linguistic support for the model (Limpo & Alves, 2013). However, data from children learning to write in Turkish, a shallow orthography, produces different patterns of relationships. Babayigit and Stainthorp (2010) found that oral language skills, oral vocabulary, had a greater effect on early written composition quality than did handwriting and spelling. Evidence of the model's ability to predict writing development in other languages is, therefore, inconsistent. Moreover, recent research with English speaking beginning writers suggests that the role of oral language skills in early written composition might have been underestimated by current developmental models of writing (e. g. Kim, Al Oltaiba, Folsom, Greulich, & Puranik, 2014; Kim, Al Oltaiba & Wanzek, 2015). Shallow orthographies offer the possibility of examining the role of oral language and text generation skills on written text production when spelling is less challenging (see Arfé & Pizzocaro, 2015).

There is a general consensus on how to assess spelling and handwriting skills and standardized tasks exist to measure these skills both in English and other languages (e.g. Abbott & Berninger, 1993; Kim et al., 2011; Wagner et al., 2011). By contrast, specific measures to assess text generation skills are lacking. Some studies have used oral language measures to capture children's text generation skills (Abbott & Berninger, 1993; Babayigit & Stainthorp, 2010, 2011). Three oral language measures have been found to contribute to written text production in English speaking children: lexical retrieval, the ability to generate sentences from lists of words

(McCutchen, Covill Hoyne, & Mildes, 1994), and receptive grammar skills (Mackie et al., 2013; Olinghouse, 2008).

However, oral language skills and text generation skills do not overlap perfectly (see Arfé & Pizzocaro, 2015). Since text generation is a writing process, measures that tap the cognitive demands of generating words and sentences while writing are also important. To address this, some authors have chosen to assess text generation skills by written text generation tasks (Berninger et al., 2011; Puranik et al., 2008). In assessing text generation skills by written measures, researchers have considered the ease with which children transformed their ideas in text, independently of their use of writing conventions, spelling or handwriting skills (Berninger et al., 2011; Limpo & Alves, 2013). For example, text generation has been assessed by asking children to write one complete written sentence about a topic (Berninger et al., 2011).

The Italian language provides an ideal medium to extend existing research and inform developmental models. As a transparent orthography it removes many of the challenges to spelling experienced by children learning an opaque orthography, like English. By contrast, Italian has a complex grammar and bound morphology, placing greater demands than English on the text generation process. Nouns and articles are grammatically inflected for both gender (masculine and feminine) and number (singular and plural), and verb inflections convey information not only about the tense and mode, but also about the subject of the verb, which is often omitted. Therefore, the generation of well-structured clauses may be particularly demanding for young Italian writers. We aimed to extend the limited research on shallow orthographies, by exploring the impact of these language-specific factors on the early written composition of monolingual Italian children.

The present study

The study had two main goals. The first was to examine whether the structure of written composition in young children who learn to write in Italian was consistent with that identified in young writers of English. The second was to explore the factors that underpinned translation skills

in these young writers. Following previous studies (Mackie et al., 2013; Puranik et al., 2008), the microstructure of children's written compositions was analyzed and the microstructural measures derived were used to perform an exploratory factor analysis and identify the main dimensions of variance in the writing products.

The independent contribution of spelling, oral language and text generation skills to the microstructure of children's texts was then examined. In addition, we also explored how these individual skills could contribute to the overall quality of children's written products. Spelling was assessed by a written spelling task. Oral language was assessed by lexical retrieval and receptive grammar measures, and text generation by written sentence generation and written sentence re-formulation tasks (Berninger et al., 2011; McCutchen, Covill, Hoyne, & Mildes, 1994). The unique contribution of oral language and written text generation measures to Italian children's early written composition was considered with that of spelling.

We predicted that in young Italian writers oral language and written text generation skills would account for significant variance in early written composition, and, in contrast to English, their contribution would be greater than that of spelling ability. Given the characteristics of the Italian language system we also predicted that lexical retrieval skills would be less influential than grammatical skills.

Participants

Participants were selected from an initial sample of 102 children. Selection criteria included being native speakers of Italian, not having been identified for cognitive or sensory disabilities, and not presenting motor disorders which could significantly hinder the execution of the writing task. Eleven children of the initial sample did not meet one or more of these criteria. Eight children, who originally consented to take part in the study, did not complete the experimental tasks or the writing task. The final sample included thus 83 second and third graders, aged 6 to 8 years (M_{age} = 7.6), and balanced for gender **(**23 girls and 23 boys in grade two, and 19 girls and 18 boys in grade three).

Children who had received a diagnosis of reading and/or writing problems or who had been identified by teachers for reading and writing difficulties were included and corresponded to approximately four per cent of the sample, reflecting the incidence of reading and writing disorders in the Italian school population (Barbiero et al., 2012; Lorusso et al., 2014). Children were attending two mainstream primary schools in an area of middle socio-economic status, in the province of Milan (northern Italy). In the Italian school system children are typically taught sound-to-phoneme mappings only from grade one. Hence, at the beginning of the study (in September) the participants had received from one (second graders) to two years (third graders) of formal instruction in reading and writing.

Procedure

At the beginning of the school year, standardized tests were administered to each child individually to assess lexical retrieval and receptive grammar skills. Children also performed a standardized spelling task and two experimental sentence generation tasks. In March they performed a writing task to assess their written composition. The task to assess written composition is presented first, followed by the spelling, oral language and text generation tasks, employed to assess the components of early writing.

Written composition, microstructural analysis of texts

To maximize written text production, children were asked to write a personal narrative about a familiar topic (see also Berninger et al., 1992): “The best day I had at school was__”. Instructions were to produce narratives in response to the title. Children were allowed to write till they finished the text. All children completed the text within 20 minutes.

An analysis of the micro-structural elements of the texts, at word and sentence level, was performed by the first author, selecting measures from previous studies on English (Mackie et al., 2013; Puranik et al., 2008).

Word level. The *total number of words (TNW),* proportion of *spelling errors* and *lexical errors* were scored. The total number of words is a measure of productivity at word level. Proportion of spelling errors and lexical choice errors are measures of accuracy at word level. Lexical choice errors included inappropriate use of words (e.g. *vasca* for *vaso*; *tub* for *pot;*or *il pesce si stava appiccicando* for *il pesce stava abboccando; the fish was sticking* for *the fish was biting*), omissions or periphrasis (e.g. *C'era una parte da dove entravi* for *un'entrata; There was a part where you entered* for *an entrance*). Misspellings were not considered in the computation of lexical choice errors, but were counted separately.

Sentence level. The *total number of T- units (T-UNITS)* and the *total number of clauses (CLAUSES)* produced, correct and incorrect, were considered measures of productivity at sentence level. T-units or terminable units (Hunt, 1965) are syntactic units of meaning, corresponding to a main clause with all subordinate clauses embedded in it. Clauses that begin with coordinating conjunctions (e.g. e/*and*, *ma*/*but*) begin a new T-unit. *Mean length of T-units (MLT-UNIT)* and *clause density (C-DENSITY)* were measures of syntactic complexity. *Mean length of T-units (MLT-UNIT)* is the total number of words divided by the number of T-units in the text. Clause density corresponds to the ratio of the total number of clauses and T-units in the text. Proportion of *errors in clause construction* was the measure of accuracy at sentence level, as the generation of well-structured clauses may be particularly demanding for young Italian writers. Clauses consisting of at least a predicate and its argument were considered incorrect when the grammatical relations within them (e.g. number and gender agreement) were incorrect. Errors in punctuation, capitalization and misspellings were not considered in computing clause correctness (see Mackie et al., 2013). Since clause correctness in a text also depends on its syntactic relation with previous clauses in the text, we considered this aspect in our scoring.

A trained master student, blind to the hypotheses of the study, rescored 25% of the texts scored by the first author at microstructural level to compute reliability. Percentage of agreement

between raters ranged from 96% for total words to 81% for lexical errors. Disagreements were solved following discussion.

Written composition, macrostructural analysis of texts

Text quality scores. Text quality was assessed on a five point scale, from 0 (very poor) to 4 (very high). The score was holistic and reflected the overall perceived quality of the text, considering its overall linguistic quality, organization and coherence. A score of 0 corresponded to a text with no introduction and/or conclusion, and incoherences and linguistic errors which made the text difficult to read. A score of four, corresponded to a well organized text, with an appropriate introduction and conclusion, smooth connections between sentences, and where ideas were expressed by an accurate and rich language.

Quality scores were attributed considering children's grade level. For each grade level, four anchor texts, one per each rank (from 0 to 4), were selected and used for scoring the other texts. The first author and a research assistant, blind to the hypothesis of the study, independently ranked all the texts (100%). Percentage of agreement between raters was 90%.

Individual skills underpinning text production.

Spelling, oral language and written text generation measures were obtained for each participant.

***Spelling*.** To reflect the demands of spelling in text generation, spelling skills were examined in text dictation task (see also Arfé et al., 2012). Age-appropriate standardized text dictation tasks were selected from the Battery for the Assessment of Writing and Orthographic Competence (Tressoldi & Cornoldi, 1991) and administered to participants. Test re-test reliability values reported by the authors for this sub-test ranged from .78 for phonological errors to .59 for non-phonological errors. Validity values for this subtest were not provided. However, we could compute correlations between children's performance at this task and their performance at the word spelling subtest of the Battery for the Assessment of Developmental Dyslexia and Dysorthographia, BBDE (Sartori, Job, & Tressoldi, 2007), obtained by a parallel study (Authors, 2012): r (83) = .82.

Oral language measures. Standardized tasks were used to assess lexical retrieval and receptive grammar.

Lexical retrieval. Lexical retrieval skills were assessed by a standardized Picture Naming task (BVN battery, Bisiacchi, Cendron, Gugliotta, Tressoldi, & Vio, 2005). Children had to name pictures representing a list of objects or animals. The final score was the number of the pictures correctly named. Validity values are available and show good correlations with other naming tests (r = .75) (Brizzolara, 1989). Test retest reliability for this test was not provided by the manual. However, the present study was part of a writing intervention study. Thus, we could re-assess lexical retrieval skills at 2 months interval from the time of this first assessment. For calculating reliability for lexical retrieval and the other measures of the study we considered only data from children who did not take part in the instructional intervention (control group, n=41). Test-retest reliability for this sample of students in lexical retrieval was moderate .64. This is consistent with the time interval between the two evaluations. Language scores in children can be indeed less stable when more than two weeks-one month intervals are considered (McCauley, 2001).

Receptive grammar. Receptive grammar was assessed through sentence comprehension tasks. Two different receptive grammar tests were administered to 2nd and 3rd graders to assess their understanding of grammatical structures: the Test for the Assessment of Linguistic Comprehension (Rustioni et al., 1994) and the Test for reception of grammar (TROG), Italian short version (Bisiacchi et al., 2005). The test for the Assessment of Linguistic Comprehension (Rustioni et al., 1994) was used with 6-7 year-olds children. This test is widely used for the evaluation of language skills in Italian children (Dall'Oglio et al., 2010; Vicari et al., 2007) and assesses the comprehension of target Italian grammatical structures for age levels from 3 to 7 years. The protocol corresponding to age levels 6-7 (6 to 7 years) was used in this study. Although validity values are not reported in the manual, scores show the expected trend in the development of the specific grammatical structures tested. Test retest reliability assessed in this study was .60. The TROG, Italian short

version (Bisiacchi et al., 2005) was administered to participants who were eight years old. The test, designed for English-speaking children (Bishop, 1982), has been translated and adapted to Italian. Validity is available for correlations with children's verbal IQ, which is good (r = .66). Test retest reliability at two months interval was .58.

In language assessment, it is always preferable to use tests originally designed to assess in the examinee's first language. However, an Italian tool equivalent to Rustioni's test for an older population was not available and the short TROG version was chosen given the similarity with the Rustioni's test. The two tests assess the same construct (sentence comprehension) and have the same structure. Both tests include assessment of the following grammatical structures: relative sentences, pronouns, prepositions, adversative and negative sentences and require children to choose among four pictures the one that best portrays the sentence pronounced by the examiner. Both tests can be administered in ten minutes. To create a single measure of receptive grammar, the scores children obtained in the two tests were transformed in z scores. Each child received a z score relative to the test given, based on the means of his age group.

Text generation measures. Text generation is related to oral language, though different from oral language skills, because it presents the unique demand of retrieving lexical and grammatical knowledge, while producing written text (e.g. Abbott & Berninger, 1993; Berninger et al., 2011; Juel, 1988). To simulate the demands of text generation in writing we adopted two written sentence generation tasks (for a similar procedure see Berninger et al., 2011). Two experimental tasks designed and evaluated in a prior study (Arfé & Pizzocaro, 2015) were used to assess children's text generation skills: a written sentence generation and a written sentence reformulation task. Recent data show that both oral and written sentence generation can explain developmental changes in written composition in Italian, but written sentence generation is more directly associated with an increase in written composition proficiency (Arfé & Pizzocaro, 2015). This association seems not simply explained by children's spelling skills: In this study the

association between spelling skills and written sentence generation and reformulation tasks was modest, and respectively, r=-.26 and r=-.38. Spelling skills were measured by number of spelling errors in the test, so the correlations between spelling and written sentence generation were negative.

*Sentence generation***.** This first task was adapted from Robinson, Blair and Cipollotti's (1998) and was devised to tap children's fluency in generating ideas in written sentences. Children received a sheet of lined paper with two word pairs (*acqua-ponte*/ *water-bridge* and *bambino-macchina*/*child-automobile*) and were asked to generate as many different sentences as they could from the two words in five minutes (see Arfé & Pizzocaro, 2015). Children were instructed to always use both words in the sentences produced. Minor variations like "*The child drives the automobile*" and "*The child drives the blue automobile*" were not accepted as different sentences. Before testing, the researcher demonstrated how to perform the task and participants were invited to practice with a word pair. A score of 1 was given to each sentence that was both grammatically and semantically correct. Since the sentence generation task intended to measure text generation skills only, in scoring sentence accuracy we did not consider errors in punctuation, capitalization or misspellings. Test retest reliability at two months interval was .62.

Sentence reformulation. The second task was designed to assess the child's ability to find different words and/or grammatical structures to express a given idea. This task could be considered a higher language level task, as it involves the (metalinguistic) ability to reformulate and compare syntactic structures. Children received a sheet of lined paper with 2 simple (one clause) and 2 complex sentences (a main clause and a subordinate clause) and were asked to find alternative ways to express the meaning of the sentence. Children were instructed to try to re-formulate each sentence in three different ways, by using different words (i.e. synonyms or paraphrases) and/or transforming the grammatical structure of the sentence (e.g. from passive to active). Simple sentences were presented first, followed by complex sentences. A time limit of 10 minutes was given for each trial.

Two training items were presented before the re-formulation tasks - one for the simple and one for complex sentences. The procedure for both tasks (sentence generation and sentence reformulation) was tested in a pilot study and time limits were established accordingly. A score of two was assigned to re-formulations that were grammatically correct and also maintained the meaning of the target sentence, a score of one was given to reformulations which were grammatically correct, but did not maintain the original meaning of the item (e.g. "*Sara wants to play cards with Lucia*" for "*Sara plays cards with Lucia"*), and zero to reformulations which were incorrect both grammatically and semantically or to sentences which were totally unrelated to the target (e.g. "*Mum makes a cake"* for "*Mum waters flowers*"). In scoring the accuracy of the re-formulations we did not consider errors in punctuation, capitalization or misspellings. Test retest reliability at two months interval was .72.

A research assistant and the first author independently scored both tasks. Inter rater agreement was calculated on 100% of the items. Percentage of agreement between raters was 94% for sentence generation and 93% for sentence reformulation.

Results

The results are presented in two sections. In the first section, we report results of a factor analysis examining the structural dimensions of Italian written composition for beginning writers. In the second section, hierarchical multiple regressions are presented which investigated the individual skills underpinning the microstructural dimensions identified through the factor analysis and those underpinning overall text quality. Raw scores (*M*, *SD*), scores range, skewness and kurtosis of the score distribution for all writing measures are presented in Table 1. Three measures of the written products (total numer of words, lexical errors, and total number of t-units) had a minimal leptokurtic distribution (Kurtosis > 4 in SPSS statistics, corresponding to the critical absolute Kurtosis value > 7 proposed by West, Finch & Curran, 1995).

. However, this might reflect the nature of the measures (productivity and lexical choice errors can be less variable than the other writing measures at these ages).

Textual Factors of Early Written Composition in Italian

The first aim of the study was to identify the textual factors underpinning the early written composition of beginning Italian writers. To address this research question associations between the writing measures at sentence and word level were examined, followed by an exploratory factor analysis.

Association between microstructural writing measures. Table 2 presents the correlations between the analytic writing measures for the sample (N = 83). Bonferroni corrections were applied, adjusting levels of significance to .006. Spelling errors showed a moderate correlation with lexical errors, but a non significant correlation with clause production errors. By contrast, the correlation between lexical errors and errors in clause construction was statistically significant. Associations between total T-units, total clauses and total words were all statistically significantly. The total number of clauses was also statistically significantly associated with clause density, indicating that a greater number of clauses was associated with a greater number of clauses packaged in T-units. Finally, clause density was significantly associated with mean length of T-units. Correlations controlling for grade level produced the same results.

Exploratory factor analysis. To determine the main components underlying the children's written composition, an Exploratory Factor Analysis (EFA) with a principal component analysis factor extraction method and Oblimin rotation with Kaiser normalization was run (see Puranik et al., 2008). To avoid redundancy in data, total number of clauses was excluded from the analysis, given the strength of its correlation with the total number of words and T-units in the texts. The EFA identified three factors with eigenvalues > 1, which accounted for 79% of the variance in the microstructure of the children's texts. The three factor solution is displayed in Table 3. The correlations between factors ranged from -.01 to -.21.

Factor loadings are reported in Table 4.Total number of words and T-units loaded on Factor 1, which we interpreted as a *Productivity* factor. The factor accounted for 34% of variance in the children's texts. Mean length of T-units and clause density loaded on Factor 2, which we considered a *Complexity* factor. This factor accounted for an additional 26% of variance in children's texts. Spelling errors, lexical errors and errors in clause construction resulted in loadings on Factor 3, an *Accuracy* factor, which accounted for 19% of variance in the texts microstructure. Factor loadings were lower for spelling than for lexical and clause construction errors.

Contribution of Spelling, Oral Language and Text Generation to the Text Microstructure

The second aim of the study was to examine which individual skills underpinned the microstructure and overall text quality of early written composition in Italian. Thus, the contribution of spelling, oral language and text generation skills to *text quality* and *productivity*, *complexity* and *accuracy* was investigated.

Table 5 shows the correlations between the children's measures of spelling, oral language and text generation skills, the three components of variance identified at microstructural level in children's texts -*productivity, complexity* and *accuracy*- and text quality. Bonferroni corrections were applied, adjusting levels of significance to .005. Grade level and written sentence generation skills were associated to *productivity.* Written sentence re-formulation skills were associated with *complexity* ($p <. 05$), although this association was not significant after Bonferroni corrections were applied. Spelling skills, receptive grammar and written sentence generation and re-formulation skills were all associated with *accuracy.* Spelling skills and receptive grammar were associated with *text quality.*

Multiple regressions. Three separate multiple regressions examined the independent contribution of spelling, oral language and text generation skills to writing *productivity, complexity* and *accuracy.* A summary of the hierarchical regressions is reported in Table 6.

Productivity. Children's grade level and written sentence generation skills were the only variables that accounted for variance in writing *productivity*

Complexity. Writing *complexity* was only explained by text generation skills, that is, written sentence re-formulation (β=.45). The full model was only marginally significant.

Accuracy. Spelling skills, receptive grammar and sentence generation skills contributed to explain writing *accuracy*. The spelling beta weight (.38) was higher than the oral grammar and sentence generation beta weight, which were respectively -.20, and -.21.

It must be remembered that *accuracy* reflected the proportion of errors in the text, thus it correlated negatively with receptive grammar and written sentence generation skills (see Table 6). To estimate whether the difference between the contribution of spelling and oral grammatical skills was significant, we considered the overlap between the 95% bootstrapped confidence intervals (CIs) of the two standardized beta weights (see Cumming & Finch, 2005). Bootstrapped CIs were calculated on 1.000 resamples. If the two CIs do not overlap or the overlap is less than 50%, the two beta weights can be considered significantly different from each other. The receptive grammar 95% CIs (negative values) were transformed in absolute scores [0.20+/- (*SE**1.96)], so that .21 corresponded to the upper CIs limit and .20 to the lower limit. As shown in Figure 1, the upper bound bootstrapped 95% CI of the receptive grammar beta weight (.21) is lower than the lower bound bootstrapped 95% CI of the spelling beta weight (.37). Since the overlap between the beta weights is less than zero (and the proportion gap is greater than -0.5, i.e. -0.8), the difference between the two beta weights is significant ($p<.001$, see Cumming, 2009). In synthesis, spelling skills explained significantly more variance in microstructural accuracy than receptive grammar skills. The same procedure was applied to test the difference between the spelling and written sentence generation beta weights. Also in this case, the contribution of spelling was significantly greater than the contribution of written sentence generation ($p<.001$).

Contribution of Spelling, Oral Language and Text Generation Skills to the Text Quality

Finally the contribution of spelling, oral language and text generation skills to the global quality of the texts was examined. Text quality was explained by receptive grammar, spelling skills and sentence generation skills (Table 6). The beta weight of receptive grammar (.38) was greater than that of spelling (errors) (-.30) and sentence generation skills (.24). Like for Accuracy, the corresponding 95% confidence intervals of the receptive grammar and spelling standardized beta weights were estimated via bootstrapping procedures (with 1,000 resamples) (Cumming & Finch, 2005). The bootstrapped spelling 95% CIs (negative values) were transformed into absolute scores [0.30 +/-(*SE**1.96)], so that .31 corresponded to the upper CIs limit and .29 to the lower limit. In this case, the upper bound bootstrapped 95% CI of the spelling beta weight (.31) was lower than the lower bound 95% CI of the receptive grammar beta weight (.38) (see Figure 2). Since the two CIs do not overlap (proportion of gap is greater than 0, i.e. -0. 3) the difference between the two beta weights is significant ($p < .01$, see Cumming, 2009). Hence, oral grammatical skills explained significantly more variance in text quality than spelling skills.

In summary, *productivity* was explained by grade level and written sentence generation skills. *Complexity* was explained by text generation skills, that is, written sentence reformulation. Spelling, oral language and text generation measures accounted for variance in *accuracy*. However, spelling accounted for significantly greater variance than oral grammatical and written sentence generation skills. Finally, oral grammatical skills, spelling skills and written sentence generation skills significantly contributed to overall text quality. In this case, the contribution of oral grammar accounted for significantly more variance than spelling. Thus both spelling and oral and written grammatical skills were important factors in the written composition of these beginning Italian writers.

Discussion

The present study explored whether our current knowledge of the factors that explain early written text production in English can be extended to Italian. To address this question the textual factors and individual skills which have been found to explain variance in early text production in English were used to assess the written text production of Italian beginning writers. The early writing of 83 monolingual Italian children was examined using micro analytic measures of written texts and global quality scores of the texts.

The Structure of Early Writing in Italian

Three dimensions have captured the microstructure of the texts of both younger and older children writing in English: *productivity*, *complexity* and *accuracy* (Puranik et al., 2008; Wagner et al., 2011). Measures were used to tap these dimensions in the young Italian writers, and to explore the structure of their written composition. The results were consistent with those of prior research in English. The three components explained approximately the same amount of variance in Italian as in English. As in Puranik et al.'s study (2008), the majority of variance in the Italian writing was explained by *productivity*, followed by *complexity* and *accuracy*. These results suggest that the microstructural characteristics of early written composition identified in English generalize to Italian, supporting this analytic approach to text products. However, the impact of specific features of Italian were more evident when the cognitive underpinnings of the written text were examined.

Skills Underpinning Early Written Composition in Italian

The Italian language depends heavily on the grammatically accurate use of words and the impact of this factor was evident in the children's writing. As predicted, oral and written grammatical skills accounted for variance in early written composition in Italian, contributing to the *productivity*, *complexity* and *accuracy* of the children's written products and to their *overall quality*. By contrast, spelling skills independently contributed only to *accuracy* and *quality*. The comparison between the contribution of spelling and grammatical skills partially confirmed our initial

hypothesis that, in Italian, grammatical skills would contribute more than spelling to early writing. Grammatical skills were indeed more significant than spelling skills at text (macrostructural) level. Yet, they contributed less than spelling to the microstructural accuracy of the text. Lexical retrieval skills did not contribute to variance in writing in the current study. It is likely that word level skills assessed in lexical retrieval tasks do not capture the word level skills that influence most writing in Italian.

The results of this study further suggest that, in comparison to English (Berninger et al. 2011), in Italian oral and written grammatical abilities have a greater impact on early text production. However, their contribution to the microstructural accuracy of the text (clause accuracy) was significantly less than that of spelling. Contrary to results from other shallow orthographies, such as Turkish (Babayigit & Stainthorp, 2010), in Italian spelling skills were also important. They contributed significantly to the text microstructure (accuracy) and also to text quality. This result is consistent with work in Portuguese (Limpo & Alves, 2013), and with the simple view and not-so-simple view of writing (Berninger, 2000; Juel, 1988). Differences between our study and Babyigit and Stainthorp's may reflect features of the orthography. The Turkish orthography represents the most extreme of the continuum between shallow and deep orthographies (Raman, 2003). Although shallow, the Italian orthographic system is less transparent than the Turkish and thus Italian spelling rules may challenge the novice writers to a greater extent.

Currently it is not clear whether the divergence between our results and those of Babayigit and Stainthorp's (2010) study are more parsimoniously explained by measurement differences. There were differences in how variation in writing was measured, the indices of text structure and the kind of measures used to assess grammatical and spelling skills. We used analytic measures of text structure, whereas Babayigit and Stainthorp used a quality scale. While Babayigit and Stainthorp (2010) used a single word spelling in their regression models, the current study used a text dictation task. It may be that spelling words in the linguistic context of a text capture the

spelling skills involved in written text production more than spelling single words (see Arfé et al., 2012, Broc et al., 2013).

Our results are consistent with current developmental models of writing (Berninger, 2000; Berninger et al., 2002), and therefore indicate that these models are applicable to the development of early writing skills in language systems with shallow orthographies. Yet, they also suggest that language specific factors moderate the influence of transcription and text generation skills in writing and should be explicitly incorporated within the models. The results of this study also show that the impact of spelling and text generation skills can be different when the microstructural and macrostructural characteristics of the texts are considered. At this age, spelling skills constrained writing accuracy at microstructural level more than receptive grammar and text generation skills. By contrast, receptive grammar skills impacted on the macrostructural level of written composition significantly more than spelling. To our knowledge, this differential effect of grammatical and spelling skills on text quality has not previously been reported at this point in development. It appears that, for this aspect of writing, beginning writers may draw on their language skills, which help with the organisation of the text content and the production of cohesive discourse. These results are consistent with other recent research in English (Kim et al., 2014) and Italian (Pinto, Tarchi & Bigozzi, 2015). For example, Pinto et al. (2015) show that although spelling skills initially mediate the relationship between oral narrative skills in preschool years and written production in first grade, by second grade, the meditational effect of spelling is less important, and preschool oral narrative competence has a direct effect on second graders' written narrative production.

Spelling skills are a powerful cognitive constraint in the development of written composition in English. The need to focus attentional and memory resources on spelling may significantly constrain the execution of other linguistic processes related to writing (Berninger et al., 2011; Juel, 1988). This study shows that this is also important in Italian. However, in Italian spelling is easier, and represents less of a constraint for text generation, but the grammatical system is complex, and

thus the text generation process is significantly influenced by the child's mastery of grammar.

Recently, Kim et al. (2014) examined the dimensions of early written composition in English speaking beginning writers (first graders) and found that oral language skills (a composite score of oral expressive vocabulary and grammatical skills) contributed to children's writing quality. However, in their study oral grammatical skills did not contribute to writing productivity and complexity at microstructural level. In our study oral and written grammatical measures contributed to microstructural *productivity*, *complexity*, *accuracy* and to the overall *quality* of the text. The different results of our and Kim et al.'s study, could be determined by the greater experience of our participants with writing. Our participants were 2nd and 3rd graders, while Kim et al.'s study involved first graders. Yet, our results differ also from those of Berninger et al. (2011), who involved older students, and found that in English only from grade four syntactic knowledge contributed uniquely to children's ability to translate ideas into sentences. Models of writing development do not yet incorporate details of language-specific factors in their view of how writing skills develop. This is an important addition to our understanding of writing process, one which should inform assessment and instructional intervention.

In this study, we also extended previous research (Babayigit & Stainthorp, 2010; Berninger et al., 2011; Puranik et al., 2008) by examining both the contribution of oral language and written text generation skills to early writing. In previous research oral language skills often have been used to assess children's text generation abilities (Babayigit & Stainthorp, 2010; Mackie et al., 2013). The results of this study demonstrated that written text generation skills explained variance in writing *productivity*, *accuracy* and in writing *complexity* and *text quality*, independently of age, spelling, and oral language measures. Sentence reformulation skills, which reflected children's ability to modify simple and complex syntactic structures, were the only variable associated with writing *complexity*. Whereas, *sentence generation* skills, which reflected fluency in generating ideas in sentences, were the only linguistic variable associated with writing *productivity*. These results

suggest that the aspects tapped by these measures, grammatical fluency and syntactic revision, can be critical in assessing early writing proficiency, at least in Italian. They also indicate that examining both oral language measures and written language measures may be important to gain a comprehensive view of text generation skills from the initial stages of learning to write.

Limitations

Research which aims to test models derived in one language on a second language has a number of inherent challenges which impact on the interpretation of the results and limit cross-linguistic comparisons. These limitations are evident in the current study. Measures used across languages can be, at in part, different and will not have been subject to the same standardization process, which limits the generalizability of the results. By corollary, the current study did not include a measure of handwriting, which is common in studies examining early writing skills. Handwriting skills, have been shown to be an important predictor of early writing skills in English (Wagner et al., 2011). While there was no reason to predict handwriting would be any less important in transparent orthographies (Maki et al., 2001), future studies should aim to include a measure of handwriting to examine whether there is a similar role across orthographies.

In the current study we did not collect data that examined the instruction the children received and the learning opportunities they were exposed to. Children in different countries enter formal education at different time points and will experience different curricula and different approaches to teaching. Not only does this raise questions about the ways in which teaching may impact on the development of writing, but it also highlights the problems of comparing early writing skills and performance across languages. These issues raise important challenges for models of writing development. Where models are confirmed, as we have shown for the components of the writing process, this adds strengths to the models. But the reasons why differences occur across data sets may not be obvious.

The use of written language measures to assess text generation skills in young writers can be seen as another limitation of this study, since written sentence generation tasks require transcription skills as well. However, they also represent an ecologically valid measure of the child's ability to generate the text while managing the competing demands of transcription. Using these measures in combination with transcription measures, as in this study, may allow a control for the influence of these potential confounding variables, while offering at the same time a valuable estimate of an important writing process.

Implications for Writing Assessment and Instruction

The findings of this study have implications both for the assessment of writing and for writing instruction. The assessment of writing skills is largely based on the administration of standardized spelling tasks, even in languages such as Italian (Sartori, Job, & Tressoldi, 2007; Tressoldi, & Cornoldi, 1991). These measures are known to be markers of writing skills in English but, as we have shown, may be less important in Italian. In this study we found that grammatical skills and the ability to generate sentences may constrain writing at least as much as spelling skills in Italian children. Indicators of writing skills and early writing achievement can vary between languages and orthographic systems. Thus, the focus of educational assessment may vary across languages as well.

Other implications of this study concern instruction. Interventions typically do not focus on the link between oral and written language development (Arfé et al., 2014). By contrast, interventions typically focus on spelling, handwriting, planning and other self-regulation skills (Berninger et al., 2002; Englert, Raphael, Anderson, Anthony, & Stevens, 1991). Given the role that oral language skills play in early written composition, instructional interventions that bridge and integrate oral language and writing skills are needed, particularly in shallow orthographies, such as Italian.

References

Abbott, R. D., & Berninger, V. W. (1993). Structural equation modeling of relationships among developmental skills and writing skills in primary-grade and intermediate-grade writers. *Journal of Educational Psychology, 85*(3), 478-508. doi: 10.1037/0022-0663.85.3.478

Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal Relationships of Levels of Language in Writing and Between Writing and Reading in Grades 1 to 7. *Journal of Educational Psychology, 102*(2), 281-298. doi: 10.1037/a0019318

Arfé, B., De Bernardi, B., Pasini, M., & Poeta, F. (2012). Toward a redefinition of spelling in shallow orthographies: Phonological, lexical and grammatical skills in learning to spell Italian. In V.W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 359-387). NY: Psychology Press/Taylor Francis Group.

Arfé, B., Dockrell, J. E., & Berninger, V. W. (2014). *Writing development in children with hearing loss, dyslexia or oral language problems: Implications for assessment and instruction* Oxford: Oxford University Press.

Arfé, B., & Pizzocaro, E. (2015). Sentence Generation in Children with and without Problems of Written Expression. In J. Perera, M. Aparici, E. Rosado, and N. Salas (Eds.), *Written and spoken language development across the lifespan. Essays in honor of Liliana Tolchinsky.* Springer International Publishing.

Authors (in press).

Authors (accepted).

Babayigit, S., & Stainthorp, R. (2010). Component processes of early reading, spelling, and narrative writing skills in Turkish: a longitudinal study. *Reading and Writing, 23*(5), 539-568. doi: Doi 10.1007/S11145-009-9173-Y

Babayigit, S., & Stainthorp, R. (2011). Modeling the Relationships Between Cognitive-Linguistic Skills and Literacy Skills: New Insights From a Transparent Orthography. *Journal of Educational Psychology, 103*(1), 169-189. doi: 10.1037/a0021671

Barbiero C, Lonciari I, Montico M, Monasta L, Penge R, et al. (2012) The Submerged Dyslexia Iceberg: How Many School Children Are Not Diagnosed? Results from an Italian Study. PLoS ONE 7(10): e48082. doi: 10.1371/journal.pone.0048082

Berman, R. (2014). Linguistic perspectives on writing development. In B. Arfé, J. Dockrell, & V. Berninger (Eds.), *Writing development in children with hearing loss, dyslexia or oral language problems: Implications for assessment and instruction* (pp.176-186). NY: Oxford University Press.

Berninger, V., Yates, C., Cartwright, A., Rutberg, J., Remy, E., & Abbott, R. (1992). LOWER-LEVEL DEVELOPMENTAL SKILLS IN BEGINNING WRITING. *Reading and Writing, 4*(3), 257-280. doi: 10.1007/bf01027151

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.

Berninger, V. W., Nagy, W., & Beers, S. (2011). Child writers' construction and reconstruction of single sentences and construction of multi-sentence texts: contributions of syntax and transcription to translation. *Reading and Writing, 24*(2), 151-182. doi: 10.1007/s11145-010-9262-y

Berninger, V. W., & Swanson, H. L. (1994). Modifying Hayes and Flowers' model of skilled writing to explain developing writing. In E. C. Butterfield (Ed.), *Advances in cognition and educational practice. Children's writing: Toward a process theory of the development of skilled writing* (Vol. 2, pp. 1-30). Greenwich: JAI Press.

Berninger, V. W., Vaughan, K., Abbott, R. D., Begay, K., Coleman, K. B., Curtin, G., . . . Graham, S. (2002). Teaching spelling and composition alone and together: Implications for the

simple view of writing. *Journal of Educational Psychology*, *94*(2), 291-304.. doi: 10.1037//0022-0663.94.2.291

Bishop, D. V. M. (1982). *Test for the reception of grammar*. Oxford, UK: Medical Research Council.

Bisiacchi, P., Cendron, M., Gugliotta, M., Tressoldi, P., & Vio, C. (2005). *BVN 5-11: Batteria di valutazione neuropsicologica per l'età evolutiva* [Battery for neuropsychological assessment in children]. Trento: Erikson.

Brizzolara, D. (1989). *Test di vocabolario figurato* [Picture naming test. Technical report of the research project 500.4/ 62.1/1134 supported by a grant from the Italian Department of Health]. Pisa: IRCCS Stella Maris.

Broc, L., Bernicot, J., Olive, T., Favart, M., Reilly, J., Quemart, P., & Uze, J. (2013). Lexical spelling in children and adolescents with specific language impairment: Variations with the writing situation. *Research in Developmental Disabilities, 34*(10), 3253-3266. doi: 10.1016/j.ridd.2013.06.025

Cumming, G., & Finch, S. (2005). Inference by eye: Confidence intervals, and how to read pictures of data. American Psychologist, *60*, 170–180.

Dall'Oglio, A. M., Rossiello, B., Coletti, M. F., Bultrini, M., de Marchis, C., Rava, L., . . . Cuttini, M. (2010). Do healthy preterm children need neuropsychological follow-up? Preschool outcomes compared with term peers. *Developmental Medicine and Child Neurology, 52*(10), 955-961. doi: 10.1111/j.1469-8749.2010.03730.x

Dockrell, J. E., & Connelly, V. (2013). The role of oral language in -underpinning the text generation -difficulties in children with specific -language impairment. *Journal of Research in Reading.* doi: 10.1111/j.1467-9817.2012.01550.x

Englert, C. S., Raphael, T. E., Anderson, L. M., Anthony, H. M., & Stevens, D. D. (1991). MAKING STRATEGIES AND SELF-TALK VISIBLE - WRITING INSTRUCTION IN REGULAR AND SPECIAL-EDUCATION CLASSROOMS. *American Educational Research Journal, 28*(2), 337-372. doi: 10.3102/00028312028002337

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S. P., & Whitaker, D. (1997). Role of mechanics in composing of elementary school students. A new methodological approach. *Journal of Educational Psychology, 89*(1), 170–182. doi: 10.1037/0022-0663.89.1.170

Hayes, J. R., & Flower, L. S. (1986). Writing research and the writer. *American Psychologist, 41*(10), 1106-1113. doi: 10.1037/0003-066x.41.10.1106

Hunt, K. W. (1965). *Grammatical structure written at three grade levels*. Champaign, IL: National Council of Teachers of English, Research Report No. 3.

Juel, C. (1988). LEARNING TO READ AND WRITE - A LONGITUDINAL-STUDY OF 54 CHILDREN FROM 1ST THROUGH 4TH GRADES. *Journal of Educational Psychology, 80*(4), 437-447. doi: 10.1037/0022-0663.80.4.437

Kim, Y.-S., Al Otaiba, S., Folsom, J. S., Gruelich, L., & Puranik, C. (2014). Evaluating the dimensionality of first grade writing composition. *Journal of Speech, Language, and Hearing Research, 57*, 199-211. doi:10.1044/1092-4388

Kim, Y.-S., Al Otaiba, S., Puranik, C., Folsom, J. S., Greulich, L., & Wagner, R. K. (2011). Componential skills of beginning writing: An exploratory study. *Learning and Individual Differences, 21*(5), 517-525. doi: 10.1016/j.lindif.2011.06.004

Kim, Y. S., Al Otaiba, S., Wanzek, J., & Gatlin, B. (2015). Toward an Understanding of Dimensions, Predictors, and the Gender Gap in Written Composition. *Journal of Educational Psychology, 107*(1), 79-95. doi: 10.1037/a0037210

Limpo, T., & Alves, R. A. (2013). Modeling Writing Development: Contribution of Transcription and Self-Regulation to Portuguese Students' Text Generation Quality. *Journal of Educational Psychology, 105*(2), 401-413. doi: 10.1037/a0031391

Lorusso M. L., Vernice M., Dieterich M., Brizzolara D., Mariani E. Masi, S. D. & Mele, **A.(2014).** The process and criteria for diagnosing specific learning disorders: indications from the Consensus Conference promoted by the Italian National Institute of Health. *Annali dell'Istituto Superiore di Sanità, 50(1),* 77-89.

Mackie, C. J., Dockrell, J., & Lindsay, G. (2013). An evaluation of the written texts of children with SLI: the contributions of oral language, reading and phonological short-term memory. *Reading and Writing, 26*(6), 865-888. doi: 10.1007/s11145-012-9396-1

Maki, H. S., Voeten, M. J. M., Vauras, M. M. S., & Poskiparta, E. H. (2001). Predicting writing skill development with word recognition and preschool readiness skills. *Reading and Writing, 14*(7-8), 643-672. doi: 10.1023/a:1012071514719

McCauley, R. J. (2001). *Assessment of Language Disorders in Children*. New York: Psychology Press.

McCutchen, D., Covill, A., Hoyne, S. H., & Mildes, K. (1994). Individual differences in writing - implications of translating fluency. *Journal of Educational Psychology, 86*(2). doi: 10.1037//0022-0663.86.2.256

Puranik, C. S., Lombardino, L. J., & Altmann, L. J. P. (2008). Assessing the microstructure of written language using a retelling paradigm. *American Journal of Speech-Language Pathology, 17*(2), 107-120.

Raman, I., (2003). Lexicality effects in single-word naming in alphabetic Turkish orthography. In M. Joshi, C.K. Leong and B.L.J. Kaczmarek (Eds.), *Literacy Acquisition: Role of Phonology, Morphology and Orthography (pp. 83-93).* The Netherlands : IOS Press of Amsterdam.

Reilly, J.S., Bernicot, J. Olive, T., Uzé, J., Wulfeck, B., Favart, M., & Appelbaum, M. (2014). Written narratives from French and Egnlish speaking children with lagnuage impairment. In B. Arfé, J. Dockrell, & V. Berninger (Eds.), *Writing development in children with hearing*

loss, dyslexia or oral language problems: Implications for assessment and instruction (pp.176-186). NY: Oxford University Press.

Robinson, G., Blair, J., & Cipolotti, L. (1998). Dynamic aphasia: An inability to select between competing verbal responses? *Brain, 121,* 77-89.

Rustioni Metz-Lancaster, D. & Associazione "La nostra famiglia" (1994). *Prove di valutazione della comprensione linguistica* [Test for the assessment of linguistic comprehension]. Firenze: Organizzazioni Speciali.

Sartori G., Job, R, Tressoldi, P. (2007). *DDE-2. Batteria per la valutazione della dislessia e della disortografia evolutiva* [Battery for the assessment of developmental dyslexia and dysorthographia]. Firenze: Giunti OS.

Torrance, M., Alamargot, D., Castelló, M., Ganier, F., Kruse, O., Mangen, A., . . . van Waes, L. (2012). *Learning to write effectively: Current trends in European research*. Emerald.

Tressoldi, P. E., & Cornoldi, C. (1991). *Batteria per la valutazione della scrittura e della competenza ortografica nella scuola dell'obbligo* [BVSCO, Battery for the assessment of writing skills of children from 7 to 13 years old]. Firenze, Italy: Giunti OS.

Vicari, S., Menghini, D., Di Paola, M., Serra, L., Donfrancesco, A., Fidani, P., . . . Carlesimo, G. A. (2007). Acquired amnesia in childhood: A single case study. *Neuropsychologia, 45*(4), 704-715. doi: 10.1016/j.neuropsychologia.2006.08.004

Wagner, R. K., Puranik, C. S., Foorman, B., Foster, E., Wilson, L. G., Tschinkel, E., & Kantor, P. T. (2011). Modeling the development of written language. *Reading and Writing, 24*(2), 203-220. doi: 10.1007/s11145-010-9266-7

West, S.G., Finch, J.F. & Curran, P.J. (1995). Structural equation models with nonnormal variables. Problems and remedies. In R.H. Hoyle (Ed.). Structural equation modeling: Concepts, issues and applications (pp. 56-75). Newbury Park, CA: Sage.

Table 1

Individual Skills Underpinning Writing and Writing Scores. Descriptive Statistics (N=83)

	Individual skills				
	M	*SD*	Min-Max	Skewness	Kurtosis
Spelling (errors)	6.16	4.98	0-23	1.38	1.42
Lexical retrieval (correct responses)	15.0	2.63	8-20	-.61	.19
Receptive grammar (z scores)	.00	.99	-3.5-2.1	-.69	-1.15
Sentence generation (correct)	5.43	2.62	0-13	.34	.26
Sentence reformulation (correct)	13.52	4.53	2-21	-.49	-.73
	Writing scores				

Word level					
TNW	74.35	38.97	24-261	1.7	5.6
Spelling err (proportions)	.07	.07	.00-.33	1.5	2.42
Lexical choice err (proportions)	.04	.04	.00-.21	1.5	4.59
Sentence level					
T-UNITS	8.34	4.49	2-29	1.5	4.3
CLAUSES	11.57	6.51	2-41	1.4	3.9
MLT-Units	9.31	2.59	5.20-19.75	1.2	2.42
C-density	1.39	.33	1-2.63	1.2	1.93
Clause construction err (proportions)	.26	.22	.00-1.00	1.2	1.5
Text					
Quality (score)	1.67	1.3	0-4	.27	-.79

Note. TNW= total number of words; T-UNITS=total number of T-Units; CLAUSES= total number of clauses; MLT-Units=Mean length of T-units; C-density=Clause density

Table 2

Bivariate Correlations Among the Microstructural Writing Scores (N = 83)

Variable	1	2	3	4	5	6	7	8
1. TNW	-							
2. Spelling err %	-.19	-						
3. Lexical err %	-.16	.32**	-					
4. T-units	.89***	-.21	-.08	-				

5. Clauses	.95***	-.16	-.08	.93***	-			
6. MLT-unit	.13	-.03	-.20	-.29	-.03	-		
7. C-density	.29	.03	-.07	-.03	.32**	.68***	-	
8. Clause err %	-.25	.22	.62***	-.18	-.22	-.20	-.20	-

Note: , ** *p<.005, ***p<.001*

Table 3

Factor Analysis: Three Factors Solution

	Extraction sums of squared loadings			
Component	Initial eigenvalues	% of variance	% cumulative	Total rotated
1	2.38	34.01	34.01	2.00
2	1.80	25.70	59.71	1.83
3	1.36	19.39	79.11	1.93
4	.79	11.35	90.46	
5	.38	5.42	95.88	
6	.27	3.82	99.70	
7	.02	.30	100.00	

Table 4

Principal Component Analysis: Factor Loadings for the Three Components

	Productivity	*Complexity*	*Accuracy*
T-units	**.98**	-.18	-.20
TNW	**.96**	.22	-.25
MLT-unit	-13	**.91**	-.17
C-density	.14	**.91**	-.06
Spelling errors %	-.23	.10	**.60**
Lexical errors %	-.07	-.15	**.88**
Clause errors %	-.20	-.25	**.81**

Table 5

Bivariate Correlations Between Spelling, Oral Language, Text Generation Measures, Productivity, Complexity, Accuracy and Text Quality (N = 83)

Variable	1	2	3	4	5	6	7	8	9	10
1. Grade level	-									
2. Spelling (errors)	-.33**	-								
3. Lex_ retrieval	.22	-.39***	-							
4. Recept_gramm	.00	-.19	.22	-						
5. Wrt _Sent_ gen	.40***	-.26	.20	.19	-					
6. Wrt_Sent_ ref	.46***	-.38***	.28	.30	.46***	-				
7. Productivity	.51***	-.27	.17	.12	.38***	.24	-			
8. Complexity	-.07	.00	-.05	.06	-.07	.25	-.01	-		
9. Accuracy	-.15	.49***	-.26	-.38***	-.39***	-.44***	-.21	-.10	-	
10. Text Quality	.02	-.31**	.09	.44***	.29	.18	.26	.04	-.69***	-

*Note. ** p < .005, *** p < .001*

Lex_retrieval= Lexical retrieval, Recept_gramm= Receptive grammar, Wrt _Sent_gen= Written sentence generation; Wrt_Sent_ref= Written sentence reformulation.

Accuracy reflects the proportion of errors in the texts. Thus it correlates negatively with scores of receptive grammar, lexical retrieval and written sentence generation and reformulation.

Tables 6.

Multiple Regressions: Individual Factors Contributing to Productivity, Complexity, Accuracy and Text Quality (N = 83; 95% confidence intervals (CIs) of the standardized beta weights estimated via bootstrapped procedure).

Predictor		*SE β*	*β*	t	*p*	Bootstrapped 95% CI *β* Lower	Bootstrapped 95% CI *β* Higher
Productivity (T-units,TNW)	Grade level	.003	.451	3.89	.001	.445	.457
	Spelling (errors)	.004	-.107	-.85	.40	-.114	-.098
	Lexical retrieval	.004	.002	.06	.95	-.009	.005
	Recept_ grammar	.003	.083	.90	.37	.076	.090
	Wrt_sentence gen	.004	.228	2.01	.05	.218	.236
	Wrt_sentence ref	.004	-.125	-1.06	.29	-.132	-.118
	R^2	.32					
	F	5.85^{***}					
Complexity (MLT-UNIT, C-DENSITY)	Grade level	.004	-.185	1.43	.16	-.194	-.177
	Spelling (errors)	.005	.036	.31	.76	.026	.045
	Lexical retrieval	.005	-.087	-.66	.51	-.097	-.079
	Recept_grammar	.004	-.018	-.14	.88	-.026	-.009
	Wrt_sentence gen	.004	-.162	-1.45	.15	-.170	-.155
	Wrt_sentence ref	.004	.453	3.39	.001	.444	.462
	R^2	.14					
	F	$2.14^{p=.06}$					
Accuracy (Spelling errors, Lexical errors, Clause errors)	Grade level	.003	.158	1.47	.14	.152	.164
	Spelling (errors)	.004	.376	3.62	.001	.367	.383
	Lexical retrieval	.003	-.008	-.08	.94	-.013	-.002
	Recept_grammar	.003	-.203	-2.08	.04	-.209	-.196
	Wrt_sentence gen	.003	-.215	-2.18	.03	-.221	-.209
	Wrt_sentence ref	.004	-.205	-1.79	.08	-.213	-.198
	R^2	.41					
	F	8.83^{***}					
	Grade level	.004	-.109	-.95	.34	-.116	-.103
	Spelling (errors)	.004	-.300	-2.56	.01	-.308	-.293

Text Quality	Lexical retrieval	.004	-.102	-1,00	.32	-.108	-.095
	Recept_ grammar	.003	.384	3.70	.001	.379	.389
	Wrt_sentence gen	.004	.237	2.19	.03	.229	.245
	Wrt_sentence ref	.004	-.083	-.67	.50	-.091	-.076
	R^2	.30					
	F	5.48^{***}					

Note. *** $p < .001$. *Accuracy* reflects the proportion of errors in the texts. Thus it correlates negatively with scores of receptive grammar, lexical retrieval and written sentence generation and reformulation.

Figure 1. Accuracy: Overlap between the bootstrapped 95% CIs of spelling and receptive grammar standardized Beta coefficients.

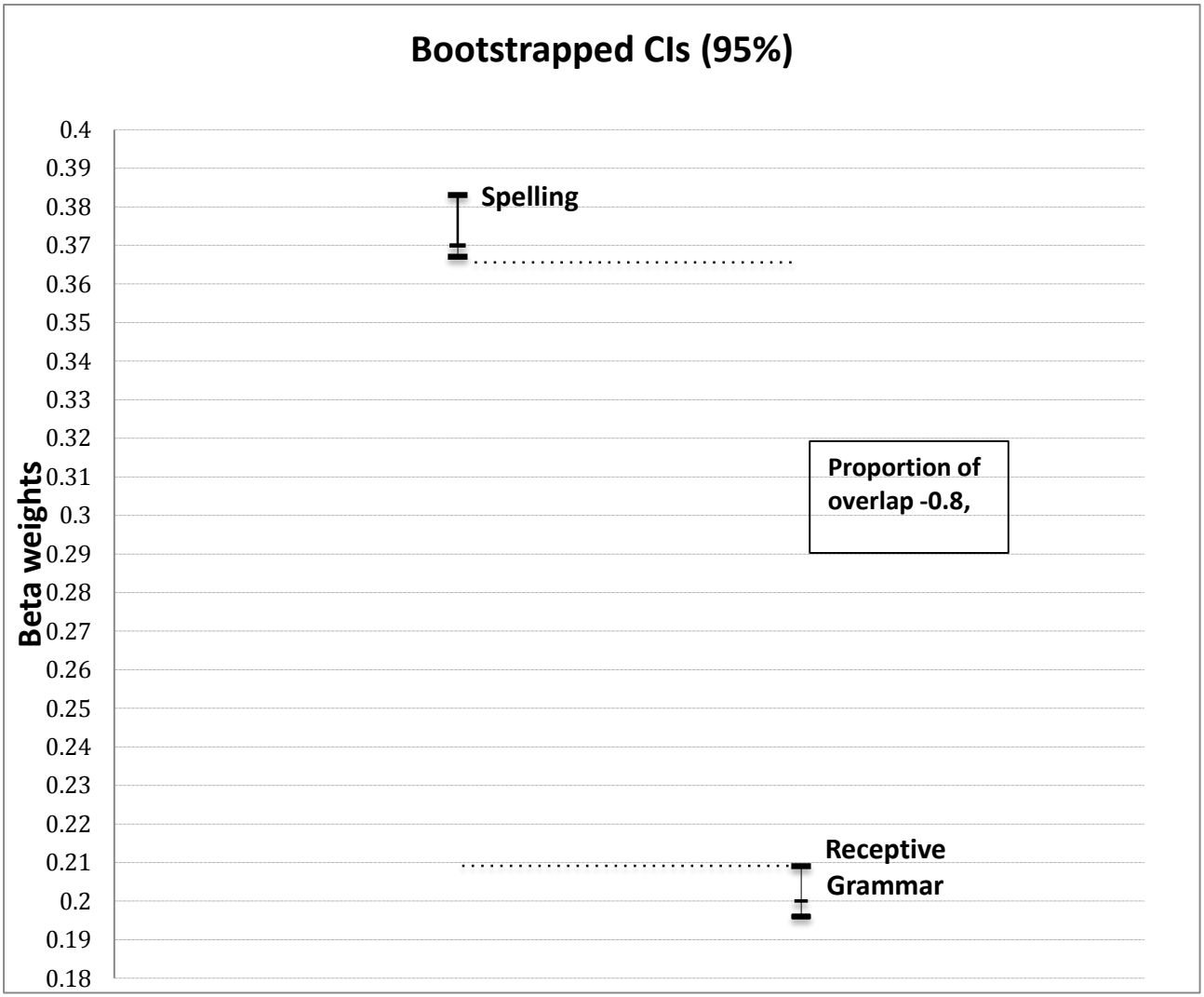

Figure 2. Text Quality: Overlap between the bootstrapped 95% CIs of spelling and receptive grammar standardized Beta coefficients.