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Language, literacy, attentional behaviors, and instructional quality predictors of written composition for first graders

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ABSTRACT

We had two primary purposes in the present study: (1) to examine unique child-level predictors of written composition which included language skills, literacy skills (e.g., reading and spelling), and attentiveness and (2) to examine whether instructional quality (quality in responsiveness and individualization, and quality in spelling and writing instruction) is uniquely related to written composition for first-grade children ($N = 527$). Children's written composition was evaluated on substantive quality (ideas, organization, word choice, and sentence flow) and writing conventions (spelling, mechanics, and handwriting). Results revealed that for the substantive quality of writing, children's grammatical knowledge, reading comprehension, letter writing automaticity, and attentiveness were uniquely related. Teachers' responsiveness was also uniquely related to the substantive quality of written composition after accounting for child predictors and other instructional quality variables. For the writing conventions outcome, children's spelling and attentiveness were uniquely related, but instructional quality was not. These results suggest the importance of paying attention to multiple component skills such as language, literacy, and behavioral factors as well as teachers' responsiveness for writing development.

According to NAEP data, only 35% of students in eighth grade can write proficiently and this proportion has not changed since 2002 (National Center for Education Statistics, 2003, 2012). The majority of US students write at a basic level or below the basic level, which makes it difficult for them to communicate in writing at school and limits future employment opportunities. Writing connected text, including sentences, paragraphs, and essays (i.e., written composition), is a highly complex task drawing on multiple processes such as oral language skills, transcription skills, and memory (both long-term and working memory; Berninger, Abbott, Graham, & Richards, 2002; Berninger & Swanson, 1994; McCutchen, 2006; Shanahan, 2006). While it is well-known that some of these child-level skills (e.g., spelling) are mediated by instructional influences, the majority of previous studies have focused on either child (Abbott & Berninger, 1993; Berninger & Abbott, 2010; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Kim, Al Otaiba, et al., 2011; McMaster, Du, & Petursdottir, 2009; Olinghouse, 2008; Wagner et al., 2011) or instructional factors (i.e., particular instructional approaches; Graham, 2006; Graham, Harris, & Mason, 2005; Moats, Foorman, & Taylor, 2006; Pritchard & Honeycutt, 2006) in relation to children's writing achievement. However, as children experience writing instruction mostly in formal schooling (Shanahan, 2006), it is important to examine both child and instructional factors in tandem for children's writing achievement, and to understand these factors early in their academic careers. In fact, the newly released Common Core Standards indicate that by the end of first grade, students should be able to write opinion, narrative, and informative/explanatory texts (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).

In the present study, we examined multilevel predictors – child-level predictors such as language, literacy (e.g., reading and spelling), and attentiveness, and classroom-level predictors such as instructional quality – for written composition for children in grade one. Specifically, we had two primary purposes in the present study. The first purpose was to examine unique child-level component skills of written composition, which included language skills, literacy skills, and attentional difficulties, after accounting for instructional quality. The second purpose was to examine whether instructional quality makes a unique contribution to written composition for first-grade children after accounting for child-level language and literacy skills. Children's written composition was examined in two dimensions, substantive quality and writing conventions.

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Instructional quality was observed and rated based upon a rating scale used in prior studies to examine reading outcomes (Al Otaiba, Folsom, et al., 2011) and description of spelling and writing instruction at kindergarten (Puranik, Al Otaiba, Folsom, & Greulich, 2010).

1. Child-level predictors of written composition

According to a developmental model of writing, multiple cognitive and linguistic factors are necessary for writing development, including lower level transcription skills (spelling and handwriting) and high-level language and cognitive processes (Berninger & Swanson, 1994; also see Berninger et al., 2002). Because children are still developing in their literacy, cognitive, and motor skills, transcription skills are essentially critical for the task of writing. However, children's ability to translate ideas into language at the word, sentence, and discourse level is also hypothesized to be important for developing writers. When children further develop into junior high grades, cognitive skills such as planning and revision are expected to play a more constraining role in written composition.

Transcription skills, including spelling and letter writing fluency, are hypothesized to be important for written composition as they free cognitive resources for higher-level composition processes such as generating ideas and content during writing (Graham, 1990; Graham et al., 1997; Graham & Harris, 2000; McCutchen, 1988, 2006; Scardamalia, Bereiter, & Goleman, 1982). It appears that children's spelling ability is important particularly for beginning writers as spelling skills may support or constrain generation of text (Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Ehri, 2000; Graham, Harris, & Chorzempa, 2002; Kim, Al Otaiba, et al., 2011; Puranik & Al Otaiba, 2012; Treiman & Bourassa, 2000). In addition to spelling, letter writing automaticity (typically referred to as handwriting fluency; Berninger, 1999; Graham et al., 1997) – i.e., the accuracy and rate at which children retrieve and produce letters – is also consistently related to children's writing quality and productivity not only for young writers (Graham et al., 1997; Kim, Al Otaiba, et al., 2011; Puranik & Al Otaiba, 2012; Wagner et al., 2011), but also even into adolescence (Graham et al., 1997).

Empirical evidence of the importance of language in beginning writing is accumulating but findings are somewhat inconsistent. On the one hand, Puranik and Al Otaiba (2012) did not find that oral language skills were related to the number of words or ideas produced by kindergarteners (i.e., writing productivity) once spelling and handwriting were entered into a regression model. However, using structural equation modeling with latent variables, Kim, Al Otaiba, et al. (2011) showed that children's oral language skill, captured by vocabulary and grammatical knowledge, was uniquely related to writing productivity (how much children wrote) for children at the end of kindergarten. Similarly, third-grade students' grammatical understanding was uniquely related to writing quality (ideation, organization, grammar, sentence structure and vocabulary choice), after accounting for word reading, IQ, writing productivity, and spelling (Olinghouse, 2008). In addition, oral language skill composed of verbal reasoning, phonological awareness, and sentence memory was uniquely related to writing productivity (total number of words written) among second- and third-grade students and to writing quality among first- and sixth-grade students, after accounting for reading (Abbott & Berninger, 1993).

In addition to transcription and language skills, converging findings from previous studies suggest that reading skill, reading comprehension in particular, might be a unique correlate of writing skill for children in grades one and above (Abbott & Berninger, 1993; Berninger & Abbott, 2010; Berninger et al., 2002; Olinghouse, 2008). Neither word reading skills nor children's reading skill composed of word reading and reading comprehension were uniquely related to children's writing productivity at the end of kindergarten (Kim, Al Otaiba, et al., 2011). Yet Berninger and Abbott (2010) showed that children's reading comprehension was uniquely related to writing quality after accounting for receptive and expressive oral language skills for children in beginning (grade one) and more advanced stages of writing development (grade seven). It has also been suggested that reading and writing may have a bidirectional relation, developing in tandem (Shanahan, 2006; Shanahan & Lomax, 1986, 1988).

Another potential factor that might influence children's writing skill is student behaviors such as inattention and hyperactivity. Although correlated, inattention and hyperactivity are distinct constructs (e.g., Barkley, 1990; Goodyear & Hynd, 1992; Lahey & Carlson, 1991). Inattention has been hypothesized to reflect problems in self-regulation of internal cognitive processes while hyperactivity may reflect problems in self-regulation of behavior (Barkley, 1996). Classrooms are complex learning environments where teacher and child characteristics interact and influence children's learning (Connor, Morrison, et al., 2009; Cunningham, Zibulsky, Stanovich, & Stanovich, 2009; Saez, Folsom, Al Otaiba, & Schatschneider, 2012; Verhoeven, Schnotz, & Paas, 2009). Furthermore, literacy acquisition (i.e., reading and writing) is a complex task with multiple cognitive demands competing for children's attention. Thus, the extent of children's attentiveness or lack thereof is likely to influence their literacy acquisition (Posner & McCandliss, 1999). Studies have shown the influence of attentional difficulties on one's prereading skills (Willcutt et al., 2007), reading, and overall academic achievement after accounting for intelligence in longitudinal studies following students from kindergarten to second grade (Dally, 2006) and from adolescence to adulthood (Fergusson, Lynskey, & Horwood, 1997).

Given that attention contributes to reading outcomes of young children, it is reasonable to hypothesize that attentional difficulties are also likely to contribute to their writing skills because writing requires the juggling of multiple processes, perhaps to an even greater extent than in reading (Moats, 2005). Indeed, a recent study showed that children's inattentiveness, but not hyperactivity, was related to their writing skills (measured by Woodcock Johnson-Revised Writing Samples and Writing Fluency tasks) indirectly via an orthographic factor (e.g., orthographic choice task and letter cluster coding task) and a rapid naming factor for children with dyslexia (Thomson et al., 2005). In other words, children's inattentiveness was directly related to orthographic and rapid naming factors which were, in turn, directly related to written composition measured by the Woodcock Johnson-Revised Writing Samples and Writing Fluency tasks. However, our understanding of the relation of attentional difficulties to writing skill is still very limited. For instance, it is not clear whether attentiveness is uniquely related to writing after accounting for other important language and literacy skills. One hypothesis is that the influence of attentiveness on written composition is via other lexical- and text-level literacy skills such as reading comprehension and spelling, such that attentiveness is not uniquely related to written composition over and above reading comprehension and spelling. This is a reasonable hypothesis given that orthographic awareness and rapid naming are sublexical skills that contribute to lexical- and text-level literacy skills (Compton, 2003; de Jong & van der Leij, 1999; Savage, Pillay, & Melidona, 2008; Thomson et al., 2005; Wolf & Bowers, 1999; Wolf & Katzir-Cohen, 2001), and thus, once spelling and reading comprehension are taken into consideration in the statistical model, attentiveness might not be uniquely related to writing. An alternative hypothesis is that attentiveness relates to children's written composition beyond language and literacy skills because writing demands coordination of multiple processes such that controlled attention is needed for written composition over and above language and literacy skills.

2. Instructional quality and writing

Children are typically exposed to writing instruction with formal schooling although some nascent form of writing (e.g., letter strings) starts before children enter school (Bissex, 1980; Harst, Woordward, & Burke, 1984). It is suggested that teachers play an essential role in children's learning to write, and thus high-quality instruction is critical for children's writing development (New Standards Primary Literacy Committee, 1999). However, a surprisingly limited number of studies has investigated the relation of instructional quality to children's written composition. While studies on the effectiveness of writing instruction have demonstrated that instruction on writing is important for the development of children's writing skills (e.g., strategy instruction, Graham, 2006; process approach, Pritchard & Honeycutt, 2006), these studies are limited to the particular writing instructional approach. What is lacking in the literature is the answer to whether overall instructional quality (e.g., how organized classroom instruction is, how responsive the teacher is) is related to children's writing achievement.

In addition, given that children's reading skills appear to be related to their writing skills (Berninger et al., 2002; Shanahan, 2006), variation in teachers' instructional quality in literacy areas such as reading might be important to children's writing skills. To date, few studies conducted observational research with a focus on writing development, and those few existing observational studies were mostly conducted in the 1980s (Applebee, 1981; Bridge & Hiebert, 1985; Florio & Clark, 1982). An exception is a Moats and her colleagues' (2006) study which showed that children in high-quality writing instruction in grade three and four wrote longer compositions with correctly spelled words than children with poor quality instruction (Moats et al., 2006). Although informative, this study included a small number of classrooms ($N = 10$) and children ($N = 40$), and did not include important child predictors such as language, literacy, or attentional behaviors.

3. Present study

In summary, we investigated the relations of child-level variables such as language, literacy, and attention, and classroom-level variables such as instructional quality to first grade students' written composition. The two primary research questions were as follows: (1) What are unique child-level predictors (i.e., oral language, literacy, and attentional behaviors) of written composition for first-grade students after accounting for instructional quality? (2) What are unique instructional quality predictors of written composition for first-grade students after accounting for child-level language, literacy, and attentional behaviors? Children's written composition was evaluated for multiple aspects, using an analytic or trait approach (Northwest Regional Educational Laboratory, 2011), which is the most widely used evaluation scale for writing across schools in the United States (Gransle, Van Der Heyden, Noell, Resetar, & Williams, 2006). The trait approach includes seven aspects such as ideas (richness, clarity, development, and relevance to topic and purpose), organization (internal structure and the logical pattern of presentation of ideas), word choice (phrasing, choice and arrangement of words), sentence flow (flow of language), spelling, mechanics, and handwriting. A recent study found that when using confirmatory factory analysis, these seven aspects are best described as two related ($r = .65$) but dissociable latent variables: ideas, organization, word choice, and sentence flow capturing a 'substantive quality' dimension of written composition, and spelling, mechanics, and handwriting capturing a 'writing conventions' dimension of written composition (Kim, Al Otaiba, Sidler, Gruelich, & Puranik, 2011, under review). Thus, in the present study, these two dimensions of written composition were used as the outcomes in the analysis.

Instructional quality was rated on a rating scale on two overall aspects: overall instructional procedure and specific literacy content areas. Instructional procedure included the extent to which teachers were responsive to children (responsiveness hereafter), the extent to which teachers provided individualized instruction (individualization hereafter), and the extent to which instruction was organized (organization hereafter). Teachers' responsiveness to students' inquiries has shown to be positively related to children's reading skills (Connor, Guiliani, Rotolo, Spencer, & Morrison, under review). In addition, individualized instruction has been shown to have a causal and positive impact on kindergarten and first grade students' reading development (Al Otaiba, Connor, et al., 2011; Connor, Morrison, et al., 2009). Thus, we hypothesized that the extent to which teachers' instruction is organized and prepared might be related to children's written composition. In addition to quality in overall instruction, we also included instructional quality in specific literacy areas such as spelling, writing, and reading comprehension.

4. Method

4.1. Participants

Data were collected from 531 first-grade students (mean age = 6.21, $SD = 39$) in seven public schools and 34 classrooms in a northern Florida community. Four students did not write anything and therefore, their written compositions were not coded. The final sample size in the present study was 527. The participants included 45% girls, 47% Black, 41% White, 2% Asian, and 10% Other (e.g., Hispanic, Multiracial, unknown/not reported). Fifty-six percent of these children were eligible for free or reduced lunch. The students were participating in a larger study investigating the efficacy of core reading instruction within a response to treatment (RTI) framework (Al Otaiba, Folsom, et al., 2011). Fifty percent of children were in the treatment condition. Children were randomly assigned within their classrooms to one of two researcher-administered RTI conditions. In the Dynamic condition, students with the weakest initial skills received intervention (Tier 2 or Tier 3 immediately). In the Typical condition, students began in Tier 1 and progress to Tier 2 if they did not respond to Tier 1 and to Tier 3 if they did not respond to Tier 2. Well-trained research staff conducted all interventions; Tier 2 was provided in 30 min bi-weekly sessions (groups of 5–7 children) and Tier 3 was provided in 45 min sessions four days per week (groups of 1–3 children). The code-focused activities for Tier 2 were drawn from the first grade Open Court *Imagine It*! series and the FCRR K-3 Center Activities and Tier 3 involved *Early Interventions in Reading* (EIR; Mathes & Torgesen, 2005). The meaning-focused components for both tiers changed each 8 weeks, beginning with dialogic shared book reading (Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; Lonigan & Whitehurst, 1998; Valdez-Menchaca & Whitehurst, 1992). Then, as students were able to read decodable books, they practiced reading fluently and answered sentence-level comprehension questions. Finally, students read decodable books that included elements of sequencing text structure. Tutors used graphic organizers to model and guide students in retelling stories. In both treatment and control conditions, teachers received professional development about RTI and their school district provided them with data. The intervention was conducted from October to April and the data used in the present study were collected in the spring after the intervention was completed (April and May). In the data analysis, treatment conditions were included as a control variable.

Schools were recruited with the help of the District Reading Coordinator to represent a diverse sample and to overrepresent

schools serving students from low-SES backgrounds. All seven nominated schools and all first-grade teachers in the schools agreed to participate. All students in the classroom were recruited to participate. Teachers in all but one school used Open Court as their core reading program for 90 min per day; in the remaining school, teachers used Reading Mastery. Teacher interviews indicated that no additional writing curriculum was in place in these schools and our observations indicated that writing was not a predominant part of the literacy program.

4.2. Measures

4.2.1. Outcome: written composition

A story prompt which was used in previous studies was used to ask students to compose a text (McMaster et al., 2009). Pairs of trained graduate students administered this task to students while their classroom teachers were present in classrooms. Testing occurred in late April and May. Similar brief, timed prompts are widely used in writing research as global indicators of writing performance (Lembke, Deno, & Hall, 2003; McMaster et al., 2009) and this task was designed to be similar to state-wide curriculum-based writing assessments. The writing prompt was "One day, when I got home from school,. . ." and children were given the following direction. *Today I'm going to ask you to write a story. Before you write, I want you to think about the story. First you will think, then you will write. You will have 30 seconds to think and 5 minutes to write. If you do not know how to spell a word, you should guess. . . .Your story will begin with 'One day, when I got home from school.' Think of a story you are going to write that starts like that.* Students had 5 min to complete the task (McMaster et al., 2009).

Students' written composition was coded by an adapted 6 + 1 Traits of Writing Rubric for Primary Grades (Northwest Regional Educational Laboratory, 2011). The adapted rubric had the following seven aspects: ideas, organization/structure, word choice, sentence fluency, spelling, mechanics (capitalization and punctuation), and handwriting. The voice aspect is in the original 6 + 1 traits rubric, but was not included in the present study because of a floor effect for the children in the present study in our preliminary work. The ideas aspect evaluated the extent to which main ideas were developed and represented; the organization/structure aspect was evaluated for text structure (e.g., beginning, middle, and end); the word choice aspect for use of interesting and specific words; the sentence fluency aspect for grammatical use of sentences and flow of sentences; the spelling aspect for accuracy and for the developmental phase of spelled words; the mechanics aspect for capitalization and punctuation accuracy; and the handwriting aspect for spacing, neatness, and letter formation. These aspects were rated on a scale of 1–5, each corresponding to experimenting, emerging, developing, capable, and experienced, respectively. A score of 0 was assigned to unscorable ones in each aspect, but this was very rare (i.e., 4 children).

Two graduate student coders were rigorously trained and double-coded independently approximately 15 percent of the writing samples (i.e., 78 pieces of written composition). The inter-rater percent agreement rates were as follows: .84 for ideas, .92 for organization, .84 for word choice, .88 for sentence fluency, .92 for spelling, .92 for mechanics, and .80 for handwriting. The percent agreement rates were all exact percent agreement in the present study. As noted above, these seven aspects were found to capture two related but dissociable dimensions, substantive quality and writing conventions (Kim et al., under review). Thus, in the multilevel models addressing our main research questions, we used a sum score of ideas, organization, word choice, and sentence fluency as the 'substantive quality' outcome and a sum score of spelling, mechanics, and handwriting as the 'writing conventions' outcome.

4.2.2. Child-level predictors

4.2.2.1. Oral language skills. Students' word- and syntax-level oral language skills were assessed by expressive vocabulary and grammatical knowledge. Expressive vocabulary was assessed by the Picture Vocabulary subtest of Woodcock Johnson-III (WJ-III; Woodcock, McGrew, & Mather, 2001), which requires students to identify pictured objects. Reliability (Cronbach's alpha) was .71 for the sample. Children's grammatical knowledge was measured by the Grammatic Completion subtest of the Test of Language Development-Intermediate, third edition (TOLD-I: 3; Hamill & Newcomer, 1997). In this task, the child listens to a sentence, which has a word missing, and is asked to provide grammatically correct responses for the missing part. The 28 items include various syntactic features such as noun-verb agreement, pronoun use, plurals, and negatives (e.g., Joe likes to cook every day; yesterday he *cooked*). Each item was scored dichotomously following the protocols. Cronbach's alpha was .83 for the sample.

4.2.2.2. Reading skills. Students' reading skills were assessed by the Passage Comprehension subtest of WJ-III (Woodcock et al., 2001). Passage Comprehension is an oral cloze task in which the child reads sentences and passages and is asked to fill in blanks. Students' performance on each item was scored dichotomously. Cronbach's alpha was .88 for the sample.

4.2.2.3. Spelling. Students' spelling skill was assessed by the spelling subtest of WJ-III (Woodcock et al., 2001). This was a dictation task in which students were asked to spell words that are of increasing difficulty. The research assistant read each word, read the sentence with the word, and then repeated the spelling word (e.g., "dog." "I took my dog to the park." "dog."). Students' performance on each item was scored dichotomously. Cronbach's alpha was .86 for the sample.

4.2.2.4. Letter writing automaticity. Students' letter writing automaticity was assessed by asking children to write as many alphabet letters as possible in 1 min with accuracy (Jones & Christensen, 1999; Kim, Al Otaiba, et al., 2011; Wagner et al., 2011, but see Berninger et al., 1992 in which a similar task was used for a 15-s period). This task assessed how well children access, retrieve, and write letter forms automatically. Research assistants asked children to write all the letters in the alphabet in order, using lower case letters. The directions were: *We're going to play a game to show me how well and quickly you can write your abc's. First, you will write the lowercase of small abc's as fast and carefully as you can. Don't try to erase any of your mistakes, just cross them out and go on. When I say "ready begin", you will write the letters. Keep writing until I say stop. Ready, begin*. After 1 min, tell the students: "*Stop and put down your pencils.*" Children received a score for the number of correctly written letters, adapting Berninger et al.'s (1992) study. One point was awarded for each correctly formed and sequenced letter. Given that students were in first grade, a 0.5 was used for each imprecisely formed letter (e.g., "n" must not be confused with an "h"). The following responses were scored as incorrect and earned a score of zero: (a) letters written in cursive; (b) letters written out of order; or (c) uppercase letters. Inter-rater percent agreement was greater than .90.

4.2.2.5. Inattentiveness and hyperactivity. The SWAN is a behavioral checklist (Swanson et al., 2006) that includes 30 items that are rated on a seven-point scale ranging from a score of one (far below average) to seven (far above average) to allow for ratings of relative strengths (above average) as well as weaknesses (below average). The first nine items relate to the Attention Deficit scale (e.g., Sustain attention on tasks or play activities; Listen when spoken to directly) and the next nine items to the Hyperactivity/Impulsivity scale (e.g.,

Modulate verbal activity [control excess talking]). The last twelve items are related to indicators of operational defiant disorder and were not used in our present study. Thus, in our present study, the maximum score on a SWAN scale is 63 in attentiveness and hyperactivity, respectively (9 items x a maximum score of 7 in each item). More attention or hyperactivity problems yield lower scores on the SWAN rating scales, and therefore, higher scores indicate attentiveness and less hyperactive behaviors. Subscale scores on the SWAN are calculated by summing the scores on the items in the specific subset (e.g., Inattention or Hyperactivity). Teachers completed the SWAN checklist in the spring. In our data set, Cronbach's alpha was .98 across the 18 items used in the present study.

4.2.3. Classroom-level predictors

4.2.3.1. Instructional quality. Teachers' instruction was videotaped during the 90-min language arts block in winter (late January and February) and was rated using a checklist by trained coders. We found winter to be a reliable time for classroom observation compared to spring during which instruction may not be as representative due to high stakes testing. Coders participated in a careful training process during which they were taught to complete a instrument which evaluates the effectiveness of implementation of overall instruction (global instructional quality) as well as the overall quality of specific reading and writing instruction. The scale ranged from 0 to 3, with 0 for content that was not observed, 1 for "not effective," 2 for "moderately effective," and (3) for "highly effective." Inter-rater percent agreement ranged from .92 to 1.00 with a mean of .98, and Cohen's kappas ranged from a low of .64 to 1.00.

Overall quality of instruction included three aspects related to classroom management and instruction, namely (1) teachers' responsiveness; (2) the extent to which instruction was organized; and (3) the extent to which teachers provided individualized instruction. Teachers who are effective at selecting and incorporating students' responses and experiences in their instruction received a high score (e.g., 3) whereas those who do not and/or when they do, they are punitive in their responses to children's inquiries received a low score (e.g., 0). As for instruction quality in individualization, if a teacher was providing small-group instruction, but all of the small groups did the same thing, she would score a one (ineffective for individualization). If a teacher was observed to have clear organization and all of the students in her class were on task, she would have been rated a three for organization.

The instructional quality in specific literacy components included quality of instruction in spelling, writing, and reading comprehension. Teachers who provided specific instructional strategies and skills directly received higher rating. Specifically, a score of zero was given when instruction in the target area was not provided at all. A score of one was given when the teacher may have briefly introduced a concept, but did not provide opportunities for practice. A score of two was given when the teacher introduced and reviewed a target area and provide opportunity to practice. A score of three was assigned when the teacher introduced or reviewed a target area explicitly by following modeling, and providing multiple opportunities to students' practice. For example, in the domain of writing, moderately effective instruction (a score of 2) meant that the teacher introduced a writing activity, and set children free to finish writing rather than providing a writing model and then monitoring writing and giving feedback (which would have been score of 3 or very effective). Ineffective instruction in writing (a score of 1) would have been scored if the observation revealed students completing a writing assignment (e.g., journaling) with no feedback or support from the teacher. Cohen's kappa ranged from .90 to .93. Instructional quality using a similar approach was shown to be uniquely related to children's reading comprehension (Connor et al., under review).

4.3. Procedures

All the child measures were administered in the spring (April and May) while classroom observation was conducted in the winter. The child measures were individually assessed in a quiet room at school except for spelling, letter writing automaticity, and writing which were group administered to all consented students in their classrooms.

5. Results

5.1. Descriptive statistics and preliminary analyses

Statistical significance was set at the .05 level in all the analyses. The overall means in the various writing outcomes ranged from 2.30 to 3.35 with sufficient variation around the means (see Table 1). The sample students' oral language skills assessed by expressive vocabulary (mean standard score = 100.33) and grammatical knowledge tasks (mean standard score = 9.37) were in the average range compared to the norm sample. The students' performances on reading comprehension (mean standard score = 101.37) and spelling (mean standard score = 108.67) were in the average range as well. The mean instructional quality varied from 1.61 in individualization to 2.65 in reading comprehension with sufficient variation in each instructional aspect. Table 2 shows correlations among child-level language, literacy, and attentional variables. All these variables were statistically significantly related to each other ($ps < .001$), but the magnitudes of relations varied from small ($r = .22$ between vocabulary and hyperactivity) to fairly strong ($r = .76$ between reading comprehension and spelling).

In order to examine the relations of children's language and literacy skills, attentiveness, and instructional quality to children's writing, multilevel model analyses were conducted with

Table 1
Descriptive statistics.

	Mean	*SD*	Min–Max
Writing outcomes			
Ideas	3.05	.71	0–4
Organization	2.83	.65	0–4
Word choice	2.55	.72	0–4
Sentence flow	2.86	.62	0–4
Spelling	3.35	.83	0–5
Mechanics	2.30	1.02	0–5
Handwriting	2.71	.87	0–5
Child-level predictors			
WJ-III Picture Vocabulary	20.17	3.30	11–29
WJ-III Picture Vocabulary – SS	100.33	11.10	65–134
TOLD-3 Grammatic Completion	17.26	6.28	0–28
TOLD-3 Grammatic Completion – SS+	9.37	3.09	1–18
WJ-III Passage Comprehension	19.98	5.38	5–35
WJ-III Passage Comprehension – SS	101.37	13.005	62–132
WJ-III Spelling	25.20	5.27	7–45
WJ-III Spelling – SS	108.67	15.57	46–151
Letter writing automaticity	17.961	7.40	0–44
SWAN attentiveness	38.85	12.79	9–63
SWAN Hyperactivity+	40.40	12.03	9–63
Classroom-level predictors			
TQ Responsiveness	2.39	.55	1–3
TQ Individualization	1.61	1.25	0–3
TQ Organization	2.53	.55	1–3
TQ Spelling	1.73	1.11	0–3
TQ Writing	1.64	.83	1–3
TQ Comprehension	2.65	.71	1–3

Note: WJ-III, Woodcock Johnson-Third Edition; SS, Standard Score; TOLD, Test of Language Development-Intermediate, third edition; TQ, Teaching Quality; The standard scores for the WJ-III subtests have a mean of 100 and standard deviation of 15 whereas for the TOLD-3 Grammatic Completion a mean of 10 and standard deviation of 3.
+Higher scores represent less hyperactivity.

Table 2
Correlations among language and literacy predictors at the child level.

	1	2	3	4	5	6
1. WJ-III Picture Vocabulary	–					
2. Grammatical Completion	.59	–				
3. WJ-III Passage Comprehension	.53	.58	–			
4. WJ-III Spelling	.39	.46	.76	–		
5. Letter writing automaticity	.26	.31	.39	.37	–	
6. Attentiveness	.31	.39	.54	.54	.42	–
7. Hyperactivity+	.22	.29	.41	.42	.35	.85

Note. All correlation coefficients are statistically significant at .001 level.
+Higher scores represent less hyperactivity.
WJ-III, Woodcock Johnson-Third Edition.

the substantive quality and writing conventions as the written composition outcomes. Multilevel models were employed because children were nested within classrooms, and multilevel models correct for standard errors and associated *p*-values (Hox, 2002; Raudenbush & Bryk, 2002). First, baseline models were fitted to examine total variance attributable to child and classroom levels. Intraclass correlations in children's written composition were .14 and .13 in the substantive quality and writing conventions dimensions, respectively. In other words, approximately 13–14% of total variance in children's written composition was attributable to differences among classrooms. In subsequent models, child- (language, literacy, and attentiveness – research question 1) and class- (instructional quality – research question 2) level predictors were included simultaneously to address the two research questions. Raw scores were used in these models. In addition, children's age in months, free and reduced lunch status (1 = free and reduced lunch eligible; 0 = not eligible) and treatment conditions (1 = treatment; 0 = control) were included as control variables. Children's hyperactivity was consistently nonsignificant when language and literacy skills were in the model (including a model in which attentiveness was not included), and thus, hyperactivity is not included in the two final models reported here.

Research question 1: What are unique child-level predictors (i.e., oral language, literacy, and attentional behaviors) of written composition for first grade students after accounting for instructional quality?

Results of multilevel models are presented in Table 3 for the two writing outcomes, substantive quality and writing conventions. For the substantive quality of children's written composition, children's grammatical knowledge ($p = .001$), reading comprehension ($p = .008$), letter writing automaticity ($p = .02$), and attentiveness ($p = .003$) were all uniquely and positively related after accounting for instructional quality variables and other child-level variables in the model. For the writing conventions outcome, children's spelling ($p < .001$) and attentiveness ($p < .001$) were uniquely related after accounting for all the other variables in the model. Children's vocabulary was not uniquely related to either of the writing outcomes after accounting for instructional quality variables and other child-level variables in the model ($ps \geq .54$).

Research question 2: What are unique instructional quality predictors of written composition for first grade students after accounting for children's language, literacy, and attentional behavior?

As shown in Table 3, in the substantive quality of written composition, children whose teachers were more responsive in their instruction had higher scores ($p = .009$) after accounting for the other instructional quality variables and children's language, reading, and attention variables. The other instructional quality variables, including instructional quality in writing and spelling, were not uniquely related to the substantive quality of written composition ($ps \geq .06$). For the writing conventions outcome, none of the instructional quality variables were uniquely related ($ps \geq .09$) after accounting for child-level predictors. Interactions between child- and classroom-level predictors were tested but not reported in Table 3 because none were statistically significant for either the substantive quality or the writing convention outcome.

Table 3
Multilevel models: writing quality and writing conventions predicted by students' language and literacy skills, attention, and instructional quality for students in first grade.

	Substantive quality	Writing conventions
Fixed effects		
Intercept	5.79 (1.55)***	−.20 (1.40)
Age in months	.07 (.21)	.48 (.19)*
Treatment conditions	−.04 (.16)	.06 (.14)
Free and reduced lunch status	−.40 (.18)	−.38 (.16)*
TQ Responsiveness	.41 (.15)**	.03 (.15)
TQ Individualization	−.02 (.08)	−.11 (.07)
TQ Organization	−.03 (.16)	−.25 (.15)
TQ Spelling	.06 (.08)	.01 (.08)
TQ Writing	−.21 (.11)	−.03 (.11)
TQ Comprehension	.19 (.13)	.14 (.13)
WJ Picture Vocabulary	−.02 (.03)	.01 (.03)
Grammatic Completion	.06 (.02)**	−.005 (.02)
WJ Passage Comprehension	.07 (.03)**	.02 (.02)
WJ Spelling	.02 (.02)	.16 (.02)***
Letter writing automaticity	.03 (.01)*	.02 (.01)
SWAN attentiveness	.02 (.008)**	.04 (.007)***
Variance components		
Classroom σ_u^2	0	.02
Children σ_ε^2	3.20	2.57
−2LL	2056.5	1947.8
AIC	2090.5	1983.8

Note: TQ, Teaching Quality; WJ, Woodcock Johnson-III.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

6. Discussion

Writing is a higher-order skill, demanding coordination of multiple processes simultaneously. In the present study, we examined how a comprehensive set of child-level and instructional quality predictors were related to two dimensions of written composition (substantive quality and writing conventions) for a large sample of first-grade children. We included language and literacy skills and attentional behavior as well as instructional quality, both in general and in specific literacy content areas. The child-level predictors were measured in the spring whereas classroom instruction was observed in the winter. Overall, the results showed that children's language, literacy, and attentiveness were differentially related to their substantive writing quality and to their writing convention outcomes. In addition, instructional quality, teacher responsiveness in particular, mattered for the substantive quality of written composition.

As for the child-level predictors, the findings of the present study confirmed and also extended previous studies by showing how language and literacy skills and attentional behavior are related to different dimensions of written composition. Children's oral language skill, grammatical knowledge in particular, was uniquely related to the substantive quality of written composition. That is, children who had highly developed grammatical knowledge wrote stories of higher substantive quality in written composition than those who had low grammar knowledge – the main ideas were more germane to the topic, and more details were elaborated; ideas were presented in an organized manner; diverse and interesting words were used; and had greater sentence flow and varied sentences. Given that writing requires representation of ideas through language, the fact that children's grammatical sophistication is related to their substantive quality aspect of written composition is not surprising. This finding supports a developmental theory of writing (Berninger et al., 1992; Berninger & Swanson, 1994), and is consistent with previous studies for younger and older children (Abbott & Berninger, 1993; Berninger & Swanson, 1994; Kim, Al Otaiba, et al., 2011; Olinghouse, 2008). Surprisingly, however, children's expressive vocabulary was not uniquely related to either dimension of children's written composition after accounting for the other variables in the model. Previous intervention studies have shown that children incorporate taught topical vocabulary words in their written composition (Yonek, 2009), suggesting that vocabulary would play a role in written composition. However, the vocabulary words might have to be words that are targeted for specific topics, whereas individual differences in overall vocabulary size assessed in the present study may not have been sensitive enough to capture a unique contribution to written composition, once other language, literacy, and instructional quality variables have been accounted for.

Children's reading comprehension was uniquely related to the substantive quality aspect of written composition. These findings confirm previous studies about the relation between reading and writing (Abbott & Berninger, 1993; Berninger & Abbott, 2010; Shanahan & Lomax, 1986, 1988) and also extend them by showing that it is the substantive quality of written composition that reading comprehension positively impacts, not the writing conventions dimension. These results suggest that, at least in first grade, children's reading comprehension skills (and perhaps associated reading experiences), facilitate their writing even after accounting for their oral language skills, such as vocabulary and grammatical knowledge and other child and instructional factors.

Although the two transcription-related variables, spelling and letter writing automaticity, are hypothesized to be related to written composition by allowing attentional resources for non-automatic, higher-order processes such as ideation, the findings of the present study suggest that spelling and letter writing fluency may impact somewhat different dimensions of children's writing. Children's performance on a standardized spelling task was uniquely related to the writing conventions dimension of written composition (spelling, mechanics, and handwriting) whereas letter writing automaticity was related to the substantive quality dimension of written composition (i.e., ideas, organization, word choice, and sentence flow). It appears that the extent to which children are automated in letter writing frees cognitive resources for idea generation, representation of those ideas, and use of diverse words whereas children's accuracy in spelling contributes to more mechanical aspects of written composition, at least in first grade. However, this interpretation should be taken with caution because the spelling and letter writing automaticity were measured in a different manner – spelling was not timed but letter writing task was. Thus, the results might have been due to differences in the timed vs. untimed natures of the tasks, rather than to their spelling vs. letter writing abilities. Future studies are needed to examine whether results would vary as a function of nature of tasks (i.e., timed vs. untimed).

Attentiveness, or lack thereof, was uniquely related to both the substantive quality and writing conventions dimensions of written composition over and above language and literacy skills and instructional quality. In other words, attentiveness as judged by classroom teachers was directly related to the substantive quality and the extent to which children used writing conventions accurately in their written compositions, such that attentive children had better developed ideas, better formed sentences or demonstrated a better flow of sentences, and their spelling and handwriting were more highly developed than less attentive children. These results suggest that children's ability to attend to instruction, for instance, matters for children's writing skills, both substantive quality and writing conventions, even after accounting for other important language and literacy skills and other aspects of instructional quality. These findings are convergent with Thomson et al.'s (2005) study which showed that attentiveness, but not hyperactivity, was related to literacy outcomes. However, we found that attentiveness was uniquely related to the two dimensions of written composition even after accounting for the other variables. In contrast, Thomson et al.'s study showed that attentiveness was not directly related to writing once orthographic and rapid naming factors were included. Direct comparison of these results is not possible because of differences in the sample and/or the variables included in the studies. Thomson et al.'s (2005) study included children with dyslexia who ranged from 6 to 18 years old whereas our sample included typically developing sample of first-grade children. Assessments differed in these studies as well. The present study included spelling and reading comprehension, but did not include the letter naming tasks or orthographic awareness tasks that Thomson et al.'s did. Future research is needed to replicate the findings of the present study and clarify the direct and indirect relation of attentional difficulties to children's writing skills.

Another important finding in the present study is that instructional quality was uniquely related to children's written composition over and above a comprehensive set of child-level predictors. Children whose teachers were more responsive had better developed ideas, better organized stories, and their stories had more diverse and interesting words than children whose teachers were less responsive. In conjunction with recent studies which showed the relation of teacher responsiveness to reading comprehension (Connor et al., under review) and the relation of emotional and instructional support to children's cognitive and academic achievement (Hamre & Pianta, 2005), the present findings provide further support about the link between classroom instruction and children's literacy acquisition. Surprisingly, however, the extent to which teachers provided individualized instruction and instruction quality in spelling or writing were not uniquely related to children's written composition over and above other variables included in the present study. It is likely that in the present study, teachers' individualized instruction was more targeted for reading outcomes because of the nature of reading-assessment guided instruction, and thus teachers' individualized instruction did not specifically provide guidance for writing instruction. An alternative explanation is that during the beginning writing, overall instructional quality such as teachers' responsiveness is more important predictor of children's writing skills whereas in later phases of writing, variation in instructional quality in writing might matter for children's writing skills. Low-average scores of instructional quality in spelling and writing do not appear to explain why instructional quality in spelling and writing was not uniquely related to children's writing skill because there were sufficient variations around the means. Efforts are under way to examine and describe closely the nature of writing instruction (duration and content) in these classrooms and investigate its relation to children's writing

skills. Finally, it should be noted that classroom characteristics including instructional quality and children's performance might have a reciprocal relation, such that not only instructional quality influences children's academic and behavioral aspects, but also children's academic an behaviors influence instructional quality. For instance, drawing on the work of Bronfenbrenner (1979, 1994), this bidirectional relation has been noted in parenting behaviors and child development (Belsky, 1984; Lugo-Gil & Tamis-LeMonda, 2008; Park, 2012; Smith, 2010). Although in the present study, children's individual characteristics, such as language and literacy skills as well as behavioral aspects, were included in the multilevel model in examining the unique contribution of instructional quality, other unobserved and unmeasured aspects such as socio-emotional maturity of children were not. A future study examining the existence and nature of a reciprocal relation of child's characteristics and instructional nature would be informative. It should be noted that instructional quality data were based on a single observation in the winter. Therefore, caution needs to be exercised for interpretation and future replication would be informative.

6.1. Limitations and future studies

Detailed examinations of classroom instruction in language and literacy areas (e.g., instruction time spent on reading or writing) are needed to examine whether variation in instructional amount in various literacy areas is related to children's writing skills. In the present study, we used a writing prompt which has been used in previous studies using a curriculum based measurement framework (McMaster et al., 2009). Although the prompt used in the present study has shown to elicit reliable and valid written composition (McMaster et al., 2009, 2011), it would be interesting to compare results from more authentic journal or work samples to results from the brief timed curriculum based measurement task used in the current study. This is expected to provide some insights into the relation between classroom instruction and children's writing skills. In addition, use of one prompt is a limitation of the present study. Given the prompt effect in examining children's writing skills (Graham, Harris, & Hebert, 2011), future studies should use multiple prompts. Another limitation in the present study is that children's oral language was assessed at the word (i.e., vocabulary) and sentence level (i.e., vocabulary), but not at the discourse level (e.g., language comprehension at passage level). Thus, it will be informative to examine how children's oral language skills at the discourse level are related to their written composition after accounting for literacy, attention, and instructional variables. Finally, we did not find any statistically significant interactions between child-level and instructional quality predictors. However, given the relatively small sample size of classrooms in the present study, a future study should further investigate a potential interaction effect on children's written composition with a larger sample of classrooms.

6.2. Implications and conclusion

The results in the present study suggest that in order to improve children's written composition skills, attention needs to be paid to multiple components beyond transcription skills such as children's oral language (e.g., sentence level grammatical knowledge) and attentiveness. These are aligned with new Common Core requirements, which emphasize children's oral language and writing development. Furthermore, it appears that teachers' interaction with students, and teachers' responsiveness in particular, may be an important factor to consider and promote in facilitating children's writing development. While expanding our understanding of cognitive, linguistic, and behavioral factors in beginning writing, these results beg for future investigations about mechanisms for the relations between attentional behaviors and writing development as well as the nature of classroom instruction and its relation to children's writing development.

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